



Impact on North Stradbroke Island from ceasing sand mining

A report for Unimin

June 2010
Synergies Economic Consulting Pty Ltd
www.synergies.com.au

Disclaimer

Synergies Economic Consulting (Synergies) has prepared this advice exclusively for the use of the party or parties specified in the report (the client) and for the purposes specified in the report. The report is supplied in good faith and reflects the knowledge, expertise and experience of the consultants involved. Synergies accepts no responsibility whatsoever for any loss suffered by any person taking action or refraining from taking action as a result of reliance on the report, other than the client.

In conducting the analysis in the report Synergies has used information available at the date of publication, noting that the intention of this work is to provide material relevant to the development of policy.

Contents

1	Introduction	4
2	Background	5
2.1	Key points	5
2.2	Mining on NSI	5
2.3	Regional economic profile	7
3	Direct economic impacts	15
3.1	Key points	15
3.2	Method	15
3.3	Value of production and Value adding	17
3.4	Employment	17
3.5	Public finances	17
4	Flow-on economic impacts	19
4.1	Key points	19
4.2	Modelling framework	19
4.3	Economic Impact Measures	20
4.4	Modelled impacts	21
4.5	Public finance	24
4.6	Economic infrastructure	24
4.7	Community services	26
4.8	Structural adjustment	27
4.9	Expansion of the tourism industry	28
4.10	Alternative sources of glass sands	31
5	Conclusions	32

1 Introduction

Unimin has requested Synergies Economic Consulting (Synergies) undertake an assessment of the contribution of mining to the North Stradbroke Island (NSI) economy and community.

To assess the importance of mining activity on NSI to the local economy, this report examines the impact on NSI should all mining operations cease. The report identifies impacts on the value of production, incomes, employment and revenues received by governments. Impacts are estimated both for the direct impacts from Unimin stopping all operations on the island, and the flow-on or indirect impacts on other NSI industries. The indirect impacts are supported by an analysis of the extent of industry linkages.

The report is structured as follows:

- section two provides background information on North Stradbroke Island, including current mining activity and linkages;
- section three describes the direct economic impacts of ceasing mining activity;
- section four describes the indirect economic impacts; and
- section five outlines the conclusions of the analysis.

2 Background

2.1 Key points

- As at the 2006 census, NSI's population was 2,121 persons, with 17.3% identified as indigenous population.
- Mining on NSI accounts for roughly 14% of total employment. Comparative data for Redland City Council and Queensland are 0.8% and 1.7%, respectively.
- The linkages between sand mining and other NSI industries are very strong. The linkages are significantly stronger than for other industries, for example, tourism. Stronger linkages will magnify the economic impacts on other industries from reductions in mining activity.
- Compared to Redland City Council a larger proportion of NSI households have incomes in lower income brackets.

2.2 Mining on NSI

Mining began in 1950 on NSI. Mining occurs for the heavy minerals rutile, zircon and ilmenite and for silica. Quartz forms a large part of the residue sand. The mineral sands mined are used in a wide variety of products from every-day items to high technology applications (Box 1). The Silica mined on NSI is primarily used for glass.

The sale of these minerals over the last 5 years has generated roughly \$125 million annually on average.

Unimin currently produces around 560,000 to 600,000 tonnes of sands annually. Of this:

- 75,000 tonnes is used in glass production in Brisbane by Owens-Illinois, Inc. The sand is used to produce container glass (container glass is typically roughly 68 - 70% silica (sand));
- 50,000 tonnes was used in Brisbane in the production of white mortars and other products (this ceased in November 2008 pending the resolution of a dispute with the state government over permitting);
- 50,000 tonnes is exported to New Zealand for container glass production;

- 150,000 tonnes is exported to Japan and Sibelco Asia for high quality glass products such as solar panels and television screens;
- 25,000 tonnes goes to Riverside (who dry it and on sell it to various markets) and the CSR Bradford fibreglass plant; and
- 260,000 tonnes of mineral sands (50,000 zircon, 60,000 rutile and 150,000 ilmenite) is exported internationally (mostly to Japan, China, Thailand, and Taiwan, with some rutile going to the United States).

Box 1 Rutile, zircon and ilmenite uses

Rutile is processed to titanium dioxide to form the basis for a high quality, white pigment used in paints, plastics and cosmetics. Rutile and synthetic rutile are also processed to titanium metal for the aerospace industry and for the production of surgical equipment. Rutile sand is used on the coatings of welding rod fluxes where it stabilises the electric arc ensuring a superior joint.

Ilmenite is a mixture of iron and titanium oxides, used in the steel making industry for furnace linings and for sand blasting. By removing the iron, ilmenite can also be upgraded to produce synthetic rutile, which can be used to make titanium dioxide and titanium metal.

Titanium dioxide pigment is non-toxic and has the ability to reflect and scatter all colours of light while absorbing ultra violet light. It has replaced lead based pigments in paints. When mixed with plastic & paper it gives them a white glossy sheen. Titanium dioxide is used in the manufacture of many sunscreens because of its non-toxicity and UV absorption properties.

Titanium metal is an incredibly light and strong metal with a high melting point and is used in rockets, jet aircraft and sporting equipment. Titanium's lightness, strength and inertness (bio-compatibility) also make it ideal for use in heart pacemakers, artificial limbs/joints, spectacle frames and watches. When mixed with other metals such as iron, manganese and aluminium, it forms alloys which are both temperature and corrosion resistant. These alloys are used in power stations, paper mills, oil refineries and desalination plants.

Finely ground *zircon* is used in the ceramic industry for glazes on kitchen and bathroom tiles, dinnerware, and decorative ceramics. Zircon is used as an opacifier in the glaze on tiles, baths, basins, dinnerware and decorative ceramics. It is also widely used in television and computer screens.

Industrial ceramics containing zircon are used in applications requiring heat and corrosion resistance. Some industrial ceramics are referred to as 'refractories'. Refractories are materials that retain their physical shape and chemical composition when subjected to high temperatures and are extensively used as linings to protect furnaces and kilns for smelting and casting of metal and glass and for the manufacture of chemicals.

Source: CRL 2006 Minerals and Their Uses

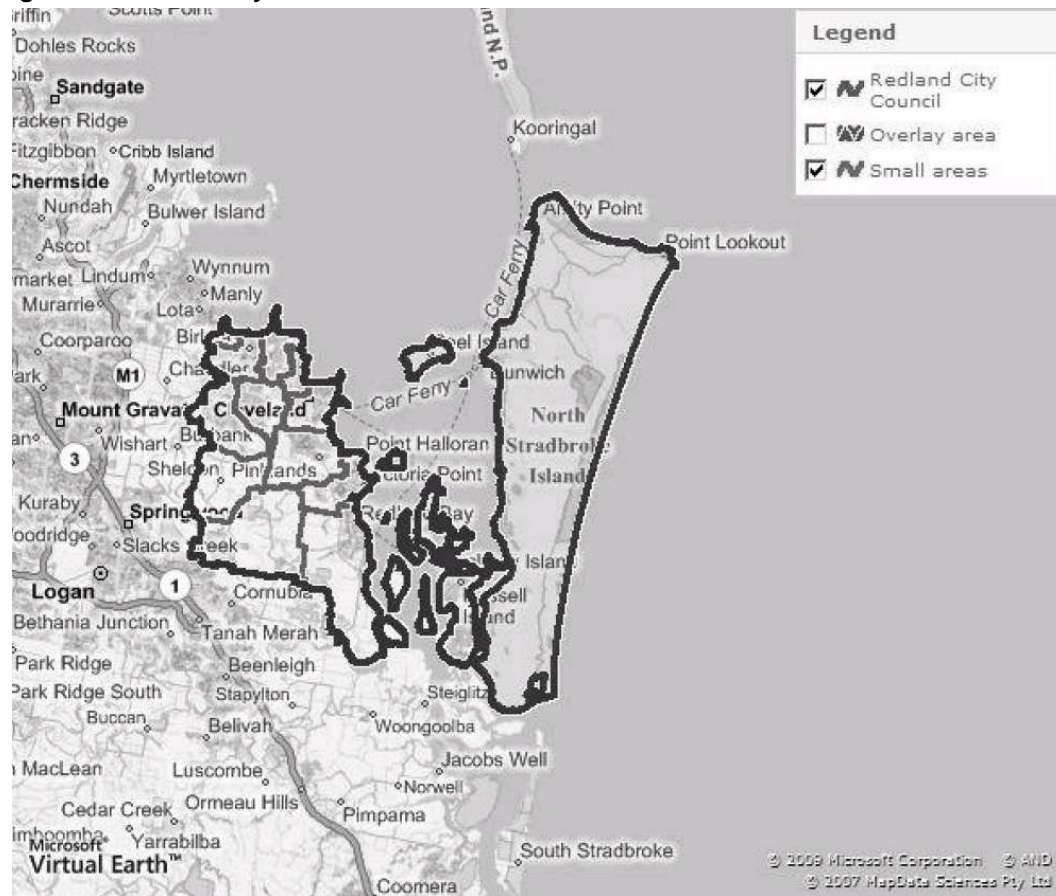
2.3 Regional economic profile

2.3.1 Geographic scope

NSI is 38km long and 12km at its widest point. It is the world's second largest sand island.¹ It is situated approximately 30 km south of Brisbane within the Redland City Council (RCC) Local Government Area (LGA) (Figure 1).

¹ <http://www.marine.uq.edu.au/index.html?page=54830>

Figure 1 Redland City Council LGA and NSI



Source: Microsoft Corporation (2009) and MapData Sciences Pty Ltd (2007)

2.3.2 Population

As at the 2006 census, the population of NSI was 2,121 persons, down from 2,410 persons in 2001. In 2006, 17.3% of the population identified as being indigenous (Table 1). This compares to 1.5% for both RCC and Queensland.

The main NSI population centres are Dunwich, Amity and Point Lookout.

Table 1 Indigenous and total population^a, 2006

	Aboriginal (#)	Torres Strait Islander (#)	Both ^b (#)	Total Indigenous (#)	Total persons ^c (#)	Indigenous share of population %
NSI	-	-	-	367	2,121	17.3
Redland City Council	1,722	137	84	1,943	127,628	1.5
Queensland	98,716	18,374	10,488	127,578	3,904,532	1.5

Notes: ^a Population data based on usual place of residence. ^b Applicable to persons who are of 'Both Aboriginal and Torres Strait Islander origin'. ^c Includes persons where indigenous status was not stated.

Source: ABS Census of Population and Housing 2006

2.3.3 Employment

Based on 2006 census data, a smaller percentage of the NSI labour force is in full-time employment compared to RCC (52.7% versus 60.8%), and a larger share is part-time employed. NSI's share of the population of working age (greater than 15 years of age) that was identified as part of the labour force is also less (55.9% versus 63.9%).

Table 2 Employment profile, persons aged 15 years and over

	North Stradbroke Island		Redland City Council		
	2006 (#)	Per cent of Labour force	Per cent of Total pop. >15 years	Per cent of Labour force	Per cent of Total pop. >15 years
Full time	506	52.7		60.8	
Part Time	417	43.4		32.5	
Not stated	12	1.3		2.5	
Total Employed	935	97.4		95.8	
Total Unemployed	25	2.6		4.2	
Total in labour force	960	100.0	55.9	100.0	63.9
Total not in labour force	644		37.5		32.0
Not Stated	113		6.6		4.1
Total pop. (>15 years)	1,717		100.0		100.0

Source: ABS Census of Population and Housing 2006

2.3.4 Industry structure

Compared to RCC and Queensland, NSI industries with a significantly larger employment share are Mining, Wholesale Trade, and Accommodation and Food Services (Table 3). NSI industries with a significantly lower industry share are Manufacturing and Retail Trade.

Table 3 Comparative industry structure by employment, 2006

	NSI	Industry share of employed (Per cent)		
	Employed (#)	NSI	RCC	Queensland
Agriculture, Forestry and Fishing	28	3.0	0.7	3.4
Mining	127 ^a	13.5	0.8	1.7
Manufacturing	19	2.0	12.3	9.9
Electricity, Gas, Water & Waste Services	3	0.3	0.9	1.0
Construction	91	9.6	10.6	9.0
Wholesale Trade	92	9.7	5.6	3.9
Retail Trade	9	1.0	12.5	11.6
Accommodation and Food Services	147	15.6	5.3	7.0
Transport, Postal and Warehousing	36	3.8	5.8	5.1
Information Media & Telecommunications	6	0.6	1.5	1.4
Financial and Insurance Services	9	1.0	3.0	2.9
Rental, Hiring and Real Estate Services	19	2.0	2.1	2.1
Professional, Scientific & Technical Services	29	3.1	5.4	5.6
Administrative and Support Services	44	4.7	3.4	3.1
Public Administration and Safety	57	6.0	5.8	6.7
Education and Training	77	8.2	6.5	7.6
Health Care and Social Assistance	93	9.9	9.9	10.2
Arts and Recreation Services	18	1.9	1.1	1.3
Other Services	20	2.1	4.2	3.7
Inadequately described or Not stated	20	2.1	2.6	2.7
Total	944	100.0	100.0	100.0

Note: 'Employed, worked full-time' is defined as having worked 35 hours or more in all jobs during the week prior to Census Night.

Source: ABS Census of Population and Housing 2006

A Unimin reports that its resident population is now 145, almost 15% greater than at the time of the 2006 census.

2.3.5 Linkages

Construction of the NSI Social Matrix

A 14 sector input-output experimental (IO) table for North Stradbroke Island economy was constructed using small area data, and data supplied by the company and some assumptions on factor input usage.²

² The table was constructed using the bi-proportional grit method within the IO8 software developed at the Centre for Economic Policy Modelling.

There are a number of important reasons as to why an input-output table was constructed for NSI rather than its large economic hinterland. First and foremost is that any attempt to use a large area table, for example, South East Queensland, would have greatly reduced the relative importance of (sand) mining within the relevant economy. As the purpose of this paper is to examine the relative importance of sand mining to the local economy, and to investigate any economic impacts from the cessation of mining, it was of important to use an economic model in which the industrial structure was accurately portrayed. As well, a specifically tailored IO table allows the generation of industrial linkage data which is of importance in describing relative sector contribution in an economy. However, it should be noted that the production of a small area model such as this, requires the use of simplifying assumptions.

Nevertheless, the developed table conforms to the aggregate data available from the Australian Bureau of Statistics.

The NSI table was used to assess the relative importance of an industry or industries. For example, input output tables are often used to identify inter-sector relationships within an economy through the use of backward and forward linkages. These linkages were first used by Rasmussen (1956) and Hirschman (1958) to identify the key economic linkages within an economy. Since then they have been used a large number of times, both in their original form and modified by further decomposition analysis. A backward linkage measures the relationship between economic activity within a sector and its supply chain (purchases from other sectors). A forward linkage measures the relationship between economic activity in a sector and the impact of its sales on overall economic activity.

Linkage analysis

The strength of the linkages between sand mining and the rest of the NSI economy is high to very high (Table 4). For example, the data suggest that with a 2.1 backward income linkage the Mineral sands industry is crucially important to the incomes of suppliers, running at double the expected or average importance. The very high forward linkages, at or near double the importance of the “average” industry, is a strong indicator of the central role played by sand mining in the island’s economy.

Table 4 Backward and Forward Linkages and Spreads for Sand Mining in the NSI Economy

Linkage	Output	Value Added	Income	Employment
Backward linkage	1.5	1.8	2.1	2.1
Backward Spread	1.1	1.0	0.8	0.8
Forward Linkage	2.2	1.9	1.9	1.95
Forward Spread	1.1	1.2	1.1	1.1

Source: Derived from the NSI Non-Linear Model

a A linkage >1 is considered strong, a linkage > 0.5 is considered average and a linkage < 0.5 is considered small. As well, a backward or forward spread > 0.5 is considered significant.

By way of comparison, the employment and value added backward linkages for all sectors are listed (Table 5). To aid comparison, a Tourism sector was constructed as an amalgam of relevant sectors such as accommodation and cafes and restaurants. The backward linkages for Sand mining compared to Tourism are twice as large for employment and 1.5 times larger for value added. This would suggest that a major increase in Tourism would be needed to offset the loss mining activity.

Table 5 Employment and Value added Backward linkages - NSI

Sector	Employment	Value added
Agriculture	1.0	0.9
Sand Mining	2.1	1.8
Manufacturing	1.1	0.9
Utilities	1.2	1.1
Construction	1.1	1.1
Trade	1.2	1.3
Transport	1.2	1.1
Tourism	1.0	1.1
Finance& Bus	1.1	1.1
Education & Train	0.9	1.2
Health & Social	0.3	0.3
Arts & Recreation	0.5	0.9
Personnel Services	1.3	1.2
Other	0.5	0.6

Source: Derived from NSI non-linear model

2.3.6 Occupational profile

NSI's occupational profile does not appear to be dramatically different to the profile for RCC (Table 6). Occupations with a notably higher share in NSI are Technicians & trade workers, Intermediate production & transport workers, and Labourers & related

workers. Intermediate clerical, sales & service workers make up a significantly smaller share of the NSI labour market, consistent with the employment data showing that the retail sales industry accounted for a significantly smaller share of industry economic activity on NSI.

Table 6 Occupational profile, 2006

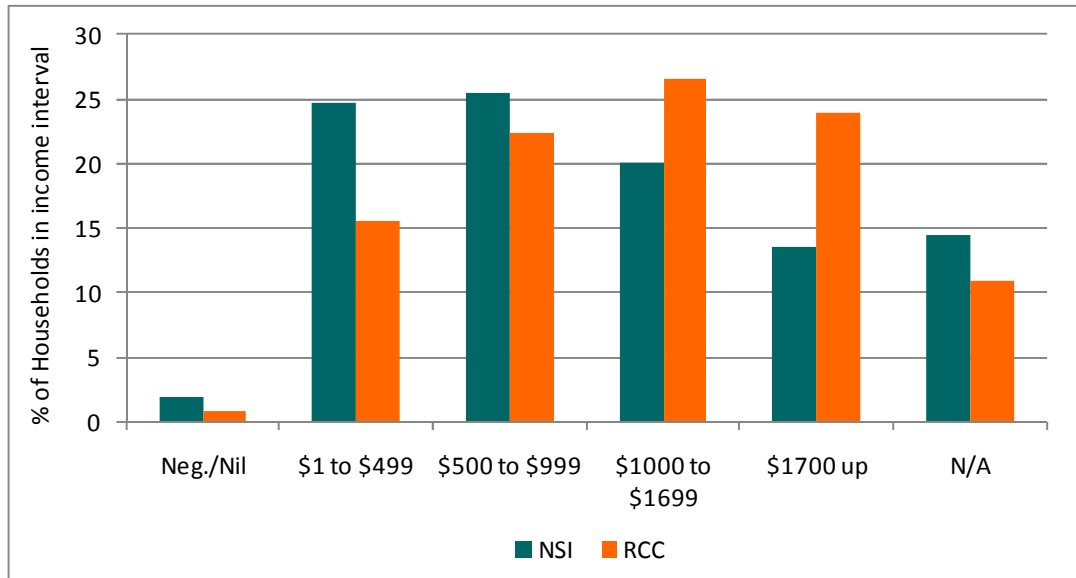
Occupation	NSI	Occupational share (%)	
	Persons employed (#)	NSI	RCC
Managers and Administrators	62	6.5	7.7
Professionals & Associated Professionals	137	14.4	14.3
Technicians & trades workers	147	15.5	11.9
Community & personal services workers	120	12.6	14.4
Advanced clerical & administrative workers	27	2.8	3.5
Intermediate clerical, sales & service workers	123	13.0	19.1
Intermediate production & transport workers	131	13.8	8.7
Elementary clerical, sales & service workers	80	8.4	10.0
Labourers & related workers	112	11.8	8.8
Inadequately described/not stated	10	1.1	1.7
Total	949	100.0	100.0

Source: ABS Census of Population and Housing 2006

2.3.7 Income

NSI has a smaller proportion of households in higher income brackets compared to RCC (Figure 2).

Figure 2 Distribution of household incomes, 2006



Notes: N/A includes responses where partial incomes were stated, or incomes were not stated.
Source: ABS, Census of Population and Housing, 2006

3 Direct economic impacts

3.1 Key points

- Loss mining production is expected to yield direct revenue losses of around \$125 million annually, of which approximately \$77.5 million represents value added or a net economic welfare loss.
- Gross Regional Product (GRP) will be reduced by approximately 26%. This impact will be greatly magnified through indirect impacts on other industries due to the heavy integration of mining with the rest of the economy.
- Employment will be reduced by 14% on the island, with additional direct job losses in South East Queensland.
- Revenues paid to governments will be reduced by up to \$196 million in net present value terms.

3.2 Method

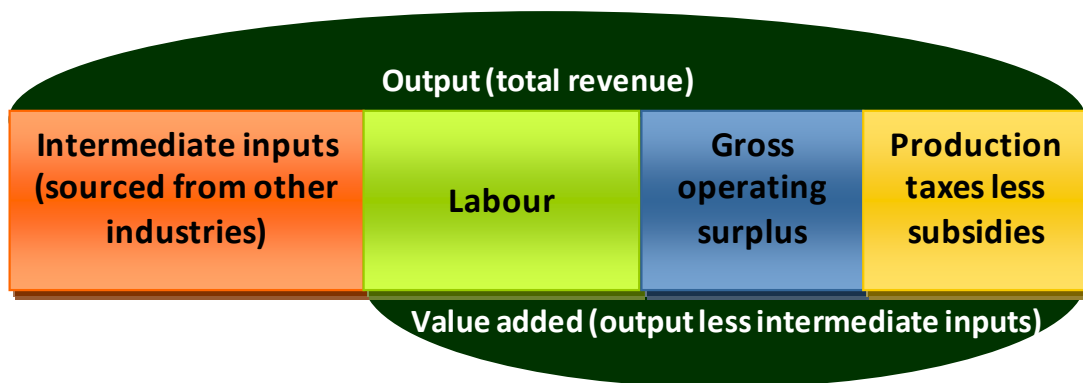
3.2.1 Sources of value from economic activity

Economic models are driven by what is called “shifts in final demand”. By this it is meant that new expenditure on finished products or the loss of output from established products represents a stimulus or contraction to economic activity. This amount of exogenous expenditure on final demand products is often increased or “multiplied” to provide an estimate of the total impact on the economy because, demand for final demand products also requires a boost in demand for intermediate products used in their production. The higher the percentage of intermediate goods the higher is this multiplied effect.

This multiplied effect often shows up in significantly expanded Gross Output/Regional Turnover. However, these data are often partially discounted due to concerns over possible double-counting during the estimation process. That is the increase in turnover of a supplier is added to the increase of its customer, rather than the net change in value. However, Gross output or Turnover effects remain a legitimate source of economic knowledge, particularly in terms of defining the capacity of an economy to undertake large projects.

In contrast the economic value of a particular activity to an economy is often measured through its value added or additions to GRP or Gross State Product (GSP). When the Government says the Queensland Economy grew by 3% per annum they mean that the GSP of Queensland increased by 3%³, where GSP is the increment added to the sum of the value of intermediate products resulting from the sale of the final demand products. As can be seen in Figure 3, value added is a sub-component of Gross Output, which in turn may be subdivided into its labour component (wages and other income such as dividends), Gross operating surplus (which includes company profits), and production generated taxes and charges.

Figure 3 Stylised Economic activity accounting framework



Source: Synergies

3.2.2 Key economic aggregates

The direct economic impacts of the cessation of mining on NSI are assessed by considering the impact on key economic aggregates, including:

- value of production;
- value added;
- employment and
- public finances.

³ Which suggests that turnover increased by 5%-6% but some of this was double counted

3.3 Value of production and Value adding

A full year of loss mine production is expected to yield direct revenue losses of around \$125 million of which approximately \$77.5 million represents value added.⁴

While there is some difficulty in estimating the Gross Regional product of a small economy, the NSI Non-linear model estimates the total GRP (value adding) in the NSI economy at between \$290 million and \$330 million.⁵ This would place the direct proportional loss at between 23% and 26% of total GRP.

However, the impact of any closure of the sand mining operations is greatly magnified due to the heavy integration with the rest of the economy, as demonstrated by the high linkage effects. These total effects are presented later in this report.

3.4 Employment

The workforce in sand mining is split between those employed on the island (145) and those employed on the mainland (130). The industry accounts for approximately 14% of total employment on NSI but a smaller percentage of total employment on the mainland. The high backward and forward linkages show that the industry underpins a significantly larger percentage of total employment within the North Stadbroke economy.

Unimin has indicated that roughly 15% of its workforce is of Indigenous descent. The impacts from loss of employment in the mining industry might be larger on indigenous communities if it is the case that the opportunities available to them to replace mining incomes are less. This would be the case, for example, if they are less likely to move and find employment on the mainland, or if their skills are less transferable.

3.5 Public finances

The cessation of mining on NSI will directly reduce government revenues. In net present value terms⁶, royalties foregone are estimated to amount to \$77.3 million, comprising \$4.6 million from glass sands and \$72.7 million from minerals sands. Reductions in rates and license fees are estimated to amount to \$17.1 million.

⁴ This represents the value of output net of raw materials and operating costs. It is akin to GDP in a National Economy.

⁵ Which corresponds to a value of output between \$360- \$500 million per annum.

⁶ A net present value calculation discounts the sum of expected future royalty payments to a value in today's dollars. This value is smaller than an undiscounted sum because a dollar today is valued higher than a dollar in the future.

Reductions in company tax paid to the Australian Government are estimated at \$104.3 million. The combined direct impact on government revenues is a loss (or foregone revenue) of \$195.8 million.

The reduction in revenues will either be matched by reductions in government expenditures and/or increases in revenues raised from alternative sources.

Table 7 Revenues to governments

Year	Royalties for Glass Sands (\$)	Royalties for Minerals Sands (\$)	Total Royalties Paid (\$)
2005	180,000	5,404,000	5,584,000
2006	237,000	6,082,000	6,319,000
2007	352,000	5,806,000	6,158,000
2008	365,000	6,348,000	6,713,000
2009	251,000	3,913,000	4,164,000
<i>Average</i>	<i>277,000</i>	<i>5,510,600</i>	<i>5,787,600</i>

<i>Source of Government revenues -</i>	Useful life of deposits (years)	Current revenues paid (\$)	NPV of revenues foregone (\$)
Royalties from Glass Sands ^a	50	277,000	4,572,001
Royalties from Minerals Sands ^a	25	5,510,600	72,671,876
Rates and License fees ^a	25	1,300,000	17,143,948
Company tax ^b	25	8,157,000	104,273,836
	<i>NPV</i>		<i>195,702,197</i>

a Average of payments 2005 to 2009. **b** Assuming a rate of 28% applied to average gross profits over the period 2005 to 2009. **c** Assuming a discount rate equal to the current 10 year Australian government bond rate at 6%. Note that rates and license fees, plus company taxes, will continue to be paid beyond the end of production of minerals sands owing to continued production of glass sands, although at a much lower level.

Source: Unimin and Synergies estimates

4 Flow-on economic impacts

4.1 Key points

- Reduction in the gross output/turnover of other industries by \$101.1 million annually.
- Flow-on reductions in GRP of \$52.2 million annually.
- A potential loss of an additional 144 jobs on NSI through indirect impacts.
- Additional job losses of 231 full-time equivalents in South-East Queensland through indirect impacts.
- The combined direct and indirect impacts are estimated to:
 - reduce GRP (value added) by between 39% to 44% of current levels;
 - lead to heavy job losses on NSI with total employment potentially reducing by 30%.
 - note that these are continuing losses until (if) other activity moves in to take the place of Sand Mining.
- Growth in labour demand from expansion of tourism is not expected to be rapid.
- The price of ferry transport services, electricity services and fuel prices on NSI may rise significantly.
- The magnitude of the economic impacts will have flow-on effects across community activities and services. Schools, volunteer organisations, community development projects, social activities (e.g. sporting activities) and the indigenous community will all be negatively impacted.

4.2 Modelling framework

The purpose of economic impact modelling is to estimate the impact of an economic change on economic activity. It is well known that changes in exogenous expenditure will produce impacts greater than the original impact.

The direct reductions in the value of production, employment and impacts on public finances will have indirect impacts on the regional economy of NSI and Redlands. These impacts were modelled as discussed below.

Traditional linear IO modelling is a popular method of undertaking economic impact evaluation because of its flexibility and relative data frugality. However, it has several limiting features. Traditional IO is unable to allow for changes in the production function (for example, through technological progress), an implicit assumption that all economic stimulus is expansionary (exogenous) rather than displacing, an inability to incorporate price effects or allow for large scale structural change. For these reasons traditional IO modelling is best suited to situations of new investment, on a relatively small scale and where short term (1-5 years) estimation is required.

A more recent modification to IO modelling is the introduction of non-linear capabilities. These models have the advantage of avoiding the proportionality assumptions of traditional IO and allow for the estimation of marginal rather than average coefficients.

The indirect impacts in this report have been estimated with a non-linear input-output model developed by the Centre of Policy Modelling at the University of Queensland.

4.3 Economic Impact Measures

The primary economic impact measures used in this section are as described below.

- *Gross Output (regional turnover)* - refers to the gross value of increased production from an additional economic activity. Within this gross value is included the value of raw materials that, in most cases, have already been counted as part of gross output from earlier production. Therefore there is a tendency for Gross output figures to include some double counting. As a result, more concentration is placed upon incremental (additional output created) or *value added*. Nevertheless, the concept of Gross output should not be abandoned because it is a good indicator of the level of turnover in the economy and its capacity to accommodate increased economic activity. As a result it is a useful measure of the total level of economic activity.
- *Value Added* - refers to added or net output. Value Added is equivalent to the Gross State / Regional Product as used by the Australian Bureau of Statistics. It is the measure usually preferred when measuring economic impact. It measures the added value placed on intermediate products (raw materials) from the productive process. It is made up of margins, wages, profits and transfers.
- *Factor Income* - relates to the share of value added (and gross output) which is directly paid to individuals or firms in the form of wages and or profits. By definition it is a percentage of value added and cannot exceed value added.

- *Jobs* - relates (usually) to the amount of labour required for the level of production. Depending upon the type of activity, job numbers measure either the use of existing labour (continuing jobs) or hiring new staff. Full Time Equivalent (FTE's) employment refers to the number of full time person-years of employment generated by a particular project or event. This alleviates the overstating of the level of job growth due to the stimulus.
- *Government revenues* - Government taxes and charges estimated through the indirect taxes and charges within the IO Framework.

4.4 Modelled impacts

The revenue received from annual production (\$125 million) was used as the exogenous shock to the NSI nonlinear model to estimate the total economic impacts.

The key results are:

- a reduction in gross output/turnover of \$226.1 million annually;
- a reduction in GRP of \$129.7 million annually;
- reduced factor incomes of \$97.7 million annually;
- a potential loss of 289 jobs from the North Stradbroke economy; and
- additional job losses of 231 FTE in South-East Queensland.⁷

⁷ The additional job losses were estimated outside the model with an appropriate employment multiplier, based on the mainland employment reductions likely for Unimin if sand mining were to cease on NSI.

Table 8 reports the direct impact as a final demand impact resulting from loss of the value of production from sand mining. The impacts on suppliers to Unimin are shown as industry effects. Finally the reduced activity also impacts households who have reduced income and therefore reduced total consumption. This is shown as the consumption effect. The sum of the industry and consumption effects is the indirect economic impacts.

Table 8 Total Economic Impacts of Cessation of Sand Mining \$ Million per Annum

Indicator	Direct impact	Flow-on Industry Effects	Flow-on Consumption Effects	Total
Gross Output	125.0	43.9	57.2	226.1
Value Added	77.5	17.3	34.9	129.7
Factor income	62.8	12.4	22.4	97.7
Employment(Stradbroke)	145	53	91	289
Employment (S. E Qld)	130	36	66	231

Source: Estimated from NSI Non-linear Model

These losses are permanent unless another activity moves into to take the place of sand mining. For NSI it has been suggested that Tourism might expand if sand mining ceases. However, as indicated earlier, growth in other industries are unlikely to have the same broader impacts across the economy as linkages are lower.

In terms of GRP (value added), the loss will be between 39% and 44% of current levels. Job losses will also be heavy with total employment on the Island potentially reducing by approximately 30%, and over 230 job losses elsewhere in South East Queensland.

The following table shows the breakdown of the non-mining indirect or flow on losses across the remaining industries. Both employment and value added impacts are shown (Table 9). The sectors that are particularly impacted are:

- Manufacturing with 15% of indirect employment losses being felt in this sector, (this equates to approximately 37 FTE);
- Utilities (9% of employment losses);
- Trade (15%);
- Transport and communications (14%), particular concern being the viability of the ferry services;
- Construction (12%); and
- Finance & Business (8%).

Table 9 Percentage distribution of indirect losses from cessation of sand mining by sector

Sector	Employment (Per cent)	Value added (Per cent)
Agriculture	2	1.5
Manufacturing	17	15
Utilities	11	10
Construction	13	14.5

Sector	Employment (Per cent)	Value added (Per cent)
Trade	15	13.5
Transport & Communications	15	13.5
Tourism	2	3
Finance & Business Services	8	7.5
Education & Training	5	6
Health & Social Services	4	5
Arts & Recreation Services	2	3.5
Personnel Services	2	3.5
Other	4	3.5
<i>Total</i>	<i>100</i>	<i>100</i>

Source: Derived from NSI non-linear model

4.5 Public finance

The direct reductions in royalty, tax and other revenues from the cessation of mining may in part be offset by increases in revenues paid to governments where investment capital and labour freed-up leads to other economic activity that would otherwise not have happened, and that activity generates revenues for governments.

However, investment driven offsetting impacts are expected to be muted with a large proportion of Unimin assets stranded, and their value determined by their scrap metal value. As at 2006, CRL company reports had recorded assets of \$173.3 million.

4.6 Economic infrastructure

4.6.1 Ferry services

Unimin undertook consultation with Stradbroke Ferries on the expected impacts on their business if mining was to cease on NSI (assuming there was no alternative source of demand to fill the void).⁸ The key results were:

- a reduction in sales by over \$4 million dollars;
- a likely reduction in trip frequency to a 2-3 hourly cycle;
- a likely passing of the costs of maintenance and other on-going costs to remaining customers through ticket price increases;

⁸ Unimin Issues Discussion Paper - The Economic and Social Impact of Mining on North Stradbroke Island.

- a reduction in full-time employment by 20 persons.

These impacts are consistent with the modelled results for the Transport and Communication industry. These impacts could undermine the viability of the continued operation of Stradbroke Ferries resulting in exit from the market, leaving a single operator and reducing competition with implications for prices and service quality.

4.6.2 Electricity services

Unimin spends roughly \$12 million annually on electricity. Information provided to us by Unimin indicates that Unimin believes it is funding a large proportion of the island's electricity transmission network costs. The cost structure of electricity transmission is characterised by high fixed costs and very low marginal costs.

Currently, half of Unimin's electricity costs are transmission costs. Assuming the network assets are maintained for other customers following the cessation of mining, other customers will face a higher impost from the allocation of network costs across a smaller customer base. Assuming the size and service quality of the network is maintained, prices to remaining customers will need to rise substantially.

4.6.3 Fuel prices

In Unimin's consultation with Stradbroke Fuel, the company indicated that the mining industry accounted for more than 80% of the demand for fuel. It was further suggested that their supplier, Neumann's Fuel, may withdraw their support for NSI by removing the existing fuel depot. If this was to happen, then businesses (including the island's fishing industry) would need to source fuel off-island. With the removal of the ability to store fuel at the fuel depot, linked with a possible reduction in the economies of scale in transporting fuel to the island resulting from much lower volumes being transported, fuel prices are likely to rise.

Similarly to electricity transmission, to the extent that there are unavoidable fixed costs in transporting fuel, the reduction in mining related demand will result in fuel operators seeking to allocate a greater share of costs to remaining customers.

4.7 Community services

4.7.1 Schooling

The total population of the island in 2006 was 2,178 persons. Infants (0-4 years) accounted for 118 persons and children (5-17 years) accounted for 360 persons.

Approximately 40% of the children enrolled in Dunwich primary and secondary schools are from mining or mining related families.⁹ Stradbroke Early Learning Centre has 78 children enrolled, 26 of those are from mining families and many of the staff are partners of miners.¹⁰

The significant reductions in employment that will result from the cessation of mining has implications for the demand for schooling. If mining families, or families with incomes earned from other industries linked to mining, are forced to leave NSI in search of employment elsewhere, then this may reduce the school population. Schools with declining populations are typically not able to offer the same range of services to remaining students (e.g. have the critical mass to justify specialist teachers and programs), and can even become unviable.

4.7.2 Community activities and social networks

As shown earlier, mining's share of employment on the island is large. The employment, income and potential de-population impacts will have wide-ranging consequences for community activities and social networks, including on or through:

- sporting clubs, including having critical mass to field teams;
- RSL patronage;
- emergency service organisations like the Volunteer Marine Rescue, Queensland Fire and Rescue Service (QFRS) and the SES where mining employees and contractors make up a large proportion of the volunteer workforce. In the case of QFRS, one third of volunteers are mining employees; and
- reductions in funding to volunteer and community development projects. Unimin has contributed over \$ 1 million to projects over the last ten years.¹¹

⁹ Unimin Issues Discussion Paper - The Economic and Social Impact of Mining on North Stradbroke Island.

¹⁰ Ibid.

¹¹ Ibid. Over the last 15 years, the Volunteer Marine Rescue (VMR) has been provided with funds to purchase three rescue boats and essential equipment such as outboard motors and medical equipment. Recently, Unimin also agreed to provide \$100,000 in funding towards the development of an emergency services pontoon, essential for evacuations and disabled access to and from the island.

4.8 Structural adjustment

Over the longer term, the employment and income impacts on NSI will be influenced by the extent to which there is offsetting growth in other NSI industries, particularly tourism.

However, even if all of the displaced mining employment immediately found work in a growing NSI tourism or other industry, there would still be income impacts as these jobs are likely to have lower real wages compared to typical mining jobs, and the linkages between tourism and other industries are less than for sand mining.

In practise, it is likely that a process of structural adjustment would see a rise in NSI unemployment, some de-population of NSI as a proportion of mining workers and their families seek employment elsewhere, some transitions of mining workers into other NSI industries, and possibly some attraction of population to NSI if newly created jobs require skills sets that are significantly different to those of displaced mining workers (depending on their ability and suitability for re-training). Many factors would impact on the dynamics of this process, including:

- prevailing economic conditions on NSI, particularly the demand for labour and vacancy rates;
- wage rates on offer relative to the reservation wages¹² of the displaced mining workers, where their reservation wages are influenced by the strength of their preferences to remain on NSI (work-life choices) and their income requirements (e.g. levels of debt requiring financing);
- opportunities for supplementary income (e.g. part-time employment, two income households, off-NSI employment opportunities allowing continued residence on NSI);
- availability and size of government transfer payments; and
- the long-term outlook for the demand for labour.

¹² A reservation wage is the wage rate below which a job seeker will choose not to enter employment.

4.9 Expansion of the tourism industry

4.9.1 Performance and forecasts

In the decade to 2008, growth in international travel to Australia was strong with visitors increasing at an annual average rate of 3.0 %, and visitor nights increasing at a rate of 5.7 % (Table 10). The number of international visitors to Queensland has grown at a faster rate at 5.5 %, while visitor nights have grown similarly to the Australian average.

Forecasts to 2018 produced by Tourism Research Australia suggest that international tourism will continue to grow solidly, but at a slower rate, particularly for visitor nights. Major risks to the international forecasts include exchange rate assumptions, airline route capacities, fuel costs, and shocks, such as, disease outbreaks.

Table 10 Australia and Queensland international visitor nights

Calendar year	Visitors (millions)		Nights (millions)	
	AUS	QLD	AUS	QLD
1998, 1999*	4.2	2.0	108.0	24.6
2008	5.6	2.2	177.2	40.6
2009	5.6	2.2	185.8	39.3
2010	5.8	2.3	190.2	40.3
2011	6.1	2.4	198.6	41.4
2018	7.9	3.2	258.2	52.7
<i>Compound annual growth rate -</i>				
1998, 1999 to 2008	3.0%	5.5%	5.7%	5.6%
2008 to 2018	3.5%	3.5%	3.8%	2.6%

Notes: * Australian visitor numbers are for 1998. Other data is based on 1999 figures.

Source: Tourism Forecasting Committee, *Forecast 2009 Issue 2*, Tourism Research Australia, Canberra

Growth in domestic visitor nights has been much weaker. Total domestic visitor nights for Brisbane-Gold Coast showed almost no growth between 1998 and 2008 (Table 11).

National level data show a similar weakness in domestic tourism. The annual average number of trips per person (aged 15 years and over) decreased from 3.9 trips in 1999 to 3.1 trips in 2009.¹³ Further, the number of domestic visitor nights taken by Australians fell from an average of 19.9 nights in 1999 to 14.6 nights in 2009 because of the decline in trips per person and a trend toward trips of shorter duration.

¹³ Tourism Forecasting Committee, *Forecast 2009 Issue 2*, Tourism Research Australia, Canberra, pages 65-66.

Table 11 Brisbane and Gold Coast domestic visitor nights by purpose of visit

Calendar year	Holiday (‘000)	VFR (‘000)	Business (‘000)	Other (‘000)	Total (‘000)
1998	14,760	9,633	4,065	1,193	29,651
2008	14,569	9,445	4,199	1,474	29,687
2009(f)	14,013	8,752	3,533	1,280	27,577
2010(f)	14,576	9,276	3,909	1,516	29,277
2011(f)	14,673	9,368	4,024	1,571	29,636
2018(f)	14,959	9,848	4,269	1,705	30,781
<i>Compound annual growth rate (%) -</i>					
1998 to 2008	-0.1	-0.2	0.3	2.1	0.0
2008 to 2018	0.3	0.4	0.2	1.5	0.4

Source: Tourism Forecasting Committee, *Forecast 2009 Issue 2*, Tourism Research Australia, Canberra

Explanations for the weakness in domestic tourism include:¹⁴

- a loss of competitiveness associated with high petrol prices (over 90% of domestic overnight travel is conducted by car);
- a higher Australian dollar (which has lowered the cost of many competing goods, including travel to overseas);
- the emergence of a wide range of new competing goods and services; and
- recent growth in international aviation capacity has placed additional downward pressures on international airfares and package travel, further increasing the price competitiveness of outbound travel relative to domestic travel.

Domestic visitor nights forecasts show continued weakness in growth in domestic tourism. For Brisbane and the Gold Coast, growth in domestic visitor nights is forecast at only 0.4% per annum. Given underlying increases in population, this implies a continued decline in the average number of overnight trips taken by each Australian resident.

Underlying these forecasts is the assumption that domestic tourism will continue to face intense competitive pressure from other goods and services and outbound travel. Australian resident departures are forecast to grow at an average annual rate of 3.1% from 2009 to 2018.

¹⁴ Ibid.

Growth in tourism demand is expected to be strongest in the 'active seniors' (persons aged 55–69 years) group. This segment has been the best performing age group for domestic tourism in the past decade with visitor nights up 20% to 70 million nights in the year ending September 2009 compared with the 2000 calendar year. In comparison, domestic visitor nights in Australia by the other age cohorts combined fell 20% over the same period. Senior travel now represents around 27% of total visitor nights, compared with just 20% in 2000.

4.9.2 Implications for expansion of the tourism industry on NSI

Forecast domestic tourism activity for Australia, Queensland and Brisbane-Gold Coast suggest that, at least in the next ten years, growth in tourism on NSI is likely to be much less than would be required to offset the negative employment impacts from cessation of mining. As noted earlier, the incomes generated from new tourism industry jobs will be significantly less than the incomes generated from current mining operations. This will have flow-on impacts on incomes and employment in other industries.

Other factors that do not support rapid growth of tourism on NSI are:

- likely higher water transport costs to NSI as service providers seek to recover a proportion of revenues loss from the cessation of mining;
- likely reduction in access to NSI as the number of transport services are reduced; and
- potentially higher re-fuelling costs on NSI.

Possible effects that may partially offset these impacts are:

- reductions in housing prices making holiday rental accommodation cheaper; and
- possible environmental amenity improvements feeding through to increased tourism activity.

In addition, growth in the tourism industry on NSI could vary substantially from aggregate Australian, Queensland or even Brisbane-Gold Coast forecasts. Given the small size of the market, a large single investment, or small number of investments, could have a significant impact on the size of the NSI tourism industry. [To the best of our knowledge, there are no large investment plans progressing through planning and regulatory processes.]

Another factor that will limit the ability of an expansion in tourism to offset the impacts of the cessation of mining is the lesser degree to which the tourism industry is

linked backward with suppliers. The earlier linkage analysis showed that Sand mining had significantly higher backward linkages than tourism (2.0 versus 1.0 for employment, and 1.6 versus 1.1 for value added).

4.10 Alternative sources of glass sands

If NSI sands are unavailable, then Owens-Illinois and customers of Riverside will need to find alternative supplies. Other sources of premium grade glass sands are in Ballina (a very small operation) and Cape Flattery (which is past Cooktown). If Owens Illinois were to replace NSI sand with Cape Flattery sand, Unimin has indicated that there would likely be a cost penalty to Owens-Illinois of around \$20 per tonne. This would translate to an increase in their input costs of around \$1.5 million (equivalently, an increase of around \$0.003 to \$0.005 per individual bottle). Owens-Illinois produces around 500 tonnes of glass per day. The company is in competition with international suppliers and the increase in its costs may lead to higher imports of glass.

Queensland Construction Materials (a wholly owned subsidiary of Unimin) has a resource of 60 million tonnes of construction sands, with potential sales of 500,000 tonnes per annum. There is currently a forecast shortage in construction sands from 2015. Removal of NSI as a source of supply will place additional upward pressure on construction sand prices (currently around \$20 - \$30 per tonne) as alternative sources would require further dredging in Moreton bay, or transport from regions outside of the Brisbane area. The resulting cost increase for public infrastructure projects and the building industry would be directed to the consumer, raising the cost of economic development in Brisbane.

5 Conclusions

The population of NSI is highly dependent on sands mining for employment and incomes.

Direct employment in mining accounts for a much larger share of total employment than it does in Redland City Council or Queensland as a whole. Unimin employs around 13% to 15% (based on 2006 census data) of NSI's total workforce.

Linkage analysis shows that the Mineral sands industry is crucially important to the incomes of suppliers. The very high forward linkages, at or near double the importance of the "average" industry, is a strong indicator of the central role played by sand mining in the island's economy.

It is estimated that the economic impacts from the cessation of mining will:

- result in direct revenue losses of around \$125 million per year of which approximately \$77.5 million represents value added;
- directly reduce the GRP of the island by between 23% and 26%. The total impact will be greater because of the high degree of integration of mining with the rest of the economy;
- directly reduce employment by up to 14% on the island, with additional direct job losses in South East Queensland;
- reduce revenues paid to governments by up to \$196 million in net present value terms.

Overall, reductions in GRP (Value added) on NSI are estimated to range from 39% to 44% of current levels. Job losses on NSI will also be heavy with total employment potentially reducing by 30%. These are continuing losses until (if) other activity moves into to take the place of sand mining.

The price of ferry transport services, electricity services and fuel prices may rise significantly as service providers see major reductions in demand for their services, particularly where there are economies of scale in service provision.

Potential growth in labour demand from expansion of the tourism industry appears limited given tourism forecasts for the next ten years (especially weakness in domestic tourism growth), likely higher transport costs to the island, and higher island fuel costs.

The dramatic reduction in employment on the island, reduction in incomes, and potential de-population effects will have wide ranging impacts across community activities and services. Schools, volunteer organisations, community development projects, social activities (e.g. sporting activities) and the indigenous community will all be negatively impacted.