Kangaroo Island
Reduction in Transport Costs

A report prepared for

Kangaroo Island Regional Development Board

Prepared by

econsearch

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Abbreviations

ABS	Australian Bureau of Statistics
DECON	demographic-economic (model)
GRP	gross regional product
I-O	input-output
KIDB	Kangaroo Island Development Board

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1. Introduction

EconSearch Pty Ltd was contracted by the Kangaroo Island Development Board Inc (KIDB) to undertake an assessment of the impact of reduced transport costs on the Island's population and labour force requirements. The specific objectives of the project were to:

- identify the current financial situation and growth potential of key industries or sectors on the island;
- assess the importance of transport costs in determining the financial viability of these industries;
- estimate the economic and population impact of some alternative regional economic growth scenarios; and
- discuss the implications of these growth projections for freight cost support and infrastructure funding support.

The approach to the analysis and report structure is outlined below[1].

Section 2

Consultation with Representatives of Kangaroo Island's Key Industries: a summary of the objectives and outcomes of the consultation process.

Section 3

The Impact of Transport Costs on the Financial Viability of Key Industries: an assessment of the sensitivity of profit at the individual firm level for selected, key industries and the sensitivity of tourism expenditure to changes in transport costs.

Section 4

Estimates of the Economic and Demographic Impact of Growth Scenarios for Kangaroo Island's Key Industries - this section of the report includes:

- a description of the process of updating and extending the Kangaroo Island input-output table;
- definition of the indicators of economic and demographic impact used in the analysis;
- data sources for and quantification of growth scenarios for Kangaroo island's key industries;
- estimates of the regional economic and demographic impact of the growth scenarios; and
- an assessment of the sensitivity of the impacts to alternative transport cost outcomes.

Section 5

The Implications of the Growth Projections for Freight Cost Support and Infrastructure Funding Support: a qualitative analysis of the type of freight cost support and/or infrastructure funding support that may be necessary in order to achieve the economic and population growth projections outlined in previous sections of the report.

[1] This report follows on from a working paper delivered to the client in draft form on 28 June and a final version on 6 July 2007.

2. Consultation with Representatives of Kangaroo Island's Key Industries

2.1 The Objectives of the Consultation Process

Telephone interviews with representatives of Kangaroo Island's key industries were conducted during the months of June, July and August 2007. The following information was sought from interviewees.

- For primary industries: checked the base assumptions in the firm-level models from EconSearch (2003) (e.g. per unit freight rates for sea and road transport). Is the cost of travel an impediment to industry growth? What factors might reduce the cost of travel (e.g. Sealink charges, waiting times, road quality/safety, etc.)?
- For tourism: confirmed the general magnitude of the elasticities (i.e. sensitivity of tourism demand to the cost of travel) from EconSearch (2003). Is the cost of travel an impediment to industry growth? What factors might reduce the cost of travel (e.g. Sealink charges, waiting times, road quality/safety, etc.)?
- For primary industries: does the level of industry growth over the next 15 years, implicit in the projections in the *Kangaroo Island Regional Transport Strategy* (Strategic Design and Development 2007), reflect industry expectations?
- For tourism and hardwood forestry: what level of industry growth is forecast over the study period (i.e. 2007 to 2021).
- For all industries: what opportunities do you see for State and/or Commonwealth Government assistance in terms of freight cost and infrastructure funding support in order to facilitate the industry growth.

The outcomes from the consultation process are summarised below.

2.2 The Outcomes from the Consultation Process

Tourism

Consultation was undertaken with four stakeholders in the tourism sector on Kangaroo Island:

- Michael Geddes, South Australian Tourism Commission;
- Richard Trembath, South Australian Tourism Commission;
- Craig Wickham, Deputy Mayor, Kangaroo Island Council and owner of Adventure Charters of Kangaroo Island; and
- Paul Brown, Chair, Tourism Kangaroo Island (TKI) and owner of Kangaroo Island Wilderness Tours.

All of the tourism stakeholders consulted agreed with the broad magnitude of the tourism demand elasticities used in EconSearch (2003). It was also confirmed that international tourism demand was significantly less sensitive to the cost of travel than interstate and particularly intrastate tourism (e.g. Divisekera 2007).

Whilst it is apparent that the cost of both air and sea travel provides some disincentive to travel to the Island it was pointed out that, for those visitors that stay on the Island for a week or more, the travel cost component of the trip is similar to that incurred for many mainland destinations.

Some factors, such as road quality and safety, whilst not unique to Kangaroo Island, may provide a disincentive to travel to the Island and can increase the cost of the trip (e.g. through increased repairs and maintenance to vehicles). A reduction in wharfage fees at Penneshaw and Cape Jervis was highlighted as one the factors which could reduce the cost to tourists of the sea crossing. In terms of the air link it was pointed out that changes in aircraft types, operators and timetables has, in recent years, been a disincentive to air travel and added to the costs of that mode of transport.

In terms of growth in visitor numbers over the study period (i.e. the 15 years, 2007 to 2021), it was suggested that it is unlikely that growth would be markedly different from the long-term trend of 2.4 per cent per annum. This is consistent with the Tourism Research Australia (2007) national-level forecasts for growth in visitor numbers which suggest a small decline in domestic demand and growth in international demand of approximately 5 per cent per annum over the period 2007 to 2016.

Given its greater than proportional exposure to international tourists, when compared with visitors to the rest of South Australia, growth in the Kangaroo Island tourism sector is also exposed to a wide range of external influences (such as exchange rates or terrorist attacks) which increase the level of uncertainty associated with any projections.

Opportunities identified for State and/or Commonwealth Government assistance in order to facilitate tourism industry growth include marketing expenditure (e.g. Tourism Australia identifying Kangaroo Island as a ‘first trip’ destination), classifying the sea crossing as part of the National Highway Network (e.g. through an equalisation subsidy) and, given its limited financial capability, financial assistance to Local Government for repairs and maintenance to existing and future infrastructure assets.

Agriculture

Consultation was undertaken or an attempt has been made to consult with three stakeholders in the agricultural sector on Kangaroo Island:

- Neil Pontifex, broadacre cropping;
- Kim Blenkiron, Agriculture KI[2]; and
- Justin Harman, KI Food Industry.

The impact of transport costs on business financial viability and growth is outlined below.

- Transport costs were identified as a significant impediment to growth of the ‘food’ industry (i.e. value adding to primary products) on the Island. For

[2] Left phone messages and sent email outlining the objectives of the consultation process but no response was received.

example, new businesses can often sell product quite easily within the local community but problems are experienced when expanding to intra or interstate markets. Relative to some mainland competitors, transport costs also add to business set-up or expansion costs, including the cost of new buildings and equipment.

- In terms of business viability in the food sector, the transport cost impediment is compensated for somewhat by the quality premium received by the region's food producers.
- Transport costs are the most significant determinant of profitability for the broadacre cropping sector on the Island. The only financially viable form of grain transport is by truck with a fertiliser backload but this is only feasible where on-farm storage is available.
- The freight rate assumptions utilised in the farm-level models in EconSearch (2003) have been updated based on information received from those consulted.

Some of the factors which might reduce the cost of transport to agriculture and food industry businesses include the following.

- Increased competition for sea and air freight could decrease the cost to the consumer of these services both in terms of price and the inconvenience associated with scheduling.
- For the region's food sector, the establishment of a common consolidation point could reduce the costs of product distribution.

Comments on growth projections for the agriculture and food sector were as follows.

- Significant growth (i.e. increase in turnover of approximately 50 per cent per annum and employment growth of 15 per cent per annum) has been experienced by the region's food sector in recent years. One of the sector's most significant problems has been satisfying the level of demand for their products. On that basis, it is anticipated that growth will continue over the study period but at a more moderate rate.
- The growth rate assumptions for grains in Strategic Design and Development (2007), whilst plausible, do not take account of the significant variability which characterises the grain production sector as a result of a wide range of external influences (e.g. world prices for grains, seasonal conditions, etc.).

Opportunities identified for State and/or Commonwealth Government assistance in terms of freight cost and infrastructure funding were as follows.

- Facilitating the establishment of the SA Regional Food Cooperative on the Island through, for example, support to a business willing to construct and operate a cool room holding facility (i.e. consolidation point). This could, in turn, reduce the distribution costs to individual food sector businesses of marketing their product in the eastern states.
- Including the ferry crossing as part of the National Highway Network and assistance to local government with road construction and maintenance.

Hardwood Forestry

Consultation was undertaken with one stakeholder in the hardwood forestry sector on Kangaroo Island:

- Phil Griffiths, Great Southern Plantations.

Over the period that the hardwood forestry sector has been in the establishment and maintenance phase of development the cost of transport has not been an impediment to growth. Without the development of a bulk port, however, this will not be the case once the harvest phase begins.

Some of the factors that might reduce the transport costs incurred by the forestry sector include:

- selected road upgrades;
- development of links between highways;
- reducing the cost of sea freight; and
- increasing the size of trucks allowable on major thoroughfares.

As the 10 year harvest cycle begins, it is estimated that between 300,000 tonnes and 750,000 tonnes of timber per annum will be harvested from local plantations. The lower bound is consistent with the estimate of harvest activity in the sector that is provided in the *Kangaroo Island Regional Transport Strategy* (Strategic Design and Development 2007, p. 51). Based on previous work undertaken by the consultants for the timber industry (e.g. EconSearch 2005c and 2005d) it will be possible to provide an estimate of the economic impact of this level of activity.

Opportunities identified for State and/or Commonwealth Government assistance for freight cost and infrastructure funding support include:

- assistance to local government with general infrastructure repairs and maintenance, given the small rate base;
- subsidising the cost of general freight to and from the Island; and
- assistance with upgrades of designated road 'black spots' and truck routes.

Aquaculture

Consultation was undertaken with one stakeholder in the aquaculture sector on Kangaroo Island:

- Trish and John Hall, KI Abalone.

The cost of transport was identified as a serious impediment to the growth and viability of the region's abalone aquaculture sector. The following factors were identified.

- There is a significant transport margin or time-related impost on most business inputs and outputs, including labour (e.g. the labour and materials cost associated with repairs and maintenance).
- The lack of airfreight capability on Kangaroo Island makes it difficult for the business to access the live product market[3] and restricts marketing options.

[3] In order to access the live product market with current transport options, staff would need to work through the night in order fit in with ferry scheduling.

- The necessity to process on-site adds to the costs of production.
- It can be difficult to access the sea-freight service in peak periods.
- There is a significant cost to the business associated with the inconvenience or inflexibility of transport options which adds to the cost of production when compared with many mainland and overseas competitors.

Some of the factors that might reduce the transport costs incurred by the abalone aquaculture sector include:

- more competition for sea freight;
- the development of a viable air freight service; and
- including the Backstairs Passage crossing as part of the National Highway Network.

Whilst the business that was consulted was planning significant expansion in the following year, this growth strategy was to be reviewed annually on the basis of a wide range of factors such as the costs of production, demand for the product, etc. For the three year period 2006/07 to 2008/09, the abalone aquaculture sector at the state level was expecting production growth in the order of 25 to 65 per cent annum (EconSearch 2007b).

The most significant opportunity identified for State and/or Commonwealth Government assistance for freight cost and infrastructure funding was the inclusion of the Backstairs Passage crossing as part of the National Highway Network.

Retail and Wholesale Sectors

Although primary industries and tourism were the focus of this study, consultation was undertaken with businesses in the retail and wholesale sectors on Kangaroo Island:

- Phil Bell, retail sector, Kingscote Mitre 10;
- Andrew Ramsay; wholesale sector, KI Fuel;

Their responses are summarised in the dot points below.

- The transport cost component of retail and wholesale sales is passed on to the consumer of the product. In the retail sector, mainland businesses are able to sell equivalent product at a lower price and some business is ‘lost’ to the mainland as a result.
- For building supplies and materials the per tonne transport rate to the Island from Adelaide is similar to rates from Adelaide to Mount Gambier or Port Lincoln.
- One of the costs imposed on building supplies and materials by the transport link between Adelaide and Kangaroo Island is damage to the goods in transit. This is a function of the quality of the road between Cape Jervis and Adelaide rather than other aspects of the transport link. Improvements to this piece of infrastructure are seen as a vital aspect of reducing the cost of transport to businesses of this nature.
- Factors which add to the cost of fuel wholesaling on the Island include underutilisation of transport equipment (i.e. truck and tanker), high turnaround times (as a result of ferry scheduling) and weight restrictions on local roads which prevent the use of more cost efficient vehicles (e.g. B-

doubles). These local roads include some of those on the Island as well as the Cape Jervis to Adelaide road.

- Growth in retail and wholesale trade is a function of broader economic and population growth. Policies and assistance which enhance the latter will benefit the former.
- Freight subsidies for the sea freight component of the link were identified as a role for State and Commonwealth Government assistance.

Transport Sector

Finally, in order to seek the perspective of a major transport service provider on some of the issues identified above, consultation was undertaken with:

- Jeff Ellison, Sealink.

Whilst aggregate transport costs were identified as a probable constraint to regional economic growth, a number of factors need to be considered when assessing the relative contribution of the ferry crossing.

- From the point of view of agriculture, forestry and other land users the relatively low cost of the land (when compared with equivalent quality land on the mainland) needs to be accounted for when assessing the financial impact of transport costs.
- Freight rates for the ferry crossing are significantly cross-subsidised through fares charged to tourists and other visitors to the Island.
- Fare increases for the ferry crossing have been minimised over time by increasing the volume of tourists using the service.

Sealink is supportive of endeavours by KIDB and other community or business representatives on the Island in their attempts to seek government assistance for freight cost support, infrastructure funding and inclusion of Backstairs Passage as part of the National Highway Network. Some of the other ways in which such support could be delivered include:

- increased tourism marketing expenditure;
- a reduction in wharfage fees and other government charges on Sealink's services which could directly contribute to reduced fares; and
- assistance with the development and maintenance of tourism related infrastructure such as roads, terminal facilities, bus stops and facilities at key tourism destinations.

3. The Impact of Transport Costs on the Financial Viability of Key Industries

The purpose of this section of the report was to assess the sensitivity of profit at the individual firm level for selected, key industries on the Island and the sensitivity of tourism expenditure to changes in transport costs.

3.1 Sensitivity of Profit at the Firm Level to Changes in Transport Costs

For the *Kangaroo Island Sea Access Economic Assessment Study* (EconSearch 2003), representative firm-level financial models were prepared for a range of primary industry sectors on the Island for the purpose of quantifying the impact of transport costs on firm-level financial viability. Based on the consultation undertaken for this study, it is clear that the broad conclusions from EconSearch (2003) are still relevant.

- Transport costs (sea and road) comprise a significant proportion of total revenue for grain producers (i.e. approximately 15 per cent), a lower but still significant proportion of total revenue for livestock producers (approximately 8 per cent) and a relatively low proportion of total revenue for some of the higher value, lower volume industries (e.g. fishing).
- By way of comparison, at the national level, expenditure by the agricultural sectors on transport services in 2001/02 was $1.0 billion, which represented approximately 2.4 per cent of total gross revenue ($41.9 billion) in that year (ABS 2006b).

Caution is required in the interpretation and use of representative firm-level financial models. The diversity in business size, enterprise mix, cost structures, prices received, etc. that is inherent at the firm level cannot be adequately represented in models of this type. Rather, there is likely to be significant variability in the sensitivity of firm-level financial viability to transport costs:

- across sectors (e.g. grains versus fishing);
- within sectors (in response to a wide variety of factors including business scale, managerial competence, etc.);
- across time (in response to seasonal conditions, product prices, other costs, etc.); and
- based on the geographical location of the business (e.g. distance from port and/or distance to arterial road).

Furthermore, for businesses based on Kangaroo Island, the transport cost impact on financial viability is manifested in a number of ways, in addition to the obvious impact of the price of these services. Some of these factors were identified during the course of the consultation process and include:

- costs associated with the scheduling (i.e. frequency and timing) of transport services (e.g. underutilisation of equipment and labour, limited access in peak periods of demand, restricted marketing options, etc.); and

- costs associated with the quality of infrastructure assets (e.g. poor road quality can add to the cost of goods and services through damage to goods in transit, restrictions to the use of more cost efficient vehicles such as B-doubles, increased repairs and maintenance costs, etc.)

3.2 Sensitivity of Tourism Expenditure to Changes in Transport Costs

In order to assess sensitivity of the employment and population impacts presented in Section 4 of the report to alternative transport cost outcomes, it was necessary to quantify the relationship between the demand for tourism goods and services and transport costs.

The relationship between the demand for tourism goods and services in the region and transport costs is measured by the transport price elasticity of demand. Estimates of the elasticity of demand for tourism goods and services to transport prices were sourced from Divisekera (2007), namely:

- an estimate of the transport price elasticity of demand by domestic tourists of -0.440; and
- an estimate of the transport price elasticity of demand by international tourists of -0.282.

Thus, for instance, a reduction in transport costs of 10 per cent would result in an increase in demand by domestic tourists of 4.4 per cent and in an increase in demand by international tourists of 2.8 per cent. In broad terms, approximately 75 per cent of visitor expenditure in the region was assumed to be related to domestic demand and the balance to international tourists (EconSearch 2005b). The price inelastic nature of the relationship is a reflection in part of the fact that transport costs are only one of the variables to which demand for tourism goods and services is sensitive. Others include, for example, food, shopping and accommodation costs.

Note that the elasticity estimates used in this study are consistent with those used in EconSearch (2003).

4. Estimates of the Regional Economic and Demographic Impact of Growth Scenarios for Kangaroo Island's Key Industries

This section of the report is structured as follows.

- Section 4.1: a description of the process of updating and extending the Kangaroo Island input-output table.
- Section 4.2: definition of the indicators of economic and demographic impact used in the analysis.
- Section 4.3: data sources for and quantification of growth scenarios for Kangaroo Island's key industries.
- Section 4.4: estimates of the regional economic and demographic impact of the growth scenarios.
- Section 4.5: an assessment of the sensitivity of the impacts to alternative transport cost outcomes.

4.1 Updating and Extending the Kangaroo Island Input-Output Table

An I-O model for the Kangaroo Island regional economy for 2002/03 was developed by the consultants for the Office of Regional Affairs (EconSearch 2005b). This model was updated to 2005/06 using a range of data, including:

- Changes in labour productivity.
- Price changes: updated using Consumer Price Index for Adelaide from ABS (2006a).
- Changes in employment and population levels: updated using DEWR (2006) and ABS (2007), respectively.
- Changes in agricultural production and value of output: updated using PIRSA *Scorecards* for the region (Carina Cartwright, PIRSA, pers. comm.).
- Changes in commercial fisheries and aquaculture production, value of output and employment: updated using EconSearch (2007a and 2007b).
- Changes in visitor numbers to the region: updated using information provided by Pauline Coates (South Australian Tourism Commission, pers. comm.).

The preliminary updated table for the region was developed by applying the modified RAS method[4], a procedure available in the specialist input-output software that was used for the task[5]. Edits and refinements to the preliminary table were undertaken using *Microsoft Excel®*.

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4 The modified RAS method is used by the Australian Bureau of Statistics in updating the national input-output table. The method is illustrated in Appendix A of ABS Cat. No. 5209, *Australian National Accounts, Input-Output Tables*. A detailed discussion of the methodology is provided in the ABS occasional paper *The RAS Method for Compiling Input-Output Tables: ABS Experience*.

5 *IOW,* developed by West (2005).

Based on work undertaken by Mangan and Phibbs (1989), the I-O model developed for this project was extended as a demographic-economic (DECON) model. The two key characteristics of the DECON model, when compared with a standard economic model, are as follows.

1. The introduction of a population 'sector' (or row and column in the model) makes it possible to estimate the impact on local population levels of employment growth or decline.
2. The introduction of an unemployed 'sector' makes it possible to account for the consumption-induced impact of the unemployed in response to economic growth or decline.

A range of data for construction of the DECON model was obtained by special request from the Australian Bureau of Statistics' *2001 Census of Population and Housing* (Sonja Williams, pers. comm.).

See Appendix 1 for a glossary of I-O terminology and Appendix 2 for further description of I-O analysis and DECON models.

4.2 Indicators of Economic and Demographic Impact

The following indicators of economic impact were generated using the regional economic modelling framework described above:

- output;
- contribution to gross regional product;
- employment; and
- household income.

(Value of) Output is a measure of the gross revenue of goods and services produced by commercial organisations (e.g. farm-gate value of wine grape production) and gross expenditure by government agencies. Total output needs to be used with care as it includes elements of double counting (e.g. the value of winery output includes the farm-gate value of wine grape production).

Contribution to gross regional product (GRP) is a measure of the net contribution of an activity to the regional economy. Contribution to GRP is measured as value of output less the cost of goods and services (including imports) used in producing the output. In other words, it can be measured as household income plus other value added (gross operating surplus and all taxes, less subsidies). It represents payments to the primary inputs of production (labour, capital and land). Using contribution to GRP as a measure of economic impact avoids the problem of double counting that may arise from using value of output for this purpose.

Employment is a measure of the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent (fte) jobs.

Household income is a component of GRP and is a measure of wages and salaries paid in cash and in kind, drawings by owner operators and other payments to labour including overtime payments, employer's superannuation contributions and income tax, but excluding payroll tax.

Estimates of economic impact are presented in terms of:

- direct impacts;
- flow-on impacts; and
- total impacts.

Direct (or initial) impacts are the initial round of output, employment and income generated by an economic activity (e.g. wine grape production).

Flow-on impacts are the sum of first-round and industrial support impacts, together called production-induced impacts, and consumption-induced impacts. Production-induced impacts are additional output, employment and income resulting from re-spending by firms (e.g. transport contractors) that receive income from the sale of goods and services to firms undertaking, for example, wine grape production. Production-induced impacts are sometimes referred to as 'indirect effects'. Consumption-induced impacts are additional output and employment resulting from re-spending by households that receive income from employment in direct and indirect activities. Consumption-induced effects are sometimes referred to as 'induced effects'.

Total impacts are the sum of direct and flow-on impacts.

The demographic impact of changes in the level of employment in the region was measured using **population** (i.e. the number of people resident in the region) as an indicator.

4.3 Growth Scenarios for Kangaroo Island's Key Industries

Alternative growth scenarios for Kangaroo Island's key industries were based primarily upon:

- the low and high growth freight movement projections in the *Kangaroo Island Regional Transport Strategy* (Strategic Design and Development 2007); and
- on the basis of consultation with representatives from key industries on the Island.

Importantly, for the purpose this impact analysis, it was assumed that the primary catalyst for regional economic and population growth would be new or expanded activity in the following sectors:

- sheep (prime lambs and wool);
- grains;
- beef;
- forestry (principally the harvest of hardwood plantations);
- commercial fishing;
- aquaculture;
- mining (principally the development of a new zinc and lead mine); and
- tourism.

It was assumed that growth in other sectors of the regional economy (e.g. manufacturing and service sectors) would be likely to occur as a consequence of direct and flow-on activity generated by growth in the key sectors identified above.

It is also possible that regional economic activity could be generated by growth in other sectors of the economy (e.g. other primary industries) but these impacts have been excluded from the analysis given the paucity of relevant data and the relatively small scale of the industries in their current form.

A low and high growth scenario for Kangaroo Island's key industries for the 15 year period 2007 to 2021 is summarised in Tables 4.2 and 4.3, respectively. Data sources and assumptions are outlined in the footnotes to the tables.

When estimating the impact of compound growth in the value of output of key sectors it was necessary to account for the impact of growth in labour productivity over time in these sectors and within the broader regional economy. Assumptions relating to labour productivity growth rates are summarised in Table 4.1.

Table 4.1 Assumed rate of growth in labour productivity, Kangaroo Island, 2007 to 2021 (annual compound rate of growth)

Sheep [a]	1.6%
Grains	1.6%
Beef cattle	1.6%
Forestry [b]	-
Commercial fishing	1.5%
Aquaculture	1.5%
Other mining	1.5%
Tourism [c]	-
All other sectors	1.5%

[a] Estimates for the sheep, grains and beef cattle sectors were derived from Knopke et al (1995).

[b] Direct employment in the sector would be unlikely to change significantly but large flow-on effects would be generated as a result of expenditure on harvesting, chipping and transport contract services.

[c] Given that the tourism industry is not specified as a separate sector within the I-O model it is assumed that there is no direct employment in this sector, rather employment is generated in a whole range of sectors (e.g. trade, 'accommodation, restaurants and cafes', transport, etc.) as a result of expenditure by tourists in these sectors.

Table 4.2 A low growth scenario for Kangaroo Island's key industries, 2007 to 2021 (annual compound rate of growth in output)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Sheep [a]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Grains [a]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Beef cattle [a]	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Forestry and logging [b]															
Harvest (t)	0	0	0	100,000	140,000	180,000	220,000	260,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Annual growth	0.0%	0.0%	0.0%	harvest cycle commences	40.0%	28.6%	22.2%	18.2%	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Commercial fishing [a]	3.0%	3.0%	3.0%	3.0%	3.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Aquaculture [c]	25.0%	25.0%	25.0%	25.0%	25.0%	12.5%	12.5%	12.5%	12.5%	12.5%	5.0%	5.0%	5.0%	5.0%	5.0%
Mining (tonnes) [d]															
Production (t)	0	0	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	103,000	106,090	109,273	112,551	115,927
Annual growth	0.0%	0.0%	0.0%	mine begins production	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Tourism [e]	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%

[a] Growth in output in the sheep, grains, beef cattle and commercial fishing sectors was based on Table 17 in Strategic Design and Development (2007) and on the basis of consultation with representatives from these industries.

[b] It was assumed that growth in the forestry and logging sector would be comprised principally of harvest activity in the hardwood sector. Direct employment in the sector would be unlikely to change significantly but large flow-on effects would be generated as a result of expenditure on harvesting, chipping and transport contract services. An expenditure profile for this sort of activity was based on previous work undertaken by the consultants (EconSearch 2005c). For the low growth scenario it was assumed that the harvest cycle would commence in 2010, reaching a peak of 300,000 t/annum by 2015 (Strategic Design and Development 2007).

[c] Growth in output in the aquaculture sector was based on previous work undertaken by the consultants (EconSearch 2007b) and on the basis of consultation with representatives from the industry.

[d] It was assumed that growth in the mining sector would be comprised principally of the establishment of a new zinc-lead mine and that production would begin in 2010 (Strategic Design and Development 2007). The value of output generated by this mining activity was based on zinc and lead yields published in www.monaxmining.com.au and current world prices for these commodities from ABARE (2006). An expenditure profile for this activity was based on previous work undertaken by the consultants (EconSearch 2005b). For the low growth scenario it was assumed that some output growth would occur from 2017.

[e] Estimates of growth in tourism expenditure were derived on the basis of consultation with representatives from this industry. The rate of growth for the low growth scenario is somewhat less than the long-term average growth rate for the industry (2.4 per cent/annum).

Table 4.3 A high growth scenario for Kangaroo Island's key industries, 2007 to 2021 (annual compound rate of growth in output)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Sheep [a]	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%
Grains [a]	2.0%	2.0%	2.0%	2.0%	2.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Beef cattle [a]	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Forestry and logging [b]															
Harvest (t)	0	0	0	100,000	159,091	218,182	277,273	336,364	395,455	454,545	513,636	572,727	631,818	690,909	750,000
Annual growth	0.0%	0.0%	0.0%	harvest cycle commences	59.1%	37.1%	27.1%	21.3%	17.6%	14.9%	13.0%	11.5%	10.3%	9.4%	8.6%
Commercial fishing [a]	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Aquaculture [c]	40.0%	40.0%	40.0%	40.0%	40.0%	20.0%	20.0%	20.0%	20.0%	20.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Mining (tonnes) [d]															
Production (t)	0	0	0	100,000	100,000	103,000	106,090	109,273	112,551	115,927	121,724	127,810	134,200	140,910	147,956
Annual growth	0.0%	0.0%	0.0%	mine begins production	0.0%	3.0%	3.0%	3.0%	3.0%	3.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Tourism [e]	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%

a Growth in output in the sheep, grains, beef cattle and commercial fishing sectors was based on Table 17 in Strategic Design and Development (2007) and on the basis of consultation with representatives from these industries.

b It was assumed that growth in the forestry and logging sector would be comprised principally of harvest activity in the hardwood sector. Direct employment in the sector would be unlikely to change significantly but large flow-on effects would be generated as a result of expenditure on harvesting, chipping and transport contract services. An expenditure profile for this sort of activity was based on previous work undertaken by the consultants (EconSearch 2005c). For the high growth scenario it was assumed that the harvest cycle would commence in 2010, reaching a peak of 750,000 t/annum by 2021 (based on the results of consultation with representatives from this industry).

c Growth in output in the aquaculture sector was based on previous work undertaken by the consultants (EconSearch 2007b) and on the basis of consultation with representatives from the industry.

d It was assumed that growth in the mining sector would be comprised principally of the establishment of a new zinc-lead mine and that production would begin in 2010 (Strategic Design and Development 2007). The value of output generated by this mining activity was based on zinc and lead yields published in www.monaxmining.com.au and current world prices for these commodities from ABARE (2006). An expenditure profile for this activity was based on previous work undertaken by the consultants (EconSearch 2005b). For the high growth scenario it was assumed that some output growth would occur from 2012.

e Estimates of growth in tourism expenditure were derived on the basis of consultation with representatives from this industry. The rate of growth for the high growth scenario was based the long-term average growth rate for the industry (2.4 per cent/annum).

4.4 Estimates of the Regional Economic and Demographic Impact of the Growth Scenarios

Estimates of the direct and flow-on economic and population impact of the growth scenarios presented in Section 4.3 of the report are provided below as single year estimates and as a time series.

Detailed estimates of the economic and population impact in 2007 of the low rate of growth in key sectors of the Kangaroo Island regional economy are provided in Table 4.4. In aggregate, it was estimated that growth in key sectors of the economy (e.g. grains, forestry, tourism, etc.) of the magnitude outlined in Table 4.2 would contribute an additional $2.4m in output in 2007. This activity would directly generate an additional 4 full time equivalent (fte) jobs, household income of approximately $0.1m and an associated population increase of 6 persons.

Table 4.4 The economic and population impact of a low growth rate in key sectors of the Kangaroo Island regional economy, 2007 [a]

Sector	Output [b]	Contribution to GRP [c]	Employment [d]	Household Income	Population
	$m	$m	fte	$m	no.
Total direct effects	2.4	0.8	4	0.1	6
Flow-on effects					
Agriculture	-	0.1	1	0.0	3
Manufacturing	-	0.0	0	0.0	1
Utilities		0.0	0	0.0	0
Trade	-	0.1	3	0.1	5
Transport and storage	-	0.1	1	0.0	1
Other service sectors		0.2	4	0.1	9
Ownership of dwellings	-	0.1	0	0.0	0
Other sectors	-	0.0	0	0.0	1
Total flow-on	-	0.5	9	0.3	19
Total	**2.4**	**1.3**	**12**	**0.4**	**25**
Regional totals, 2005/06		139	1,742	59	4,446
Proportion of regional total [e]	-	0.9%	0.7%	0.7%	0.6%

a All dollar values in the table are in 2006 dollars.

b Flow-on (indirect) output impacts are not reported as there are problems with double counting which can give a misleading impression of the significance of individual industries. For example, the value of grain processed locally is included in both the other food products and grain sectors. If the two values were added together the farm-gate value of grain would be counted twice.

c Contribution to gross regional product.

d In full time equivalents.

e Regional totals relate to the year for which the DECON model for the region was constructed (i.e. 2005/06).

Source: EconSearch analysis.

Contribution to gross regional product (GRP) is calculated as the value of output less the cost of goods and services used in producing the output. As an indicator of the net contribution to regional economic growth of a particular enterprise or activity, the use of ‘contribution to GRP’ overcomes the problem of double counting that arises from using ‘value of output’ for this purpose. It was estimated that growth in key sectors of the regional economy would directly contribute approximately $0.8m in GRP in 2007 under the low growth rate scenario.

Associated with the direct economic impact generated by the low rate of growth in key sectors of the regional economy there would be flow-on impacts in other sectors.

- In terms of contribution to GRP, the total flow-on impact was estimated to be approximately $0.5m in 2007. Flow-on GRP impacts would be concentrated in the agriculture, trade, transport and other service sectors. The total GRP impact ($1.3m) represents 0.9 per cent of the 2005/06 regional total.
- In terms of employment, flow-on business activity was estimated to generate an additional 9 fte jobs in 2007. Flow-on employment impacts would be concentrated in the trade and other service sectors. The total employment impact (12 fte jobs) represents 0.7 per cent of the 2005/06 regional total.
- Associated with flow-on employment would be additional household income of approximately $0.3m in 2007. The total household income impact ($0.4m) represents 0.7 per cent of the 2005/06 regional total.
- The flow-on population impact provides an estimate of population levels associated with market-driven activities (i.e. flow-on business activity generated by growth in key sectors) and related non-market activities (i.e. population driven services such as education). The total population impact (an additional 25 persons) represents 0.6 per cent of the 2005/06 regional total.

Detailed estimates of the economic and population impact in 2007 of the high rate of growth in key sectors of the Kangaroo Island regional economy are provided in Table 4.5. These estimates can be interpreted in an identical manner to those presented above.

Note that the impact estimates presented in Tables 4.4 and 4.5 are single-year estimates and relate to growth in 2007. It is apparent, however, that the rate of growth over the time period of the analysis (i.e. 2007 to 2021) varies quite significantly from year to year, reaching a peak in 2010 as the harvest cycle for hardwood plantations and the zinc-lead mine are assumed to commence production[6]. Note also that the growth is compound in nature.

6 See Appendix 3 of the report for details.

Table 4.5 The economic and population impact of a high growth rate in key sectors of the Kangaroo Island regional economy, 2007 [a]

Sector	Output [b]	Contribution to GRP [c]	Employment [d]	Household Income	Population
	$m	$m	fte	$m	no.
Total direct effects	4.1	1.4	12	0.3	19
Flow-on effects					
Agriculture	-	0.1	2	0.0	5
Manufacturing	-	0.0	0	0.0	1
Utilities		0.0	0	0.0	0
Trade	-	0.2	4	0.1	8
Transport and storage	-	0.1	1	0.1	2
Other service sectors		0.3	6	0.2	14
Ownership of dwellings	-	0.1	0	0.0	0
Other sectors	-	0.0	0	0.0	1
Total flow-on	-	0.9	14	0.5	32
Total	**4.1**	**2.2**	**26**	**0.8**	**52**
Regional totals, 2005/06		139	1,742	59	4,446
Proportion of regional total [e]	-	1.6%	1.5%	1.3%	1.2%

a All dollar values in the table are in 2006 dollars.

b Flow-on (indirect) output impacts are not reported as there are problems with double counting which can give a misleading impression of the significance of individual industries. For example, the value of grain processed locally is included in both the other food products and grain sectors. If the two values were added together the farm-gate value of grain would be counted twice.

c Contribution to gross regional product.

d In full time equivalents.

e Regional totals relate to the year for which the DECON model for the region was constructed (i.e. 2005/06).

Source: EconSearch analysis.

Time series estimates of compound growth in the key variables of population and employment are summarised in Table 4.6 and Figures 4.1 and 4.2 for the low and high growth rate scenarios, respectively[7]. Based on the assumptions outlined in Section 4.3 of the report, employment change generated as a result of growth in key sectors of the regional economy was estimated to range from an average of 1.0 per cent per annum for the low growth rate scenario to 2.3 per cent per annum for the high growth rate scenario over the period 2007 to 2021. Population change generated as a result of economic growth in key sectors of the regional economy was estimated to range from an average of 0.8 per cent per annum for the low growth rate scenario to 1.9 per cent per annum for the high growth rate scenario.

To put these estimates into perspective, over the 10 year period 1996 to 2006, the number of jobs on Kangaroo Island grew by approximately 2.0 per cent per annum, from 1,425 fte in 1996 to 1,742 persons in 2006[8]. Over the same time period, Kangaroo Island's population grew by approximately 0.5 per cent per annum, from 4,228 persons in 1996 to 4,446 persons in 2006 (ABS 2007). Whilst the historical rate of employment growth is similar to that which could be experienced by the region over the period 2007 to 2021, the historical rate of population growth is significantly lower.

7 More detailed estimates (i.e. year by year) are provided in Appendix 3.

8 These estimates were derived by the consultants from DEWR (2006 and previous issues) as well as information from a variety of other sources.

Table 4.6 Estimates of the employment and population impact of the low and high growth scenarios for Kangaroo Island's key industries, 2007 to 2021

	Employment (fte)	Population (no.)
Historic [a]		
1996	1,425	4,228
2006	1,742	4,446
Av. annual growth rate	2.0%	0.5%
Low growth scenario		
2006	1,742	4,446
2021	2,012	5,017
Av. annual growth rate	1.0%	0.8%
High growth scenario		
2006	1,742	4,446
2021	2,466	5,900
Av. annual growth rate	2.3%	1.9%

[a] Historical estimates of employment and population were derived by the consultants from ABS (2007) and DEWR (2006), respectively.

Source: EconSearch analysis.

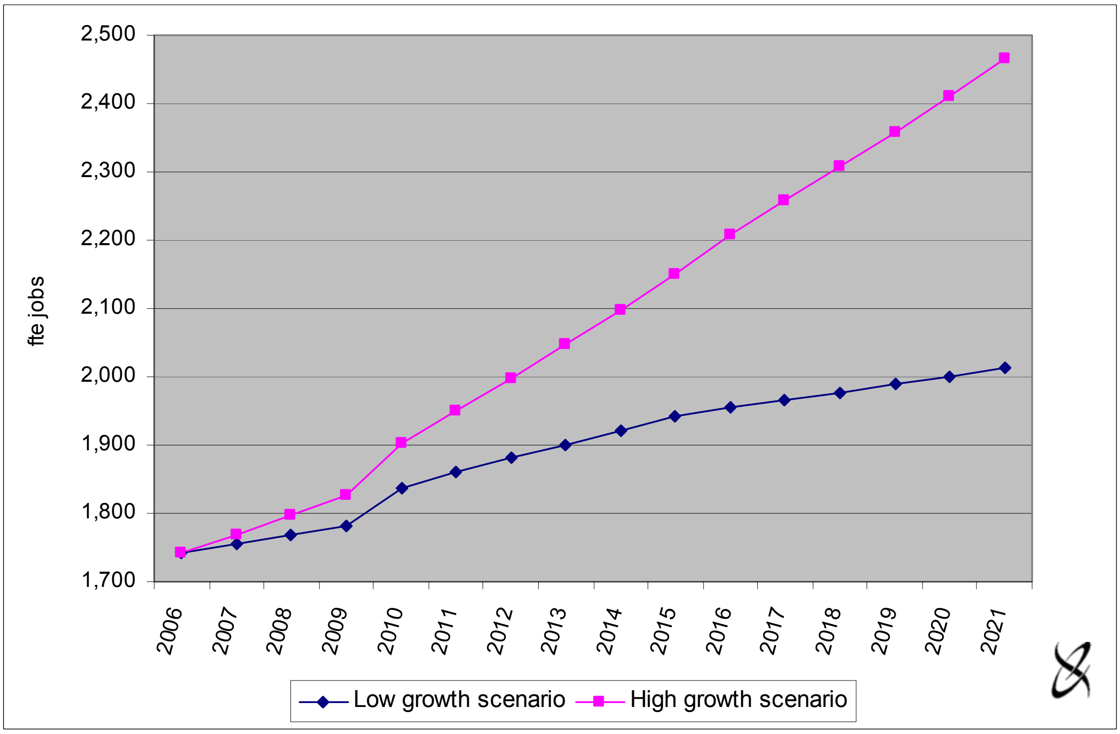
Note, however, that the regional unemployment rate in 1996 (approximately 11 per cent) was significantly higher than that in 2006 (approximately 2 per cent)[9]. Thus, differences in the historical growth rates of population and employment over the 10 year period to 2006 could be attributed to the possibility that many of the new jobs generated on Kangaroo Island over this period were filled by previously unemployed locals, with limited net addition to the population. It is likely that future employment growth will only be achievable with migration to the region of workers and their families, thus estimates of future employment and population growth rates are similar in magnitude.

Note that the analysis does not account for employment and population growth or decline that may be driven by other forces, for example:

- growth or decline in sectors of the regional economy that have not been identified in this analysis; or
- the attractiveness of the region as a place of residence for retirees.

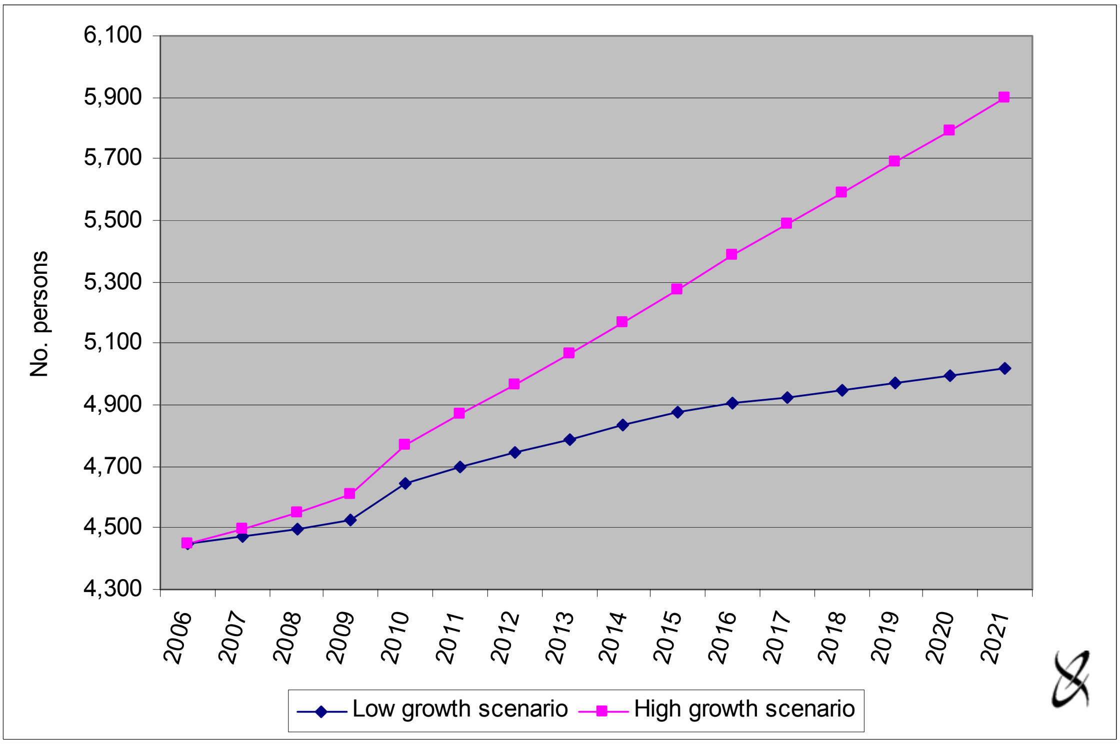
9 DEWR (2006 and previous issues).

Figure 4.1 Time series employment impact for low and high growth scenarios, Kangaroo Island, 2007 to 2021



Source: EconSearch analysis.

Figure 4.2 Time series population impact for low and high growth scenarios, Kangaroo Island, 2007 to 2021



Source: EconSearch analysis.

4.5 An Assessment of the Sensitivity of the Impacts to Alternative Transport Cost Outcomes

The purpose of this section of the report was to provide an assessment of the sensitivity of the impacts presented in Section 4.4 of the report to alternative transport cost outcomes, specifically, a reduction in transport costs with all other variables held constant. These impacts were estimated by making adjustments to the DECON models developed for this project, as described below.

The impacts on regional population and employment levels reported in Table 4.7 were imputed on the basis of a reduction in transport costs in the key growth sectors (i.e. sheep, forestry, tourism, etc.) of 5, 10 and 25 per cent in the first year of the analysis (i.e. 2007) and maintained over the period 2007 to 2021. For all sectors except tourism it was assumed that the impact of reduced costs would manifest itself as an increase in household disposable income and profit, all other variables held constant[10].

For the tourism sector it was assumed that a reduction in transport costs in the year 2007 would result in an increase in visitor numbers to the region in that year which would be maintained over the full period of the analysis. Assuming that expenditure per visitor and the expenditure profile of visitors to the region remained constant, this would result in a consequent increase in aggregate visitor expenditure. The relationship between the demand for tourism goods and services in the region and transport costs is measured by the transport price elasticity of demand. Estimates of the elasticity of demand for tourism goods and services to transport prices were sourced from Divisekera (2007)[11].

It is apparent from Table 4.7 that estimates of employment and population impact in the region attributable to growth in key sectors of the economy are relatively sensitive to transport costs in these sectors. For example, if transport costs in the sheep, grain, beef, forestry, commercial fishing, aquaculture, mining and tourism sectors were reduced by 25 per cent in 2007, direct and flow-on economic activity generated by this change would result in:

- an additional 65 fte jobs in the region by 2021 for the low growth scenario and 76 jobs for the high growth scenario (i.e. a difference of 3.2 and 3.1 per cent, respectively, relative to the base case); and
- an additional 141 persons living in the region by 2021 for the low growth scenario and 164 persons for the high growth scenario (i.e. a difference of 2.8 per cent for both scenarios, relative to the base case).

In line with the previous study undertaken by the consultants (EconSearch 2003), the impact of a transport cost reduction in the tourism sector is far more significant than an equivalent proportional reduction in the primary industry sectors. For the impact described above:

- approximately 80 per cent of the employment impact in 2021 for the low growth scenario and 77 per cent for the high growth scenario can be attributed to the transport cost reduction in the tourism sector; and
- approximately 81 per cent of the population impact in 2021 for the low growth scenario and 78 per cent for the high growth scenario can be attributed to the transport cost reduction in the tourism sector.

10 For the purpose of this analysis it was assumed that the split between household income and profit was 50:50.

11 See Section 3 of the report for details.

Table 4.7 Estimates of the sensitivity of the employment and population impacts to a reduction in transport costs in key sectors

Change in transport costs in key sectors	Low growth scenario - year 2021		High growth scenario - year 2021	
	Empl. (fte)	Pop. (no.)	Empl. (fte)	Pop. (no.)
No change	2,012	5,017	2,466	5,900
5 per cent reduction	2,025	5,045	2,481	5,933
Difference [a]	0.6%	0.6%	0.6%	0.6%
10 per cent reduction	2,038	5,073	2,496	5,965
Difference [a]	1.3%	1.1%	1.2%	1.1%
25 per cent reduction	2,077	5,158	2,541	6,064
Difference [a]	3.2%	2.8%	3.1%	2.8%

[a] Relative to the no transport cost change scenario.

Source: EconSearch analysis

5. The Implications of the Growth Projections for Freight Cost Support and Infrastructure Funding Support

This section of the report is a brief qualitative analysis of the type of freight cost support and/or infrastructure funding support that may be necessary in order to achieve the economic and population growth projections outlined above.

It is clear from the *Kangaroo Island Regional Transport Strategy* (Strategic Design and Development 2007) that the freight growth projections for the regional economy are contingent upon significant investment in the construction of new roads and other infrastructure assets as well as upgrades to and maintenance of the existing road network and other assets. Furthermore, the employment and population impacts associated with the growth scenarios developed for this analysis indicate that future population growth could exceed recent growth rates by a significant margin. This has further implications for traffic volumes and the maintenance requirement for infrastructure assets. Given that the capacity of Kangaroo Island Council to raise funds for this sort of investment is limited by the relatively small pool of rate payers, there could be a role for State and Commonwealth Government assistance.

For bulk commodities such as woodchips, mining ores and possibly grains, growth in these sectors is contingent upon investment in the road network as well as the construction, operation and maintenance of a new bulk loading facility. In order to achieve their regional development goals, there are a number of ways in which the State and Commonwealth Government could facilitate this investment, with a ‘public-private’ partnership being one option.

Growth in the tourism sector is an integral component of the growth scenarios developed for this analysis. Furthermore, as demonstrated in this and the previous analysis (i.e. EconSearch 2003), the employment and population impacts generated by expenditure in the tourism sector are sensitive to transport costs. To enhance Kangaroo Island’s economic development potential, a key priority should be the ongoing pursuit of measures that will bring about long-term, sustainable reductions in transport charges to tourists.

As discussed in Section 4.4, it is likely, given the low regional unemployment rate, that future employment growth will only be achievable with migration to the region of workers and their families. On the basis of consultation undertaken for this project, it is apparent that the general cost of living on the Island and the role of transport costs, in particular, are a disincentive to regional migration (see also EconSearch 2003). Thus, to ensure that Kangaroo Island’s economic development potential is met, a key priority should be the ongoing pursuit of measures that will bring about long-term, sustainable reductions in transport charges to businesses and residents.

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We have prepared the above report exclusively for the use and benefit of our client. Neither the firm nor any employee of the firm undertakes responsibility in any way whatsoever to any person (other than to the above mentioned client) in respect of the report including any errors or omissions therein however caused.

Appendix 1 Glossary of Input-Output Terminology

Basic value is the price received for a good or service by the producer. It is also known as producers' price. It excludes indirect taxes and transport, trade and other margins.

Consumption-induced impacts are additional output and employment resulting from re-spending by households that receive income from employment in direct and indirect activities. Consumption-induced effects are sometimes referred to as 'induced effects'.

Contribution to gross regional product (GRP) is a measure of the net contribution of an activity to the regional economy. Contribution to GRP is measured as value of output less the cost of goods and services (including imports) used in producing the output. In other words, it can be measured as household income plus other value added (gross operating surplus and all taxes, less subsidies). It represents payments to the primary inputs of production (labour, capital and land). Using contribution to GSP as a measure of economic impact avoids the problem of double counting that may arise from using value of output for this purpose.

DECON model is a demographic-economic model based on a traditional input-output model. The introduction of a population 'sector' (or row and column in the model) makes it possible to estimate the impact on local population levels of employment growth or decline. The introduction of an unemployed 'sector' makes it possible to account for the consumption-induced impact of the unemployed in response to economic growth or decline.

Direct (or initial) impacts[12] are the initial round of output, employment and income generated by an economic activity (e.g. wine grape production).

Employment is a measure of the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent jobs.

ess is an estimate of the proportion of employed who are not eligible for welfare benefits when they lose their job.

Exports refers to the sale of goods and services to final consumers outside the region of interest. In a regional input-output model exports refers to the sale of goods and services interstate, overseas and to other regions within the state.

First-round impacts are estimates of the requirement for (or purchases of) goods and services from other sectors in the economy generated by the initial economic activity (e.g. purchases of transport services and labour by the wine grape production sector).

Flow-on impacts are the sum of first-round and industrial support impacts, together called production-induced impacts, and consumption-induced impacts.

Household income is a component of GRP and is a measure of wages and salaries paid in cash and in kind, drawings by owner operators and other payments to labour including overtime payments, employer's superannuation contributions and income tax, but excluding payroll tax.

[12] Note that the terminology 'impacts' and 'effects' can be used interchangeably.

Imports refers to the purchase of goods and services (including labour) from outside the region of interest. In a regional input-output model imports refers to the purchase of goods and services from interstate, overseas and from other regions within the state.

Industrial-support impacts are additional output and employment resulting from re-spending by firms that receive payments from the sale of goods and services to firms undertaking, for example, wine grape production.

Input-output analysis is an accounting system of inter-industry transactions based on the notion that no industry exists in isolation.

Input-output model is a transactions table that illustrates and quantifies the purchases and sales of goods and services taking place in an economy at a given point in time. It provides a numerical picture of the size and shape of the economy and its essential features. Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

Multiplier is an index (ratio) indicating the overall change in the level of activity that results from an initial change in economic activity. They are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. They can be used to estimate the impact of a change in that particular sector on the rest of the economy.

Other Final Demand includes government expenditure, private and public sector investment (gross fixed capital formation) and change in stocks (inventories).

Other Value Added includes gross operating surplus and all taxes, less subsidies.

Output (Value of) is a measure of the gross revenue of goods and services produced by commercial organisations (e.g. farm-gate value of wine grape production) and gross expenditure by government agencies. Total output needs to be used with care as it includes elements of double counting (e.g. the value of winery output includes the farm-gate value of wine grape production).

Purchasers' price is the price paid for a good or service paid by the purchaser. It includes indirect taxes and transport, trade and other margins.

Production-induced impacts are additional output, employment and income resulting from re-spending by firms that receive income from the sale of goods and services to firms undertaking, for example, wine grape production. Production-induced impacts are sometimes referred to as 'indirect effects'.

rho is an estimate of the proportion of employees who remain in the region after they lose their job (negative employment impact) or the proportion of new jobs filled by previously unemployed locals (positive employment impact).

Total impacts are the sum of direct and flow-on impacts.

Type I multiplier is calculated as (direct effects + production-induced effects)/direct effects.

Type II multiplier is calculated as (direct effects + production-induced effects + consumption-induced effects)/direct effects.

Type IV multiplier is a modified Type II multiplier, calculated by including a population and unemployed row and column in the 'closed' direct coefficients matrix of the traditional input-output model.

Appendix 2 An Overview of Input-Output Analysis and DECON Models

Input-output analysis provides a comprehensive economic framework that is extremely useful in the resource planning process. Broadly, there are two ways in which the input-output (I-O) method can be used.

First, the I-O model provides a numerical picture of the size and shape of an economy and its essential features. The I-O transactions model (or table) can be used to describe some of the important features of an economy, the interrelationships between sectors and the relative importance of the individual sectors.

Second, I-O analysis provides a standard approach for the estimation of the economic impact of a particular activity. The I-O model is used to calculate industry multipliers that can then be applied to various development or change scenarios.

The input-output transactions table

Input-output analysis, as an accounting system of inter-industry transactions, is based on the notion that no industry exists in isolation. This assumes, within any economy, each firm depends on the existence of other firms to purchase inputs from, or sell products to, for further processing. The firms also depend on final consumers of the product and labour inputs to production. An I-O transactions table is a convenient way to illustrate the purchases and sales of goods and services taking place in an economy at a given point in time.

As noted above, input-output models provide a numerical picture of the size and shape of the economy. Products produced in the economy are aggregated into a number of groups of industries and the transactions between them recorded in the transactions table. The rows and columns of the I-O table can be interpreted in the following way:

- The rows of the I-O table illustrate sales for intermediate usage (i.e. to other firms in the region) and for final demand (e.g. household consumption, exports or capital formation).
- The columns of the I-O table illustrate purchases of intermediate inputs (i.e. from other firms in the region), imported goods and services and purchases of primary inputs (i.e. labour, land and capital).
- Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

In summary, the I-O transactions table can be used to describe some of the important features of a regional economy, the interrelationships between sectors and the relative importance of the individual sectors. The model is also used for the calculation of sector multipliers and the estimation of economic impacts arising from some change in the regional economy.

Using input-output analysis for estimation of regional economic impacts

The standard approach for the estimation of the regional economic impact of a particular activity, such as wine grape production, for example, is to employ I-O analysis. The I-O model conceives the economy of the region as being divided up into a number of sectors and this allows the analyst to trace expenditure flows.

To illustrate this, consider the example of a vineyard that, in the course of its operation, purchases goods and services from other sectors. These goods and services would include fertiliser, chemicals, transport services, and, of course, labour. The direct employment created by the vineyard is regarded in the model as an expenditure flow into the household sector, which is one of several non-industrial sectors recognised in the I-O model.

Upon receiving expenditure by the vineyard, the other sectors in the regional economy engage in their own expenditures. For example, as a consequence of winning a contract for work with vineyard, a spraying contractor buys materials from its suppliers and labour from its own employees. Suppliers and employees in turn engage in further expenditure, and so on. These indirect and induced (or flow-on) effects[13], as they are called, are part of the impact of the vineyard on the regional economy. They must be added to the direct effects (which are expenditures made in immediate support of the vineyard itself) in order to arrive at a measure of the total impact of the vineyard.

It may be thought that these flow-on effects (or impacts) go on indefinitely and that their amount adds up without limit. The presence of leakages, however, prevents this from occurring. In the context of the impact on a regional economy, an important leakage is expenditure on imports, that is, products or services that originate from outside the region, state or country (e.g. machinery).

Thus, some of the expenditure by the vineyard (i.e. expenditure on imports to the region) is lost to the regional economy. Consequently, the flow-on effects get smaller and smaller in successive expenditure rounds due to this and other leakages. Hence the total expenditure created in the regional economy is limited in amount, and so (in principle) it can be measured.

Using I-O analysis for estimation of regional economic impacts requires a great deal of information. The analyst needs to know the magnitude of various expenditures and where they occur. Also needed is information on how the sectors receiving this expenditure share their expenditures among the various sectors from whom they buy, and so on, for the further expenditure rounds.

In applying the I-O model to economic impact analysis, the standard procedure is to determine the direct or first-round expenditures only. No attempt is made to pursue such inquiries on expenditure in subsequent rounds, not even, for example, to trace the effects in the regional economy on household expenditures by vineyard employees on food, clothing, entertainment, and so on, as it is impracticable to measure these effects for an individual case, here the vineyard.

The I-O model is instead based on a set of assumptions about constant and uniform proportions of expenditure. If households in general in the regional economy spend, for example, 13.3 per cent of their income on food and non-alcoholic beverages, it is assumed that those working in vineyards do likewise. Indeed, the effects of all expenditure rounds after the first are calculated by using such standard proportions (i.e. multiplier calculations). Once a transactions table has been compiled, simple mathematical procedures can be applied to derive multipliers for each sector in the economy.

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13 A glossary of I-O terminology is provided in Appendix 1.

Input-output multipliers

Input-output multipliers are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. As well, they can be used to estimate the impact of a change in that particular sector on the rest of the economy.

Detailed explanations on calculating I-O multipliers, including the underlying assumptions, are provided in any regional economics or I-O analysis textbook (see, for example, Jensen and West (1986)). They are calculated through a routine set of mathematical operations based on coefficients derived from the I-O transactions model, as outlined below.

The transactions table may be represented by a series of equations thus:

$$X_1 = X_{11} + X_{12} + \ldots\ldots\ldots\ldots\ldots\ldots + X_{1n} + Y_1$$
$$X_2 = X_{21} + X_{22} + \ldots\ldots\ldots\ldots\ldots\ldots + X_{2n} + Y_2$$
$$X_n = X_{n1} + X_{n2} + \ldots\ldots\ldots\ldots\ldots\ldots + X_{nn} + Y_n$$

where X_i = total output of intermediate sector *i* (row totals);
X_{ij} = output of sector *i* purchased by sector *j* (elements of the intermediate quadrant); and
Y_j = total final demand for the output of sector *i*.

It is possible, by dividing the elements of the columns of the transactions table by the respective column totals to derive coefficients, which represent more clearly the purchasing pattern of each sector. These coefficients, termed 'direct' or 'I-O' coefficients, are normally denoted as a_{ij}, and represent the direct or first round requirements from the output of each sector following an increase in output of any sector.

In equation terms the model becomes:

$$X_1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots\ldots\ldots\ldots\ldots + a_{1n}X_n + Y_1$$
$$X_2 = a_{21}X_1 + a_{22}X_2 + \ldots\ldots\ldots\ldots\ldots\ldots + a_{2n}X_n + Y_2$$
$$X_n = a_{n1}X_{11} + a_{n2}X_2 + \ldots\ldots\ldots\ldots\ldots\ldots + a_{nn}X_n + Y_n$$

where a_{ij} (the direct coefficient) = X_{ij}/X_j. This may be represented in matrix terms:

$X = AX + Y$

where A = $[a_{ij}]$, the matrix of direct coefficients.

The previous equation can be extended to:

$(I\text{-}A)X = Y$

where $(I\text{-}A)$ is termed the Leontief matrix, or $X = (I\text{-}A)^{-1}Y$

where $(I\text{-}A)^{-1}$ is termed the 'general solution', the 'Leontief inverse' or simply the inverse of the open model.

The general solution is often represented by:

$Z = (I\text{-}A)^{-1} = [z_{ij}]$

The I-O table can be 'closed' with respect to certain elements of the table. Closure involves the transfer of items from the exogenous portions of the table (final demand and primary input quadrants) to the endogenous section of the table (intermediate quadrant). This implies that the analyst considers that the transferred item is related more to the level of local activity than to external influences. Closure of I-O tables with respect to households is common and has been adopted in this project.

The 'closed' direct coefficients matrix may be referred to as A^*. The inverse of the Leontief matrix formed from A^* is given by:

$Z^* = (I\text{- } A^*)^{-1} = [z^*_{ij}]$

Z^* is referred to as the 'closed inverse' matrix.

A multiplier is essentially a measurement of the impact of an economic stimulus. In the case of I-O multipliers the stimulus is normally assumed to be an increase of one dollar in sales to final demand by a sector. The impact in terms of output, contribution to gross regional product, household income and employment can be identified in the categories discussed below.

(i) The initial impact: refers to the assumed dollar increase in sales. It is the stimulus or the cause of the impacts. It is the unity base of the output multiplier and provides the identity matrix of the Leontief matrix. Associated directly with this dollar increase in output is an own-sector increase in household income (wages and salaries, drawings by owner operators etc.) used in the production of that dollar. This is the household income coefficient h_j. Household income, together with other value added (OVA), provide the total contribution to gross regional product from the production of that dollar of output. The contribution to gross regional product coefficient is denoted v_j. Associated also will be an own-sector increase in employment, represented by the size of the employment coefficient. This employment coefficient e_j represents an employment/output ratio and is usually calculated as 'employment per million dollars of output'.

(ii) The first round impact: refers to the effect of the first round of purchases by the sector providing the additional dollar of output. In the case of the output multiplier this is shown by the direct coefficients matrix $[a_{ij}]$. The disaggregated effects are given by individual a_{ij} coefficients and the total first-round effect by Σa_{ij}. First-round household income effects are calculated by multiplying the first-round output effects by the appropriate household income coefficient (h_j). Similarly, the first-round contribution to gross regional product and employment effects are calculated by multiplying the first-round output effects by the appropriate contribution to gross state product (v_j) and employment (e_j) coefficients.

(iii) Industrial-support impacts. This term is applied to 'second and subsequent round' effects as successive waves of output increases occur in the economy to provide industrial support, as a response to the original dollar increase in sales to final demand. The term excludes any increases caused by increased household consumption. Output effects are calculated from the open Z inverse, as a measure of industrial response to the first-round effects. The industrial-support output requirements are calculated as the elements of the columns of the Z inverse, less the initial dollar stimulus and the first-round effects. The industrial support household income, contribution to gross regional product and employment effects are defined as the output effects multiplied by the respective household income, contribution to gross regional product and employment coefficients. The first-round and industrial-support impacts are together termed the production-induced impacts.

(iv) Consumption-induced impacts: are defined as those induced by increased household income associated with the original dollar stimulus in output. The consumption-induced output effects are calculated in disaggregated form as the difference between the corresponding elements in the open and closed inverse (i.e. $z^*_{ij} - z_{ij}$, and in total as $\Sigma(z^*_{ij} - z_{ij})$). The consumption-induced household income, contribution to gross regional product and employment effects are simply the output effects multiplied by the respective household income, contribution to gross regional product and employment coefficients.

(v) Flow-on impacts: are calculated as total impact less the initial impact. This allows for the separation of 'cause and effect' factors in the multipliers. The cause of the impact is given by the initial impact (the original dollar increase in sales to final demand), and the effect is represented by the first-round, industrial-support and consumption-induced effects, which together constitute the flow-on effects.

Each of the five impacts are summarised in Table 2.1. It should be noted that household income, contribution to gross regional product and employment multipliers are parallel concepts, differing only by their respective coefficients h_j, v_j and e_j.

The output multipliers are calculated on a 'per unit of initial effect' basis (i.e. output responses to a one dollar change in output). Household income, contribution to gross regional product and employment multipliers, as described above, refer to changes in household income per initial change in output, changes in contribution to gross regional product per initial change in output and changes in employment per initial change in output. These multipliers are conventionally converted to ratios, expressing a 'per unit' measurement, and described as Type I and Type II ratios. For example, with respect to employment:

Type I employment ratio = [initial + first round + industrial support]/initial

and

Type II employment ratio = [initial + production induced[14] + consumption induced]/initial

[14] Where (first round + industrial support) = production induced.

Appendix Table 2.1 The structure of input-output multipliers for sector *i* [a]

Impacts	**General formula**
Output multipliers ($)	
Initial	1
First-round	$\Sigma_i a_{ij}$
Industrial-support	$\Sigma_i z_{ij}$-1-$\Sigma_i a_{ij}$
Consumption-induced	$\Sigma_i z^*_{ij}$-$\Sigma_i z_{ij}$
Total	$\Sigma_i z^*_{ij}$
Flow-on	$\Sigma_i z^*_{ij}$-1
Household Income multipliers ($)	
Initial	h_j
First-round	$\Sigma_i a_{ij} h_i$
Industrial-support	$\Sigma_i z_{ij} h_i$- h_j-$\Sigma_i a_{ij} h_i$
Consumption-induced	$\Sigma_i z^*_{ij} h_i$-$\Sigma_i z_{ij} h_i$
Total	$\Sigma_i z^*_{ij} h_i$
Flow-on	$\Sigma_i z^*_{ij} h_i$-h_j
Contribution to gross regional product multipliers ($)	
Initial	v_j
First-round	$\Sigma_i a_{ij} v_i$
Industrial-support	$\Sigma_i z_{ij} v_i$- v_j-$\Sigma_i a_{ij} v_i$
Consumption-induced	$\Sigma_i z^*_{ij} v_i$-$\Sigma_i z_{ij} v_i$
Total	$\Sigma_i z^*_{ij} v_i$
Flow-on	$\Sigma_i z^*_{ij} v_i$-v_j
Employment multipliers (full-time equivalents)	
Initial	e_j
First-round	$\Sigma_i a_{ij} e_i$
Industrial-support	$\Sigma_i z_{ij} e_i$- e_j-$\Sigma_i a_{ij} e_i$
Consumption-induced	$\Sigma_i z^*_{ij} e_i$-$\Sigma_i z_{ij} e_i$
Total	$\Sigma_i z^*_{ij} e_i$
Flow-on	$\Sigma_i z^*_{ij} e_i$-e_j

[a] In a DECON model, Z^* (the 'closed inverse' matrix), includes a population and an unemployed row and column (see Section 3 of the report for details).

Input-output model assumptions

There are a number of important assumptions in the I-O model that are relevant in interpreting the analytical results. These are discussed below.

Industries in the model have a linear production function, which implies constant returns to scale and fixed input proportions. This assumption applies in the calculation of flow-on effects. However, for the purpose of this project, on-farm adjustments to changes in natural resources management policy, for example, have been modelled outside the I-O framework and have involved changes in both aggregate sales and input coefficients.

Another model assumption is that firms within a sector are homogeneous, which implies they produce a fixed set of products that are not produced by any other sector and that the input structure of the firms are the same. It is preferable to have as many sectors as possible specified in the regional models and the three models for this study were compiled with 36 sectors (see Section 2.2 for further detail).

The model is a static model that does not take account of the dynamic processes involved in the adjustment to an external change, such as a permanent change in natural resources management (e.g. reduced irrigation water availability). The dynamic processes involve both investment and time to facilitate the adjustment. The model is silent on the timeframe of adjustment and assumes that the investment required for the forecast change is not an impediment to the realisation of that change. Thus, estimates of economic impact in this report are presented as net impacts, that is, relative to a baseline year (i.e. 2004/05, as outlined below).

Extending the Input-Output Model as a Localised Demographic Model

Based on work undertaken by Mangan and Phibbs (1989), the I-O models developed for this project were extended as demographic-economic (DECON) models. The two key characteristics of the DECON model, when compared with a standard economic model, are as follows.

3. The introduction of a population 'sector' (or row and column in the model) makes it possible to estimate the impact on local population levels of employment growth or decline.
4. The introduction of an unemployed 'sector' makes it possible to account for the consumption-induced impact of the unemployed in response to economic growth or decline.

These additional sectors are described below.

The Population Sector

The introduction of a population 'sector' to the traditional I-O model allows for the calculation of population multipliers. These multipliers measure the flow-on population impact resulting from an initial population change attributable to employment growth or decline in a particular sector of the regional economy.

Calculation of population multipliers is made possible by inclusion of a population row and column in the 'closed' direct coefficients matrix of the I-O model.
Population row: the population coefficient (p_j) for sector j of the DECON model is represented as:

$$p_j = e_j * (1-rho_j) * family\ size_j$$

where e_j = the employment coefficient for sector j;

rho_j = the proportion of employees in sector j who remain in the region after they lose their job (negative employment impact) or the proportion of new jobs in sector j filled by previously unemployed locals (positive employment impact); and

$family\ size_j$ = average family size for sector j.

Population column: the population column of the DECON model is designed to account for growth or decline in those sectors of the economy that are primarily population-driven (i.e. influenced by the size of the population) rather than market-driven (i.e. dependent upon monetary transactions). Clearly, many of the services provided by the public sector fit this description and, for the purpose of this analysis, it was assumed that the following sectors (see Table 2.3), at the regional level, were primarily population-driven:

- public administration and defence;
- education;
- health and community services; and
- cultural and recreational services.

Thus, the non-market coefficient for sector *j* of the DECON model is represented as expenditure on that non-market service (by governments) in $million per head of population.

The population multiplier for sector *j* is represented as: z^*_{pj} / p_{pj}

where z^*_{pj} = coefficient of the 'closed inverse' matrix in the population row for sector *j*; and

p_{pj} = coefficient of the direct coefficients matrix in the population row for sector *j*

Sources of local data for the population sector of the DECON models used in this study included the following.

- rho: little or no published data were available to assist with estimation of this variable, particularly at a regional level, thus it was subjectively determined based on the consultants' knowledge of the regions used in the study and experience in the field of regional economic impact analysis. The analyst can modify this estimate if superior data is available.
- Family size: in order to estimate average family size by industry relevant data were obtained by special request from the Australian Bureau of Statistics (*2001 Census of Population and Housing*).

The Unemployed Sector

As outlined above, the introduction of an unemployed 'sector' to the traditional I-O model makes it possible to account for the consumption-induced impact of the unemployed in response to economic growth or decline.

Through the inclusion of an unemployed row and column in the 'closed' direct coefficients matrix of the traditional I-O model it is possible to calculate Type IV multipliers (for output, contribution to GRP, household income and employment).

The key point to note is that, in the situation where at least some of the unemployed remain in a region after losing their job (negative employment impact) or some of the new jobs in a region are filled by previously unemployed locals (positive employment impact), Type IV multipliers will be smaller than the more frequently used Type II multipliers.

Unemployed row: the unemployed coefficient (u_j) for sector *j* of the DECON model is represented as:

$u_j = \mathrm{rho}_j * (1-ess_j) * \mathrm{e}_j$

where *rho*$_j$ = the proportion of employees in sector *j* who remain in the region after they lose their job (negative employment impact) or the proportion of new jobs in sector *j* filled by previously unemployed locals (positive employment impact); and

ess$_j$ = the proportion of employed in sector *j* who are not eligible for welfare benefits when they lose their job.

e_j = the employment coefficient for sector *j*;

Unemployed column: the unemployed column of the DECON model is an approximation of total consumption expenditure and the consumption pattern of the unemployed. It is represented as dollars per unemployed person rather than $million for the region as a whole, as is the case for the household expenditure column in a traditional I-O model.

Sources of local data for the unemployed sector of the DECON models used in this study included the following.

- ess: in order to estimate the proportion of employed by industry who are not eligible for welfare benefits when they lose their job, relevant data were obtained by special request from the Australian Bureau of Statistics (*2001 Census of Population and Housing*).

Unemployed consumption: total consumption expenditure by the unemployed was based on an estimate of the *Newstart Allowance* whilst the pattern of consumption expenditure was derived from household income quintiles in the ABS *1998/99 Household Expenditure Survey.*

Appendix 3 Estimates of Employment and Population Impact, 2007 to 2021

Appendix Table 3.1 Estimates of the employment and population impact of the low and high growth scenarios for Kangaroo Island's key industries, 2007 to 2021

																	Av. annual growth rate	
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2007 to 2021	1996 to 2006 [a]
Low growth scenario																		
Employment																		
Total employment (fte)	1,742	1,754	1,767	1,781	1,838	1,861	1,881	1,901	1,921	1,942	1,955	1,966	1,978	1,989	2,000	2,012	1.0%	2.0%
Additional jobs (fte)		12	13	13	57	23	20	20	20	21	13	11	11	11	11	12		
Population																		
Total population (no.)	4,446	4,471	4,497	4,524	4,647	4,698	4,743	4,788	4,832	4,877	4,903	4,926	4,949	4,971	4,994	5,017	0.8%	0.5%
Additional persons (no.)		25	26	27	123	51	45	45	45	45	26	23	23	23	23	23		
High growth scenario																		
Employment																		
Total employment (fte)	1,742	1,769	1,796	1,826	1,902	1,951	1,998	2,047	2,098	2,151	2,207	2,257	2,307	2,359	2,412	2,466	2.3%	2.0%
Additional jobs (fte)		26	28	30	76	49	47	49	51	53	56	49	51	52	53	54		
Population																		
Total population (no.)	4,446	4,498	4,552	4,611	4,769	4,870	4,967	5,067	5,170	5,276	5,387	5,487	5,588	5,690	5,794	5,900	1.9%	0.5%
Additional persons (no.)		52	55	58	158	101	97	100	103	107	111	99	101	102	104	106		

a Historical estimates of employment and population were derived by the consultants from ABS (2007) and DEWR (2006), respectively.

Source: EconSearch analysis.