Economic Benefits of Restoring Skyline Tier Scamander Plantation, Tasmania

Prepared for

ENVIRONMENT
TASMANIA

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Australian Government

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1 INTRODUCTION

Skyline Tier is located above Beaumaris near Scamander, on Tasmania's East Coast. In the late 1960s to early 1970s about 2,000ha of native forest behind Scamander was converted to Radiata pine plantation with associated periodic clear felling of the pines on steep slopes.

With Australian Government funding, 350ha of radiata pine plantation at Skyline Tier has been restored to native forests by the North East Bioregional Network (NEBN).

Ecological restoration work undertaken at Skyline Tier has a number of economic benefits. Economic benefits relate to outcomes that affect individual and community well-being through direct use of restored areas by individuals, indirect use or non-use (James and Gillespie 2002). These economic benefits are valued based on the community's willingness to pay (WTP) for them and can be potentially be estimated using market data, revealed preference methods or stated preference methods (James and Gillespie 2002).

In addition, restoration works can provide economic activity to local communities via labour and non-labour expenditures during restoration and expenditures during ongoing management. Where restored sites are used for tourism and recreation, additional economic activity can be generated for a local community.

This report explores the potential economic benefits from the Skyline Tier Restoration Project (the Project) as well as the economic activity generated. Section 2 provides background to economic values and valuation methods as well as economic activity analysis. Section 3 identifies a range of potential economic benefits from the Skyline Tier Project and where possible infers an economic value based on benefit transfer from nonmarket valuation studies. Section 4 examines expenditure patterns from the Project and the economic activity impacts on the Break O' Day Local Government Area (LGA).

2 ECONOMIC VALUES AND ECONOMIC ACTIVITY

2.1 Economic Values and Benefits

Economic values (costs and benefits) to the community are defined in economic theory as arising from both the consumption and production of goods and services. These goods and services may be many and varied and can be both traded in markets or exist outside of traditional markets ('nonmarketed').

The producers of goods and services generate economic value by combining resources in ways that increase their value to society. The measure of this economic value is referred to as a producer surplus and is the difference between the costs of the inputs used in the production process and the price received for the finished product. Producer surplus values generally apply to goods and services that are traded in markets and can be estimated from market data. Any gain of producer surplus as a result of increased quantity of production, increased price of a product or decreased costs of production represents an economic benefit. These values are estimated using market data (BDA Group and Gillespie Economics 2007).

The benefit derived by a consumer of goods and services is valued as the difference between what that person would be WTP for the good or service and what they have to pay. This net benefit to consumers is the consumer surplus. Consumer surplus values may be associated with use and non-use of a resource and hence is the relevant measure of value for nonmarket recreation, improvements in conservation outcomes and amenity. Any gain of consumer surplus as a result of increased quantity of a good, increased demand for a good or decreased price of a good represents an economic benefit. Valuation of the consumer surplus requires implementation of nonmarket valuation techniques (BDA Group and Gillespie Economics 2007).

The range of nonmarket valuation methods is provided in
Table 2.1. These have different applications and strengths and weaknesses (James and Gillespie 2002).

Table 2.1 - Main Types of Environmental Valuation Techniques

Market based	Revealed preference (or surrogate market)	Stated preference (or survey technique)
Productivity method	Travel cost method	Contingent valuation
Human capital approach	Wage differential method	Choice modelling
Defensive expenditures method	Property valuation method	
Replacement/repair cost method		
Shadow projects		
Opportunity cost method		

At the forefront of nonmarket valuation is choice modelling (CM). CM uses questionnaires that describe a hypothetical policy scenario that will cause environmental and social changes away from a base case. In a survey of the affected population, respondents are presented with a series of questions (choice sets), where each question shows the outcome of two or more alternative policy scenarios including a 'status quo' or 'no policy change' scenario. These outcomes are described in terms of different levels of a monetary attribute (cost) to be borne by the respondent and several non-marketed attributes. Respondents are asked to choose their preferred option from the array of alternatives. By observing people's choices between alternatives with differing levels of each attribute it is possible to determine the trade-offs respondents make between attributes (Bennett and Blamey 2001). Because one of the attributes is a monetary one it is possible to estimate respondent WTP for changes in the other, non-monetary, attributes. Attachment 1 provides a summary of one of the only CM studies that has been undertaken in Tasmania.

Where no primary studies are undertaken, an alternative approach is benefit transfer (BT). BT involves using values from the existing nonmarket valuation literature and transferring these values from so-called "study sites" for application to a site that must be evaluated (the "policy site"). Values may be transferred as unadjusted unit values (for example, the typical value of a recreation visit), adjusted unit values (for example by substituting different values for explanatory variables in a study-site regression model), or meta-analyses of comparable study sites (the compilation of large data banks from numerous studies to permit generalised statistical analysis of economic values.

The robustness of BT depends largely on the quality of results for the study sites and the presence of similar conditions at both the study site and the policy site. Criteria for reliable use of BT are:

- the study and policy site should be similar;
- the environmental change (valuation frame) under consideration at the policy site is similar to the proposed change at the study site;
- the scale and scope of change being considered in the study site and policy site should be similar; and
- the socioeconomic characteristics and preferences of the populations should be similar.

A pre-requisite for nonmarket valuation, whether by primary valuation methods or BT, is ensuring a clear understanding of the type and magnitude of the biophysical effect of an action on consumers and producers. For instance, the extent to which an improvement in water quality affects the behaviour of swimmers e.g. increases swimming days, or increases the length of a waterway considered to be in good health[1].

In this respect it is important to distinguish between causally prior effects e.g. changes in water quality, and final effects on producers and consumers e.g. changes recreation visits or length of river in good health. It is only final impacts on consumers and producers that are relevant for valuation.

Consequently, to facilitate valuation it is necessary for the dose-response or cause-effect relationship between the action taken and the things that impact human utility to be identified. This is the domain of scientists. Economist can then value the final impact on human utility.

When BT is relied on rather than a primary nonmarket valuation study, the metric to measure the impact on human utility is already defined by the previous study. Consequently, it is necessary for scientists to identify the consequence of the policy action in terms of the final metric specified in previous studies. For instance, a number of economic studies identify the benefit of an increase in the length of a river in good health. To utilise such studies for BT it is necessary for scientists to identify the increase in the length of a river in good health from an action such as revegetation.

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[1] A common metric used in CM studies.

Another issue with BT relates to the scope and scale of studies from which values are transferred. Studies have found that marginal values for the same unit of environmental change could be many times higher when only very small areas of an attribute are considered compared to when the whole amenity was considered (referred to as 'scale' differences) or where small geographic contexts are considered (referred to as scope differences) compared to larger geographic areas[2]. Consequently, calibration factors are required in BT applications between different scopes or scales. Rolfe et al (2013) found a close inverse relationship between ratio of quantities of environmental change involved and the ratio of WTP amounts. Rolfe recommended the following log-log form of this relationship as a simple and efficient way of calibrating values for benefit transfer:

$$LN(WTP_{ATTsmall}/WTP_{ATTlarge}) = LN(Quantity_{ATTlarge}/Quantity_{ATTsmall})$$

where WTP refers to the average marginal implicit price for different case studies, and Quantity refers to the amount of the attribute change (scale) across different levels of geographic scope.

Two final issue relates to that of "standing" and the aggregation of per household values. When primary valuation studies are undertaken, a decision is made as to whose values count and who is likely to hold values for the environmental good in question i.e. who has "standing". Where BT is used the community surveyed is already defined by the population surveyed in the source study. It is inappropriate to extrapolate values outside of the community that was surveyed. In this respect, some CM studies are undertaken at a national level, while others are undertaken at a State level.

Nonmarket valuation methods such as CM elicit people's WTP via survey, generally in terms of WTP per household. Average WTP per household are then aggregated to the relevant population of households. However, this necessitates assumptions about whether non-respondents to the questionnaire hold the same values as those of respondents included in the sample. Morrison (2000), found that approximately one-third of non-respondents hold values similar to questionnaire respondents. Van Bueren and Bennett (2000) support these findings in a follow-up telephone interview with non-respondents in a CM. Using this approach, aggregation of per household WTP values to the proportion of the population represented by the survey response rate plus a third of non-respondents, is recommended.

2 Scale and scope generally change together for most attributes i.e. studies involving a larger geographic scope generally involve a larger scale of environmental change (Rolfe et al. 2013).

2.2 Economic Activity

Expenditures in a local economy provide direct and indirect economic activity. A range of methods can be used to examine the economic activity impacts including economic base theory, Keynesian multipliers, econometric models, mathematical programming models and input-output models (Powell et al (1985) and computable general equilibrium analysis. Input-output techniques are the most common, measuring impacts in terms of direct and indirect effects for four main indicators:

- *gross regional output* – the gross value of business turnover;
- *value-added* – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output;
- *income* – the wages paid to employees including imputed wages for self employed and business owners; and
- *employment* – the number of people employed (including full-time and part-time).

These indicators of economic activity are not equivalent to the economic measures of consumer and producer surplus.

Gross regional output is a measure of total revenue or turnover. All costs of production would need to be subtracted to make it approximate the measure of producer surplus. Value-added is an indicator of net value to producers, but unlike the producer surplus measure, it does not take account of all production costs – only non-labour costs are subtracted from revenue. Income or wages paid to employees is a cost to the producer in the benefit cost framework and is one of the costs subtracted from revenue or output to calculate the producer surplus or net benefit to producers. Employment is a non-financial indicator identifying the physical number of jobs associated with an activity. In regional economic impact assessment the employment figure can sometimes be referring to full-time equivalents or simply job numbers, whether they are full-time or part-time.

Multipliers summarise the level of total effects compared to direct effects.

3 ECONOMIC BENEFITS OF THE PROJECT

The potential categories of benefits from the Skyline Tier Restoration Project are summarised in **Table 3.1.**

Table 3.1 - Potential Benefits of Restoration

Benefit Category	Benefit Description
Conservation Outcomes Onsite	Biodiversity conservation including threatened species, EEC etc.
Conservation Outcomes Offsite	Conservation of freshwater ecosystem values • Regulated water yield and quality • Reduced erosion and sedimentation • Establishment of riparian habitat • Reduced aerial spraying and hence impacts on terrestrial and aquatic ecosystems Enhanced connectivity between conservation areas
Carbon sequestration	Reduced impacts from global warming
Water quality and quantity benefits to water users	From regulated water yield and reduced runoff and aerial spraying
Reduced weed infestations to adjoining reserves and private property	Costs savings
Aesthetic impacts	Amenity impacts for houses in Scamandar
Employment benefits	Benefits of volunteers Benefits of mutual obligation employment and training
Educational benefits	Method for restoration of pine plantations

Conservation outcomes onsite

One of the main benefits of the Skyline Restoration Project is the direct conservation benefits that it provides in terms of the type and extent of the habitat and species that it protects. This includes:

- habitat for six threatened flora species;
- potential habitat for ten threatened fauna species;
- three threatened vegetation communities; and
- habitat for non-threatened native plants and animals and vegetation communities.

Nonmarket valuation studies related to restoration of native vegetation, as opposed to conservation or protection of existing areas of native vegetation, are few.

A CM study commissioned by the National Land and Water Resources Audit (Van Bueren and Bennett 2000) examined community values for land and water degradation. Impacts were described in terms of, among other things, the hectares of land restored or protected from degradation. The study revealed a community (Australian households) willingness to pay of $0.07 per household per year for 20 years per 10,000 ha of land restored or protected from degradation.

Inflating the value for land restored to 2016, aggregating to 50% of the Tasmanian households, scaling the value and applying it to the 350ha restored provides an economic value of $195,000.

Gillespie and Bennett (2015) in a CM survey of NSW households found a WTP of $0.10 per household per ha (once off payment) per ha of endangered ecological community planted. Inflating the value for ha planted to 2016, aggregating to 50% of the Tasmanian households and applying it to the 350ha restored provides an economic value of $11,000. This value would be significantly higher if households outside of Tasmania also held values for the restored area.

Additional values would apply if restoration increased the protection of abundance or protection of species. For example, the National Land and Water Resources Audit study (Van Bueren and Bennett 2000) found an additional value of $0.68 per household per year for 20 years per endangered species protected[3].

A study by Rolfe et al (1997) found a willingness to pay of Brisbane households in relation to the Desert Uplands region of:

- $1.69 per household per percentage increase in population size of non-threatened species (i.e. $3.4M per percentage increase in population size of non-threatened species)

- $11.39 per household per endangered species protected (i.e. $22.8M per endangered species protected). It should be noted that the valuation per endangered species protected relates to fauna species moving from "endangered" to a less vulnerable status of "threatened". In applying this valuation it is therefore necessary to make judgement of the contribution of the action being taken to protecting endangered species.

[3] Definition of endangered species protected relates to protected from the next level of threat.

Application of these or other similar types of values from the literature would require a dose-response function estimating the impact of the Skyline Tier restoration on the population of non-threatened species and the reduction in threat to endangered species.

Conservation outcomes offsite

The restoration of land at Skyline Tier potentially has a number of offsite environmental benefits.

Conservation of freshwater ecosystem values

A number of wetlands and watercourses in the Skyline Tier catchment are rated as being high value. The restoration works will:

- reduce erosion and sedimentation in downstream wetlands and watercourses as a result of stabilisation of soil on slopes and no further future clear felling;
- reestablish riparian vegetation which has biodiversity values in its own right, but also can reduce sedimentation and nutrient transfer to waterways;
- increase and stabilise water quantity in waterways over the longer term as regrowth cycles as a result of clear felling, reduce water yield from catchments;
- reduce nutrients export rates in watercourses as native forests tend to have lower nutrient runoff than pine plantations;
- reduce herbicide and pesticide drift and runoff from pine plantations.

A number of nonmarket valuation studies have found that the community value improvements in the health of waterways, wetlands, seagrass and riverside vegetation (refer to Table 3.1). However, application of these values would require a dose-response function estimating the impact of the Skyline Tier restoration for a change in the kilometres of healthy waterways, hectares of healthy wetlands or kilometres of healthy riverside vegetation[4].

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[4] Care would be need to avoid double counting with the values referred to earlier for revegetation.

Table 3.2 - Choice Modelling Studies of Waterway and Aquatic Environment Values

Attribute	Unit	Site	Author and Reference
Category: Waterways			
Healthy waterways	km	Namoi catchment NSW	Mazur and Bennett (2009)
Healthy waterways	km	Fitzroy River Basin, Qld	Rolfe et al (2002)
Healthy waterways	km	Fitzroy River Basin, Qld	Rolfe and Windle (2003)
Healthy waterways	km	Fitzroy River Basin, Qld	Rolfe and Bennett (2009)
Healthy waterways	km	Fitzroy River Basin, Qld	Windle and Rolfe (2005)
Healthy waterways	km	South East Qld and Central Coast, Qld	Windle and Rolfe (2008)
Waterway health	km	Greater Southern Region, WA and Fitzroy River Basin Qld	Van Bueren & Bennett (2004)
Length of river with water quality suitable for boating or fishing or swimming	km	Various rivers in NSW including Georges River	Morrison and Bennett (2004)
Length of river with water quality suitable for swimming	km	Hawkesbury-Nepean River, NSW	Cheesman et al (2013)
Category: Aquatic Environments			
Wetland area	ha	Upper South East, SA	Hatton MacDonald and Morrison (2010)
Area of healthy wetlands	ha	Murrumbidgee River Floodplain, NSW	Whitten and Bennett (2006)
Wetland area	ha	Macquarie marshes, NSW	Morrison et al (2002)
Seagrass in good health	ha	Great Barrier Reef, Qld	Rolfe and Windle (2010)
Seagrass in good health	ha	George Catchment, TAS	Kragt and Bennett (2011)
Category: Riverbank Vegetation			
Healthy riverside vegetation and wetlands	km	Various rivers in NSW including Georges River	Morrison and Bennett (2004)

Healthy river red gum vegetation	ha	River red gum forests, wetlands and floodplains of the Murray River	Bennett et al (2008)
Native riparian vegetation	% length of river with healthy riparian vegetation	Hawkesbury Nepean River	Cheeseman et al (2013)

<u>*Enhanced connectivity across the landscape*</u>

Skyline Tier restoration areas are strategically located to connect coastal habitats to inland natural areas including the conservation area of Scamander Forest Reserve, and large tracts of intact forest proposed for reservation. Enhanced connectivity can have biodiversity benefits for species abundance and conservation.

To the extent that the community value this improved connectivity and associated biodiversity benefits there are economic benefits to society. There no studies that have explicitly assessed the community's WTP for increased connectivity. However, to the extent that increased connectivity increases the abundance and conservation status of species then values like those identified above for conservation outcomes onsite could be applied.

Carbon Sequestration

Restoration of Skyline Tier provides carbon sequestration values to the community. Morgan (2011) estimate carbon (C) storage in 2011 at 2,083 tonnes and in 2041 at 32,279 tonnes. Sequestration is assumed to be linear between these years.

To place an economic value on C storage a shadow price of C is required that reflects its global social costs. The global social cost of C is the present value of additional economic damages now and in the future caused by an additional tonne of C emissions. There is great uncertainty around the global social cost of with a wide range of estimated damage costs reported in the literature. An alternative method to placing a value on the global damage costs of C is to examine the price of C taxes, since an efficient tax should reflect the global social cost of C. Again, however, there is a wide range of prices.

For this analysis, three scenarios of shadow price for C were used, representing Forecast European Union Emission Allowance Units price, Australian Treasury Clean Energy Future Policy Scenario and US EPA Social Cost of Carbon (NSW Department of Planning and Environment 2015). Each of the price scenarios are in CO2-e and hence sequestration quantities from Morgan (2011) were converted to CO2-e. On this basis, global carbon storage benefits from the Restoration of Skyline Tier are as follows[5].

Table 3.3 - Global Carbon Storage Benefits

Price Assumption	Present value at 7% Discount Rate	Total Value (undiscounted)
Forecast European Union Emission Allowance Units price	$519,341	$1,460,454
Australian Treasury Clean Energy Future Policy Scenario	$1,923,218	$6,148,245
US EPA Social Cost of Carbon	$991,643	$2,664,527

Benefits to Water Users

Improvements in water quality and quantity can also benefit water users. Some residents draw their water supply from watercourse, while others rely on collecting rainwater off their roofs for their water supply. Improvements in water quality can reduce health impacts or costs of water filtration. Stability of water supply and reduce costs of using alternative supplies. To place an economic value on the benefits to water users would first require information on the number of water users and how they are impacted "with" and "without" the Project.

Reduced weed infestations to adjoining reserves and private property

The project removes pine and reduces potential for pine seed to invade native vegetation areas and pastures. From an economic perspective this either reduces the costs of weed control for nearby land managers or reduces negative impacts on biodiversity values or agricultural production. To place an economic value on the benefits to adjoining reserves and private property would first require information on how they have physically benefitted e.g. reduction in quantum or frequency of pesticide use, "with" and "without" the Project.

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[5] These global benefits are total values relative to no revegetation.

Aesthetic impacts

Restoration of Skyline Tier has the potential to positively impact the amenity of coastal properties through a change in vista from pine plantations with periodic clear felling to permanent native vegetation. Amenity improvements can be reflected in property values and estimated using the property valuation method. Few studies have examined the impact of native vegetation vistas compared to pine plantations. However, studies have found that amenity does impact house prices. In Finland, Tyrväinen and Miettinen (2000) demonstrated that a one kilometer increase in the distance to the nearest urban forest area led to an average 6% decrease in the market price of the dwelling. Furthermore, dwellings with a view onto forests were on average 5% more expensive than dwellings with otherwise similar characteristics. In The Netherlands, Luttik (2000) found that a pleasant view alone leads to a considerable increase in house price (6–12%).

If the amenity benefits to the 205 free standing houses in Scamander were in the order of 1%, assuming an average property value of $300,000, the amenity benefits would be in the order of $615,000.

Social and economic benefits of employment

<u>Economic Benefit to Volunteers</u>

The most common approach estimating the economic benefits of volunteers involves placing a dollar value on the time that volunteers contribute either by calculating the opportunity cost for the volunteer (the gains the volunteer could make if using the time for employment or recreation) or the cost of replacing the volunteer with paid contractors (The Grantmaker Forum on Community and National Service 2003).

12,320 hours of volunteer work has been used on the Project. Using the replacement cost approach, and a median wage in Break O Day LGA of $19,020, the replacement cost for volunteer work is estimated at $130,263.

However, there are two limitations to this value. Firstly, it assumes that there is no opportunity cost of volunteers time. To the extent that volunteers give up valuable recreation or work time to provide their services then the replacement cost approach will overstate the net economic benefits to the volunteer. Conversely, volunteers receive a private benefit from volunteering that may exceed the replacement cost amount. In this respect, Volunteering Victoria (2007) provides a long list of reasons why people volunteer including to help others, contribute to the community, learn new skills, help friends etc. Eureka Strategic Research (2006) identified two powerful emotional motivators for volunteers: a passion for nature and a desire to make a positive difference. In economic theory this translates into a value to the volunteer which is measured by their WTP for the experience.

Ultimately, if their WTP for the experience does not exceed the private costs that they incur in volunteering (financial costs and opportunity costs), then these people would not offer their time. Hence, there is some net benefit (consumer surplus) that accrues to volunteers. This net benefit is likely, however, to be difficult to measure and there has been little research effort into its estimation.

Economic Benefits of Mutual Obligation Employment

The objective of the mutual obligation schemes are to provide opportunities for unemployed people to gain work experience; build networks; improve their self-esteem, communication skills, and motivation; and contribute to projects that are of value to the community. They can aid participants in gaining full employment, reducing the time that they may otherwise be unemployed. The economic benefit of reducing the time that people are unemployed has a number of components:

- avoided scarring - periods of non-work reduce a person's human capital relative to what it would have been if the workers had been employed - this results in a lower future stream of wages - the present value of this long term reduction in wages (productivity) is a measure of this scarring cost.
- avoided stigma - being unemployed may affect individuals psychologically through loss of self esteem. More rapid employment can reduce these effects.
- avoided physical and mental health effects, mortality and reduced life satisfaction that may be associated with being unemployed.
- avoided spill over effects e.g. if family or friends (close associates) of workers experience an empathy based loss because of the worker being unemployed.
- avoided social externality - avoided costs of unemployment that spill over to the rest of society e.g. increased crime etc (Haveman and Weimer 2015).

These potential benefits of mutual obligation schemes are difficult to quantify.

Educational Benefits

Experience and knowledge gained from the Project has the potential to reduce costs of any subsequent native vegetation restoration projects both at Skyline Tier and elsewhere.

4 ECONOMIC ACTIVITY

4.1 Introduction

This section uses IO analysis to identify the gross economic activity footprint on the Break O Day economy from the Skyline Tier restoration works.

4.2 Structure of the Local Economy

A 2011 IO table of the Tasmanian economy was developed using the Generation of Input-Output Tables (GRIT) procedure, a 2012-13 IO table of the national economy as the parent table and 2011 Census employment by industry data for the Tasmania. A 2011 IO table of the Break O Day economy was then developed using the same procedure but with the Tasmania IO table as the parent table.

The 114 sector IO table of the local economy was aggregated to 50 sectors and 8 sectors for the purpose of describing the economy.

The economic structure of the regional economy can be compared with that for Tasmania through a comparison of results from the respective IO models (Figures 4.1 and 4.2). This reveals that the agriculture/forestry/fishing, mining and trade/accommodation in the local economy are of greater relative importance than they are to the Tasmanian economy, while the manufacturing, utilities, building, business services and public/personal services sectors are of less relative importance than they are to the Tasmanian economy.

Figures 4.3 to 4.5 provide a more expansive sectoral distribution of gross regional output, employment, household income, value-added, exports and imports, and can be used to provide some more detail in the description of the economic structure of the regional economy.

In terms of output and value-added, the coal mining sector, retail trade sector, accommodation/restaurants sector and ownership of dwellings sector are the most significant sectors to the regional economy. The retail trade sector is the most significant sector for employment followed by the accommodation/restaurants sectors, education sectors and community care services sectors. Education sectors, community care services sectors, public administration, retail trade and accommodation/restaurant sectors are the most significant sectors for income. The coal mining sector and metal manufacturing sectors are the largest sectors for imports while the coal mining sector, sheep/grains/beef sectors and accommodation / restaurants sectors are the largest sectors for exports.

Figure 4.1 - Summary of Aggregated Sectors: Local Economy (2011)

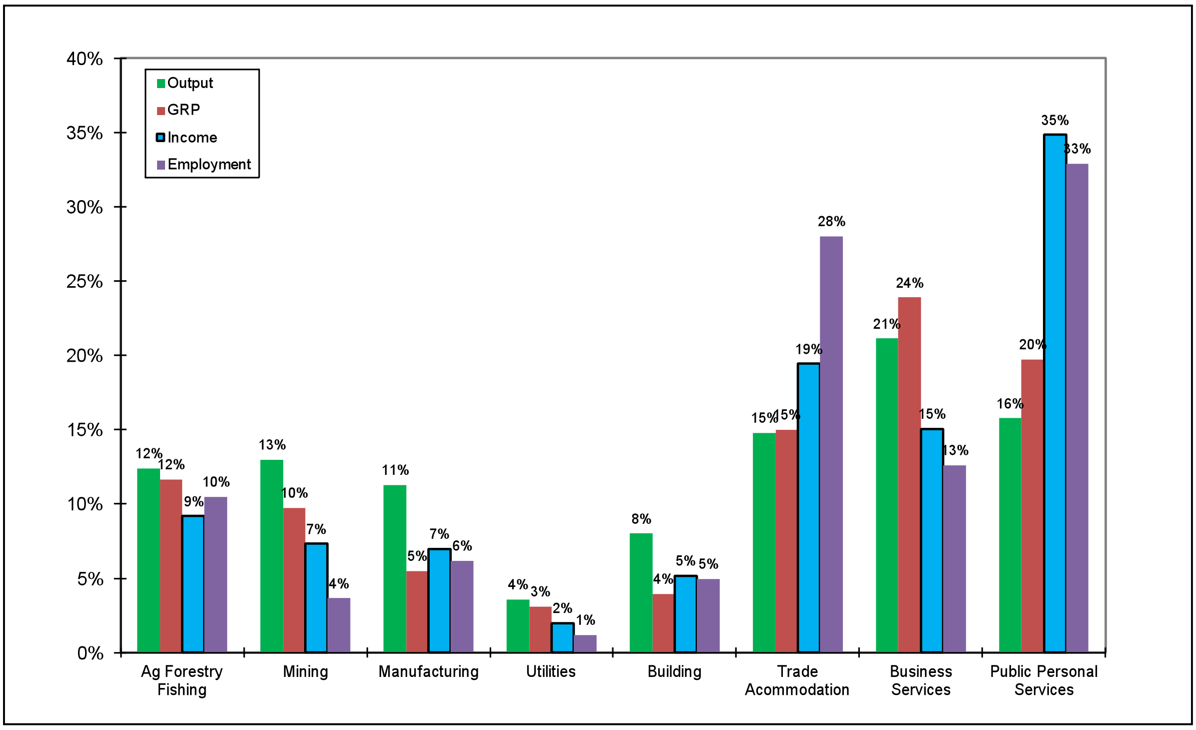

Figure 4.2 - Summary of Aggregated Sectors: Tasmanian Economy (2011)

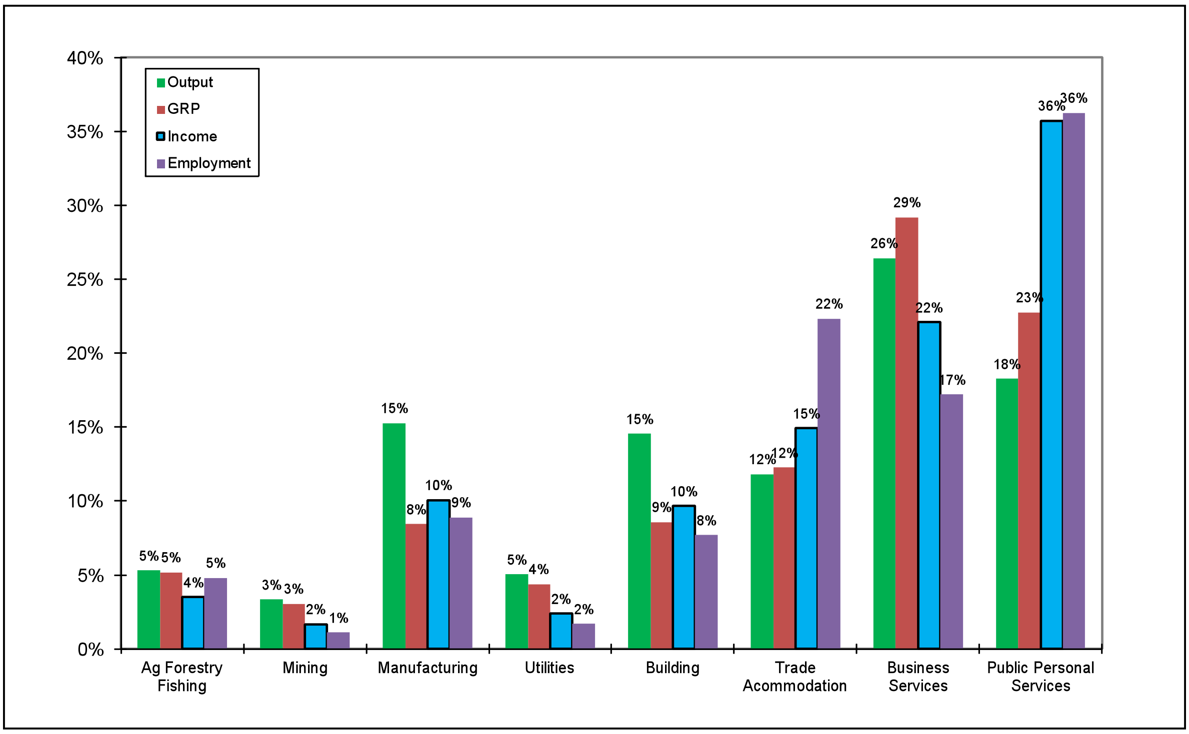

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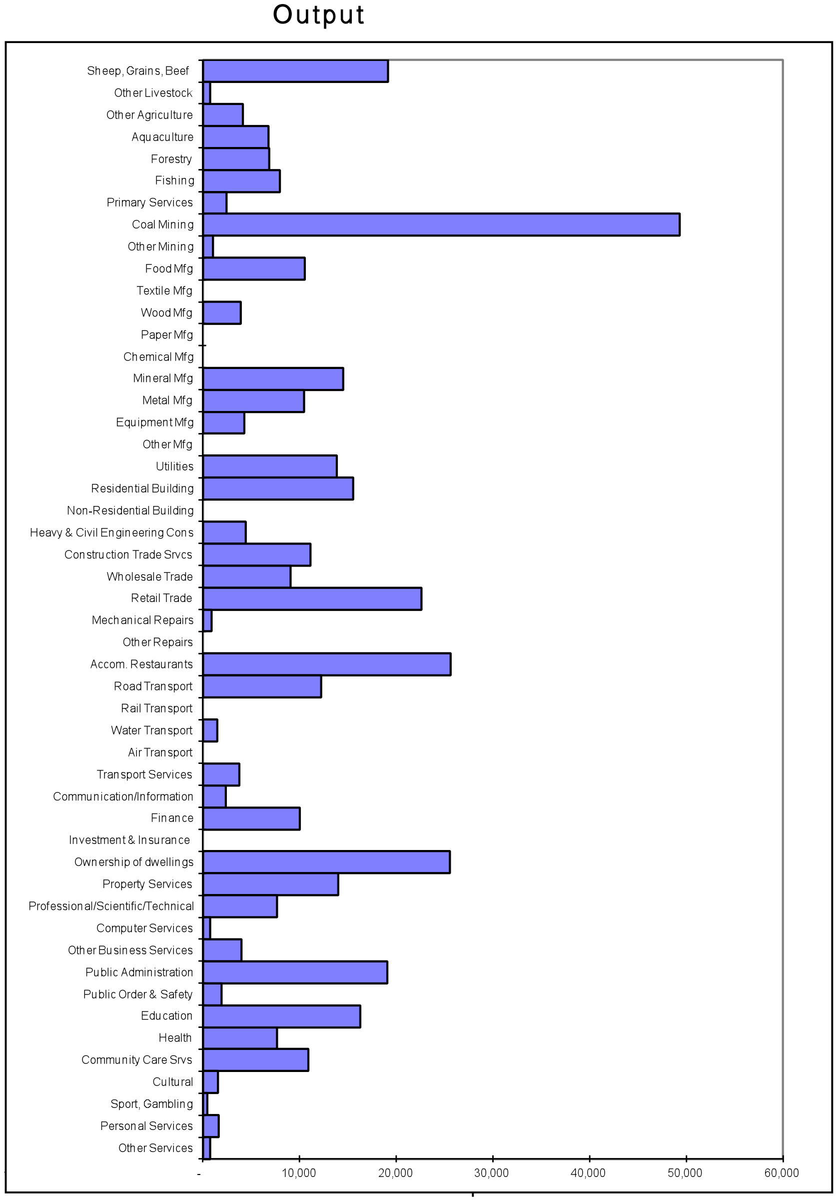
Figure 4.3 Sectoral Distribution of Gross Regional Output and Value Added ($'000)



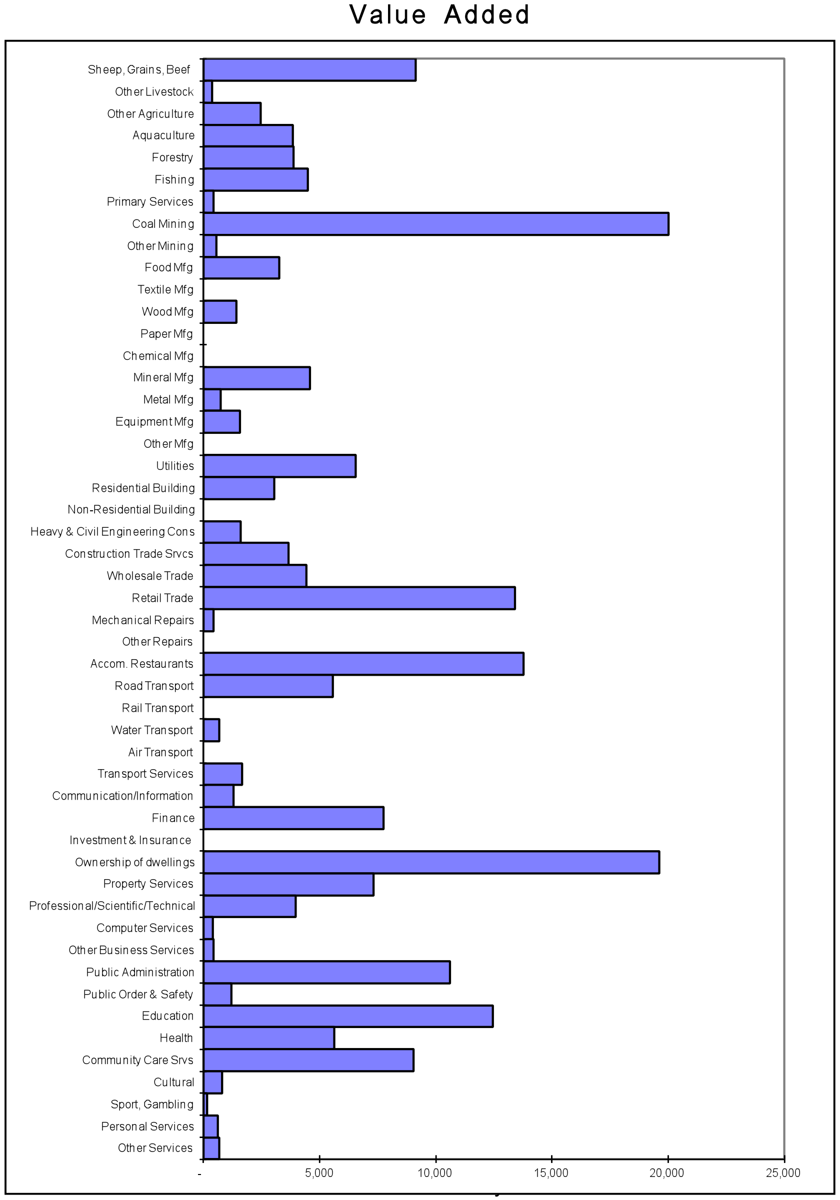


Figure 4.4 Sectoral Distribution of Income ($'000) and Employment (No.)

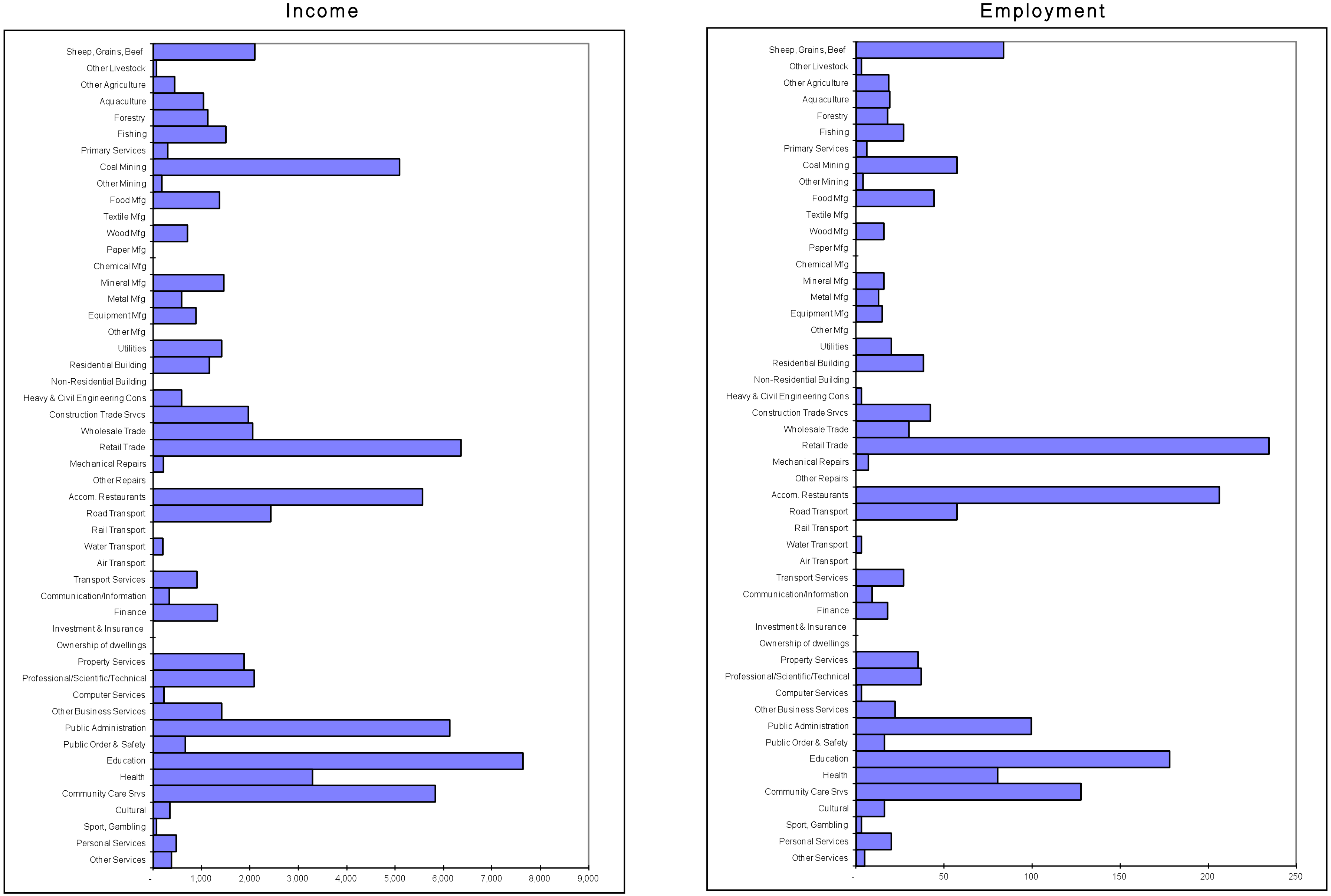
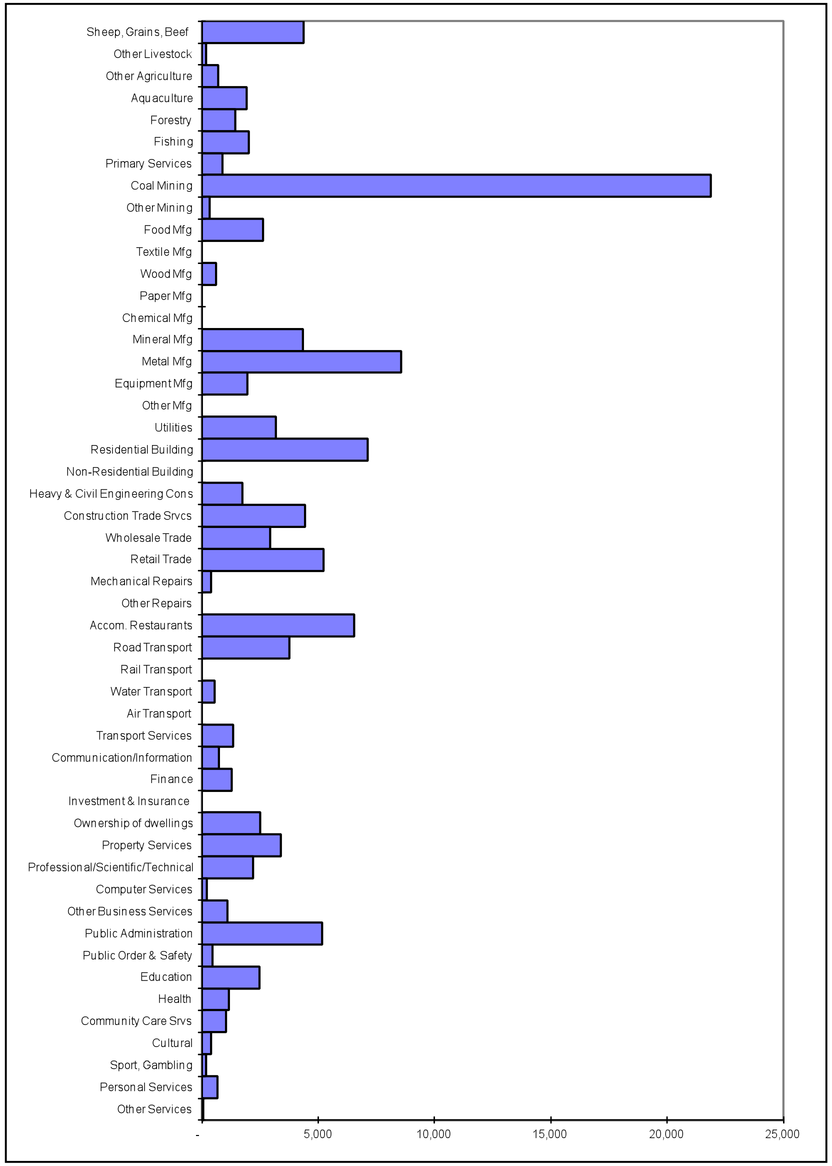


Figure 4.5 Sectoral Distribution of Imports and Exports ($'000)



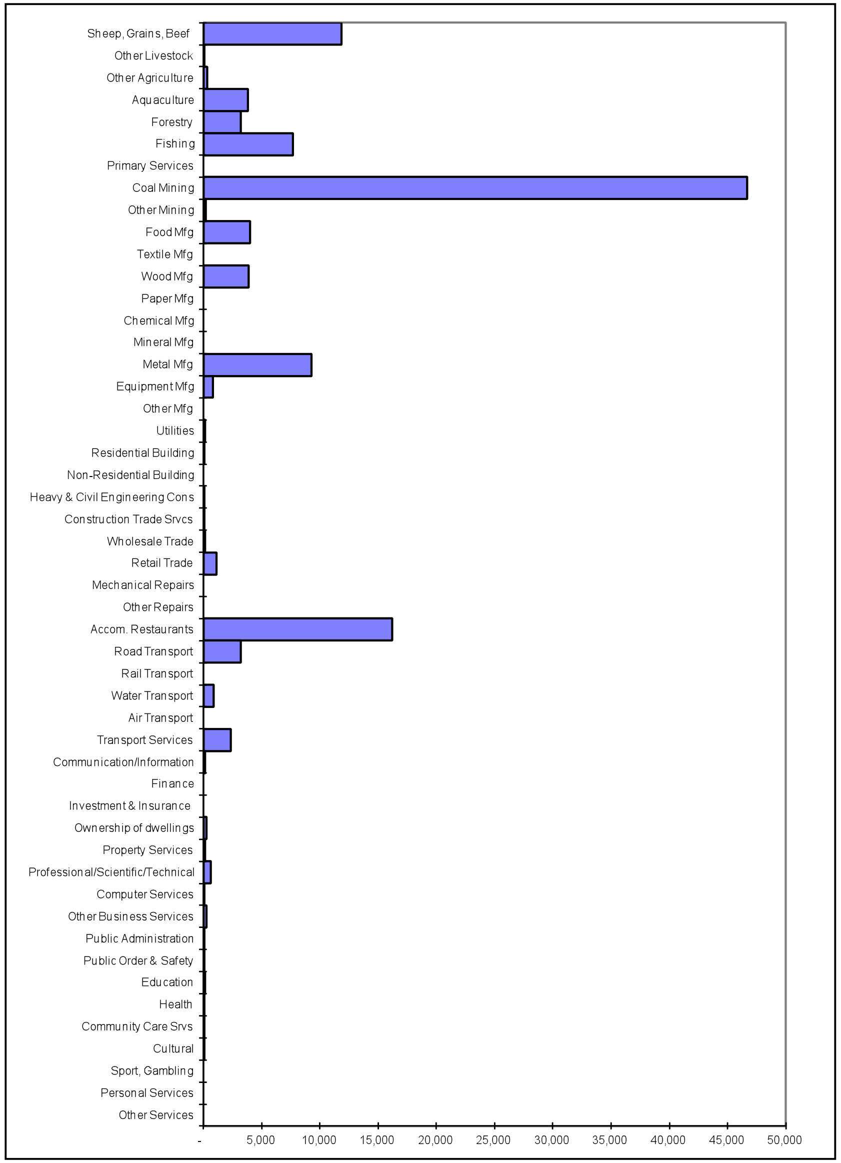
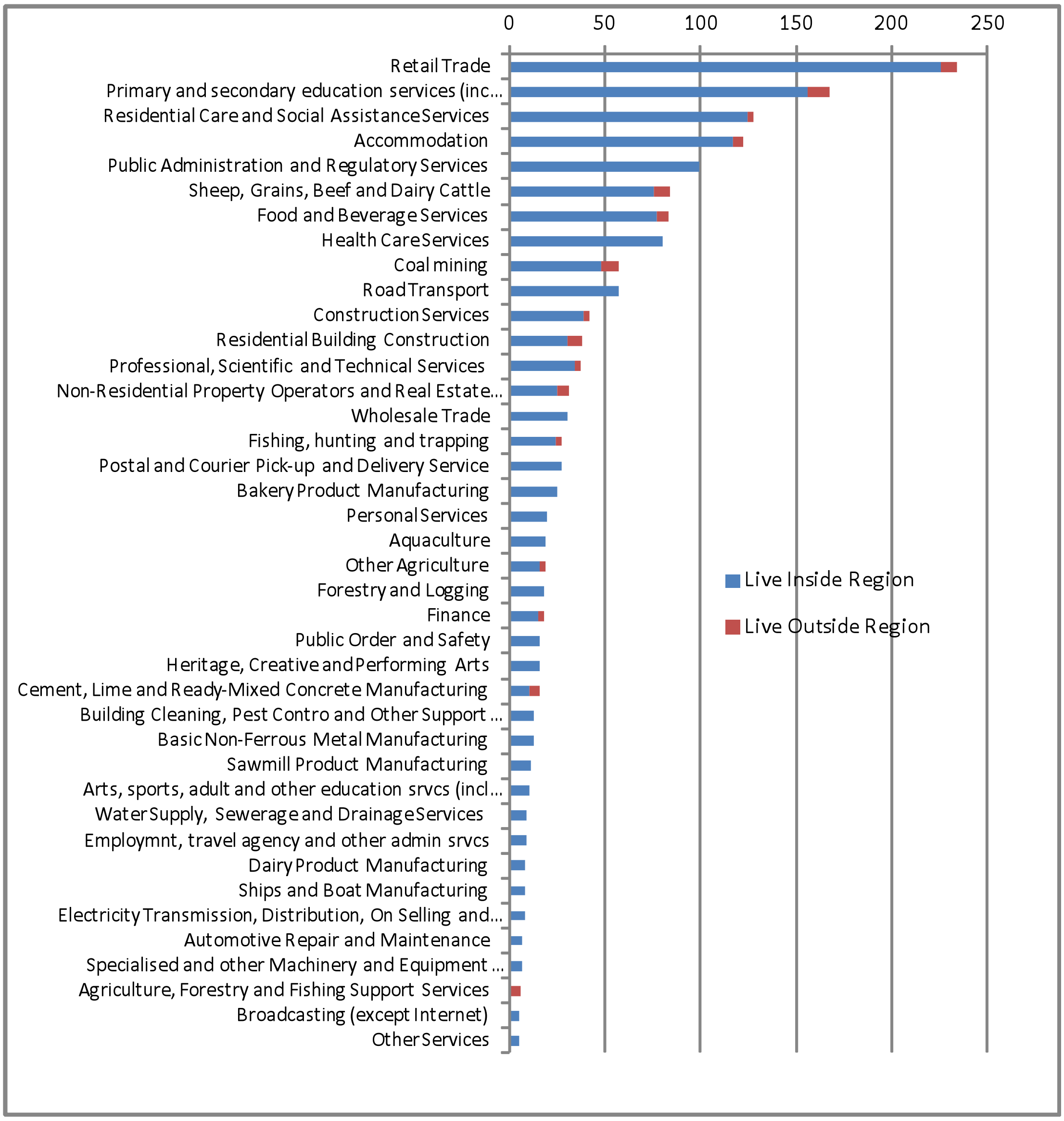


Figure 4.6 shows the top 40 individual industry sectors by employment number for the region. The five most significant employment providers in the region are the retail sector, primary and secondary education services sector, residential care and social assistance services sector, accommodation sector and public administration and regulatory services sector. In the top 40 individual industry sectors by employment, 6% of the workforce resides outside the region.

Figure 4.6 - Main Employment Sectors in the Region (Job Numbers)



Source: Generated from ABS 2011 census 4 digit employment by industry by place of usual residence data.

4.3 Regional Economic Impact of Restoration Expenditure

4.3.1 Introduction

Expenditure in the Break O' Day Local Government Area that is associated with the Project includes:

- wages expenditure from 2008 to 2014 from labour programs (including CBA/SVA, Work for the Dole, Community Work Orders, Green Corps), estimated at $470,269;
- materials purchases from 2008 to 2014, estimated at $114,188.
- wages expenditure by labour funded by Environment Tasmania from 2015 to 2016, estimated at $403,596;
- other expenditure by Environment Tasmania from 2015 to 2016, estimated at $46,458.

For the analysis of the Project on the Break O Day LGA economy a new Project sector was inserted into the regional IO table reflecting wages and expenditure pattern from 2008 to 2016. For this new sector:

- the total expenditure was allocated to the *Output* row;
- the estimated wage bill of labour residing in the region was allocated to the *household wages* row;
- non-wage expenditure in the region was initially allocated across the relevant *intermediate sectors* in the economy;
- allocation adjustment was then made between *intermediate sectors* in the regional economy and *imports* based on regional location quotients;
- purchase prices for expenditure in the each sector in the region were adjusted to basic values and margins and taxes and allocated to appropriate sectors using relationships in the (2012-13) National Input-Output Tables;
- direct full time employment associated with the Project was estimated by dividing total wages by the median person wage for those residing in the region.

4.3.2 Economic Activity Impacts

The computer program IO7 (Input-Output Analysis Version 7.1) was used to estimate the direct and indirect output, value-added, income and employment impacts (and multipliers) of this level of expenditure in the Break O Day regional economy. The total and disaggregated impacts of the Project on the regional economy (in 2016 dollars) are shown in Table 4.1

Table 4.1 - Economic Impacts of the Project on the Regional Economic ($2016)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	1,048	174	694	867	1,915
Type 11A Ratio	1.00	0.17	0.66	0.83	1.83
VALUE ADDED ($'000)	888	83	430	513	1,401
Type 11A Ratio	1.00	0.09	0.49	0.58	1.58
INCOME ($'000)	874	28	128	156	1,030
Type 11A Ratio	1.00	0.03	0.15	0.18	1.18
EMPL. (No.)	46	1	4	4	50
Type 11A Ratio	1.00	0.01	0.08	0.09	1.09

The Project is estimated to have made the following contribution to the regional economy over its life:

- $1.9M in direct and indirect regional output or business turnover;
- $1.4M in direct and indirect regional value added;
- $1.0M in direct and indirect household income; and
- 50 direct and indirect jobs.

4.4.3 Multipliers

Type 11A ratio multipliers summarise the total impact on all industries in an economy in relation to the initial own sector effect e.g. total income effect from an initial income effect and total employment effect from an initial employment effect, etc. The incremental type 11A ratio multipliers for the Project range from 1.09 for employment up to 1.83 for output.

4.4.4 Main Sectors Affected

Examination of the estimated direct and flow-on employment impacts gives an indication of the sectors in which employment opportunities would be generated by the Project (Table 4.2).

Table 4.2 - Sectoral Distribution of Incremental Employment Impacts on the Regional Economy

	Regional Economy			
Sector	Average Direct Effects	Production-induced	Consumption-induced	Total
Skyline	46	0	0	**46**
Primary	0	0	0	**0**
Mining	0	0	0	**0**
Manufacturing	0	0	0	**0**
Utilities	0	0	0	**0**
Wholesale/Retail	0	0	1	**1**
Accommodation, cafes, restaurants	0	0	1	**1**
Building/Construction	0	0	0	**0**
Transport	0	0	0	**0**
Services	0	0	1	**2**
Total	**46**	**1**	**4**	**50**

Note: Totals may have minor discrepancies due to rounding.

This indicates that flow-on employment is mainly in the wholesale/retail sectors, accommodation/cafes/restaurants sectors and services sectors. Businesses that can provide the inputs to the production process required by the Project and/or the products and services required by paid labour would directly benefit from the Project by way of economic activity.

5 MOVING FORWARD

The valuation of the economic benefits of projects and policies relies on the establishment of dose-response functions between the initial actions and changes in attributes that the community value e.g. the length of a waterway that is in good health or the contribution of the action to improving the protection status of endangered species.

Establishing these relationships is an important first step in facilitating future economic valuation of projects and policies. Economist can help scientist with identifying the ultimate effects that consumers and producers are likely to value. However, it is the domain of scientists to estimate these cause-effect relationships, whether by scientific study or expert judgement. Only then can economists place values on attributes that the community value using primary valuation methods or BT.

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ATTACHMENT 1 - CM STUDY IN TASMANIA

Kragt and Bennett (2011) use CM to analyse community preferences for natural resource management options in the George catchment of Tasmania. Catchment health attributes value were:

- the length of the native riverside vegetation (kms);
- the number of rare native animal and plant species in the George catchment (number of species present); and
- the area of health seagrass beds in the Georges Bay (hectares) (which was used as a measure of estuary condition).

Questionnaires were distributed to samples of the population of Hobart, Launceston and St Helens.

The attribute only model mixed logit found a median WTP per household of:

- $0.11 per ha increase in seagrass area;
- $3.91 per km increase in native riverside vegetation; and
- $8.62 per additional rare native animal and plant species living in the George catchment.

Aggregated across the Tasmanian population[6] the community was WTP:

- $15,914 per ha increase in seagrass area;
- $565,658 per km increase in native riverside vegetation; and
- $1,247,052 per additional rare native animal and plant species

[6] Following standard aggregation procedure, per household WTP amounts were aggregated to the survey response rate plus one third of nonrespondents.