Towong Shire Council

The Narrows Project – Technical Feasibility Study Report
Phase Two (Cost Benefit Analysis)

February 2017

Limitations of this report

This report has been prepared by GHD for the Towong Shire Council and may only be used and relied on by the Council for the purpose agreed between GHD and the Council.

GHD otherwise disclaims responsibility to any person other than the Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by the Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the preliminary cost estimates using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Capital Cost Estimate, provided by Council (SMEC Report) has been prepared for the purpose of feasibility, financial and economic analysis and must not be used for any other purpose.

Executive summary

Background

For over 50 years the construction of a water structure across a section of the Mitta Mitta River at Tallangatta has been a point of discussion. It is thought that a water control structure could improve tourism and provide recreational opportunities for the township of Tallangatta, as well as potentially providing a road link across the river.

Ongoing interest in the project has led to the commissioning of multiple studies to investigate the requirements and feasibility of constructing such a structure.

- As part of the 2010 Victorian Election, the Member for Benambra committed to providing a 'once-and-for-all' study to ascertain the feasibility of The Narrows.
- In 2014 SMEC was engaged by Towong Shire Council (TSC) to prepare the Technical Feasibility Study Report (Phase One) of building a water control structure across Lake Hume, on the Mitta Mitta River, in an area locally known as "The Narrows".
- In 2015 GHD was engaged to undertake Phase Two of the Technical Feasibility Study; a Cost Benefit Analysis (CBA) of two options that were recommended by SMEC during Phase One of the Technical Feasibility Study, and to consider the broader economic impacts that may arise from the project.

Options assessment

Four options were assessed under Phase One of the Technical Feasibility Study. Although all four options met constructability and design criteria, two were deemed cost prohibitive.

GHD has employed a CBA methodology to assess the two shortlisted options against a 'do nothing' base case. The project options include:

Option 1 – Rockfill structure with a core cut-off

This option would comprise a weir with rockfill shoulders and a nominally centrally located low permeability core and cut-off extending into the foundation.

Option 2 – Zoned earth and rockfill structure with a core cut-off

This option would comprise an earth fill structure with a centrally located low permeability core and cut-off extending into the foundation, filter/transition zone and rockfill beaching on the upstream and downstream shoulders for erosion protection.

Modelling assumptions

The CBA has taken a number of assumptions into consideration, primarily:

- Varied construction costs for the water control structure, including dam construction, a bridge (analysis models both the inclusion and exclusion of the bridge) and a fish-way.
- Ongoing operations expenses, calculated as a proportion of total capital construction cost for each project option.
- The construction of the proposed weir would result in an increase in the surface area of Lake Hume, which leads to increased evaporation loss. The SMEC report estimates that the average annual increase in evaporation from Lake Hume is 2,800 ML. As the increased evaporation loss represents a volume of water used in the Murray-Darling Basin, where water usage is capped, the project would need to acquire entitlements for this usage through purchasing Victorian Murray High Reliability Water Shares from the market to cover the 2,800 ML of evaporation.

- Increased tourism volumes at Low/Medium/High levels of demand.
- Residential development opportunities from improved foreshore amenity, considering the Tallangatta Town Planning Scheme via Amendment C25, which are being implemented to allow for an ordered rural residential development.

Each of these assumptions may have some economic impact on Gross Regional Product (GRP) and local employment, which has been further outlined in the report.

Cost Benefit Analysis results

The CBA (discounted at 7%) has tested the economic viability of the two project options at assumed Low (2.5%), Medium (4%), and High (5%) levels of tourism demand and residential development. Regarding residential development, under the Low demand scenario (Level 1), uptake of residential development sites increases from 40 to 79. The Low demand scenario reflects the growth that will result from general population increase and the stimulus of Destination Tallangatta. In the Medium demand scenario (Level 2), residential development site uptake increases to 139 sites. Under the High demand scenario (Level 3) residential development site uptake increases to 213. The Medium and High demand are linked to the direct economic stimulus impact resulting from The Narrows dam project.

Sensitivity analysis considered the impact on the Benefit Cost Ratio (BCR) due to changes in the underlying discount rate (at 4% and 10%). The results of the BCR are shown in Table 1.

Table 1 Summary of CBA results

Option 1 - Base Case : Benefits/Cost Ratio

		Demand level		
		1	2	3
Discount Rate	10.0%	0.111	0.209	0.289
	7.0%	0.186	0.350	0.487
	4.0%	0.354	0.669	0.935

Option 2 - Base Case : Benefits/Cost Ratio

		Demand level		
		1	2	3
Discount Rate	10.0%	0.124	0.235	0.324
	7.0%	0.207	0.393	0.545
	4.0%	0.394	0.746	1.042

The BCR only exceeds the decision criteria of >1.0 under the demand level 3, and then only if the discount rate is at 4%, which is substantially below the Department of Treasury and Finance (DTF) recommended rate of 7%

Sensitivity analysis was undertaken, to validate Project Case analysis and to verify to what extent the assumptions would need to be 'stretched' to achieve a BCR >1.0.

- Increased residential development through a residential/golf course development on the existing golf course. The inclusion of an additional development area of 80 residential sites will increase the BCR, but the increase is insufficient to increase the BCR to 1.0.

(*Note – no stakeholder consultations were held to verity community acceptance of the development*)

- Removal of the bridge from the construction option. The removal of the bridge from both options reduces the capital cost by $25 million, and reduces the residential development attractiveness on the north shore. The reduced capital cost is insufficient to increase the BCR to 1.0.
- The increased evaporation loss has the potential to decrease agricultural output. Potential reduction in agricultural return has not been modelled due to the wide range of factors that would need to be considered and how they could change on an annual basis. It is sufficient to indicate that any loss in agricultural output would be detrimental to the project.

Recommendations

The results of the CBA indicate that The Narrows project as it is currently presented should not proceed. The wider economic benefits that are generated for Tallangatta, the region and the broader economy under the current proposals do not match the projects capital, maintenance and operational expenditure. The in-balance between the project's benefits and costs deteriorates further if any additional costs resulting from loss of agricultural output (due to increased evaporation) are included in the economic analysis.

Through scenario analysis, the key variable of residential demand was modified in order to assess the impact on the project's viability and to identify the point at which the required objective of a BCR >1.0 would be achieved. This analysis identified that the up-take percentage of residential development sites would need to be at 3% per annum over the 30-year analysis period to achieve the BCR objective. This rate is well in excess of present and forecasted regional Victorian population growth.

Table of contents

Table index

Figure index

Appendices

Appendix A – EconSearch Economic Analysis Report

Appendix B – C25 Amendment

Appendix C – Analysis (Excel) Model

Abbreviations/Glossary

Abbreviation/ Term	Definition
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum – based on the height above sea level
BCR	Benefits Cost Ratio (or index)
CAPEX	Capital expenditure
DCF	Dam Crest Flood – the flood which can be passed through the spillway with the reservoir level at the dam crest
EconSearch Analysis	Economic Impact Assessment of The Narrows Report – report prepared for GHD, April 2016
EFT	Effective full-time equivalent (measure of employment)
G-MW	Goulburn-Murray Water
GRP	Gross Regional Product
LGA	Local Government Area
MDBA	Murray Darling Basin Authority
Megalitre (ML)	A unit of volume equivalent to one million litres
NPV	Net Present Value
OPEX	Operational expenditure
RACV	Royal Automobile Club of Victoria
SMEC Report	The Narrows – Technical Feasibility Study Report (Phase One), November 2015
SR&WSC	State Rivers and Water Supply Commission
TSC	Towong Shire Council

1. Introduction

1.1 Purpose of this Report

Towong Shire Council (TSC) has undertaken an engineering feasibility study[1] into the construction of a water control structure across a section of the Mitta Mitta River at Tallangatta called “The Narrows”. The water control structure would provide improved tourism and recreational opportunities for the township of Tallangatta, as well as potentially providing a road link across the river.

This report addresses the second stage of Phase One of the Technical Feasibility Study, that is, the Cost Benefit Analysis (CBA) of the two water control structure (dam) options proposed, and the broader economic impacts that would arise from the project.

1.2 Project History

The construction of a water control structure has been a point of discussion in Tallangatta for more than 50 years. During the heightening project of the Hume Dam in the mid-1950s, the township of Tallangatta was relocated to its present site. Bolga was selected as the relocation site as Lake Hume was deeper at this location and it was expected that when the reservoir was drawn down, the riverbed and mud flats would be observed less frequently than would be case at the alternative sites considered.

In 1952, the then Premier of Victoria reportedly justified the relocation of the “Old Tallangatta” township to its current location by inferring that the increase in water storage of Lake Hume would provide benefits to the town, especially from tourism growth.

Since the relocation of Tallangatta, the town has not experienced consistent recreation and tourism benefits due to the fluctuation of water levels of Lake Hume.

- **1968** – local member TW Mitchell raised the possibility of the construction of an earth wall across The Narrows at a height that would hold water for safe boating at Tallangatta.
- **1970** – decision to build Dartmouth Dam, with the possibility that water levels in Lake Hume could be “lower than average”.
- **1974** – during the construction of the Dartmouth Dam, the State Rivers and Water Supply Commission (SR&WSC) wrote to the Shire of Tallangatta that Dartmouth would be used as a ‘backup’ dam and that primary function of water release from Dartmouth was for irrigation and not recreational purposes.
- **1979** – the Loder and Bayley Report (commissioned by the Lake Hume Recreation Coordinating Committee) stated that a water level at RL181.5m AHD (Hume Weir is at 100% capacity at RL192.0m AHD) would lead to no useable water at Tallangatta and the “town ceases to become a viable centre for water-based recreation”.
- **1983** – after further investigation undertaken by the Rural Water Commission in 1982, the Tallangatta Shire Council suggested that an ‘embankment lock’ be constructed across the Mitta Mitta arm of Lake Hume to retain water at RL187m AHD, which would be sufficient for recreational activities at Tallangatta.

[1] SMEC Report

- **2010** – as part of the 2010 Victorian Government Election, the Member for Benambra committed to providing a 'once- and-for-all' study to ascertain the feasibility of The Narrows.
- **2014** – SMEC was engaged by TSC to evaluate the technical feasibility of building a structure at The Narrows on the Mitta Mitta River that would maintain consistent water levels in Lake Hume at the Tallangatta township over the peak tourist season (December to February) each year to encourage recreational water activities.
- **2015** – GHD was engaged by TSC to complete the Cost Benefit Analysis for the options recommended by SMEC.

This report covers the CBA for two shortlisted options, taking into account:

- The direct economic impacts resulting from:
    - Project construction
    - Residential construction (township and rural)
    - Tourism and population growth
    - Water availability
    - Council rate base
- The indirect economic benefits resulting from:
    - Industrial effect resulting from construction, tourism and population growth
    - Consumption effect resulting from construction, tourism and population growth.

1.3 Project Site

SMEC was engaged by TSC to undertake Phase One of The Narrows Project, to determine the technical feasibility of constructing a water control structure across Lake Hume, on the Mitta Mitta arm, west of Tallangatta. The site selected is approximately 3 kilometres west of the Tallangatta township, in an area locally referred to as "The Narrows", as it provides the shortest distance across the body of water (refer Figure 1).

Figure 1 Proposed Site

1.4 Destination Tallangatta

The Tallangatta Tomorrow Masterplan, developed in 2011, identified and developed a number of initiatives and projects to enable the township to become a thriving town and revitalised tourist destination – a transition from its traditional agricultural and farming focus.

Though the Masterplan, the Federal Government granted $2.65 million to TSC to undertake the Destination Tallangatta project. This project focuses on revitalising and reinvigorating the town by providing upgraded pedestrian and cycling infrastructure, redevelopment of the Tallangatta Holiday Park and improvements to the Lake Hume Foreshore areas.

These initiatives are predicted to significantly increase private investment, employment opportunities, tourist visitation and expenditure and the population of the town.

Destination Tallangatta has identified a range of undertakings, which include:

- Tallangatta Township Revitalisation – providing strategic pedestrian and cycle links and attractive landscaping and street-trees to enhance the town's appearance.
- Tallangatta Foreshore Redevelopment – redevelopment of foreshore areas in the town, complete with a regional adventure playground and natural outdoor amphitheatre.
- Tallangatta Holiday Park Redevelopment – making the most of its spectacular location on the shores of Lake Hume.

Based on an expected project investment of $5.3 million, full time employment is expected to increase by 50 jobs post the construction period, leading to a population increase of 20% by 2025.

In addition to the expected benefits under Destination Tallangatta, The Narrows Project has been considered to further enhance the township's opportunities, offerings and appeal to residents and tourists. Although Destination Tallangatta and The Narrows project are independent from each other, each would enhance the other, especially in the areas of tourism growth and property development.

2. Engineering Feasibility

SMEC, in conjunction with TSC developed a Functional Design Criteria[2] that was to address the key objectives of the project:

- To maintain consistent water levels in Lake Hume at Tallangatta township over the peak tourist season (December to February) each year to encourage recreational water activities. It is noted that the following activities need to be accommodated:
    - Boating (including power boats)
    - Water skiing
    - Fishing
- To provide an alternative road access to the north side of the Mitta Mitta arm to the west of Tallangatta.
- To provide improved water frontage and amenity in vicinity of the township.

2.1 Development Options

In response to the Functional Design Criteria four options were considered:

- **Option 1** – Rockfill structure with a core cut-off. This option would comprise a weir with rockfill shoulders and a nominally centrally located low permeability core and cut-off extending into the foundation.
- **Option 2** – Zoned earth and rockfill structure with a core cut-off. This option would comprise an earth fill structure with a centrally located low permeability core and cut-off extending into the foundation, filter/transition zone and rockfill beaching on the upstream and downstream shoulders for erosion protection.
- **Option 3** – Concrete Structure. This option would comprise a mass roller compacted concrete (RCC) gravity structure.
- **Option 4** – Twin Walled Sheet Pile with Plunge Pool. This option would comprise two parallel walls of sheet piles driven into the foundation, offset at least 5m, and backfilled above foundation level with conventional concrete. The plunge pool would be constructed from conventional reinforced concrete.

These options were evaluated against set criteria, and benefits and limitations were identified to determine the preferred option to be progressed. A tiered approach was adopted:

- Constructability (i.e. can it be constructed in water?)
- Technical
- Design.

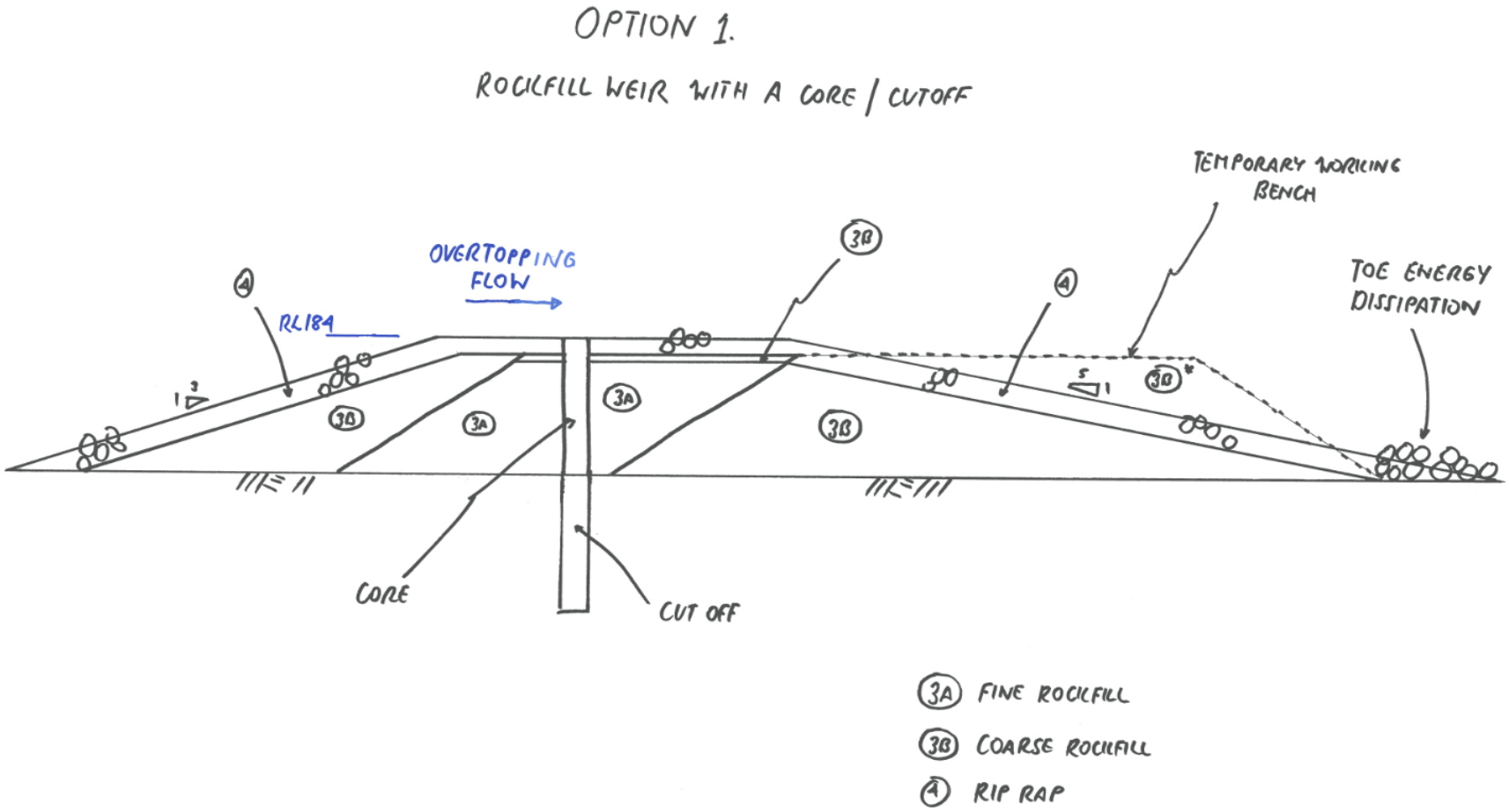
In summary, it was determined that although a construction methodology could be developed for all four options to allow for construction under water, it was judged that Option 4 would be cost prohibitive and for this reason was discounted from further consideration.

Option 3 required a rock foundation, which was not considered realistic based on the depth of alluvials overlaying bedrock. The higher cost required to ensure integrity of a rigid structure is deemed to be cost prohibitive, and as such Option 3 was also ruled out on the basis of cost.

Option 1 (rockfilled) and Option 2 (zoned earth and rockfilled) were shortlisted and taken forward to the CBA phase. The schematic sketches for these options are shown in Figure 2 and Figure 3 respectively.

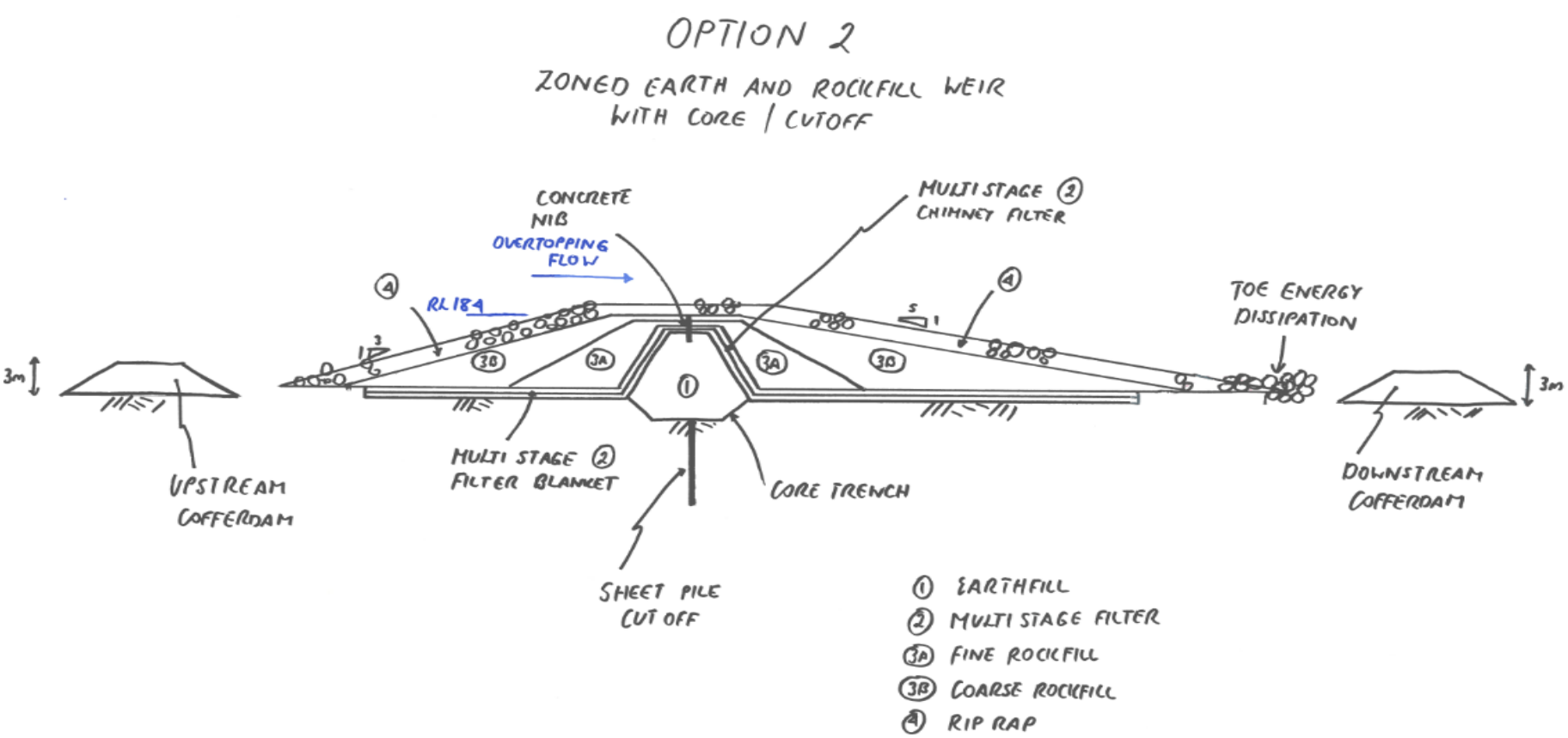
[2] SMEC Report – Appendix 1

Figure 2 Option 1 – Rockfill Weir Schematic[3]



[3] SMEC Report – Appendix 8.1

Figure 3 Option 2 – Zoned Earth and Rockfill Weir Schematic[4]



[4] SMEC Report – Appendix 8.1

3. Modelling assumptions

3.1 Methodology

The overall analysis has adopted a benefits/costs approach on the basis of comparing project options to a base case scenario.

- **Do Nothing (Base) Case** – for the base case it is necessary to forecast what would happen under a zero investment option. Since the Destination Tallangatta strategy has only recently been adopted, tourism forecasts for the Base Case have been aligned with the strategy so that it is possible to isolate the benefits which are the result of new activities and excluding those that are already in place.
- **Project Case 1** – Dam Option 1
- **Project Case 2** – Dam Option 2.

The two dam construction options will provide the same level of service and general outcomes, but will have different associated capital and maintenance costs, and different residual values at the end of the analysis period, as the new assets have a useful life in excess of the analysis period.

The Benefit Cost Ratio (BCR) is calculated on the basis of the Net Present Value (NPV) of Benefits divided by the NPV of Costs. The decision rule applied is that projects with a BCR greater than 1.0 should be accepted, and for option analysis, that project that has the highest BCR should be undertaken, provided that the BCR is greater than 1.0.

3.2 Capital Costs

The capital cost for the construction of each dam option consists of three elements:

- Dam construction
- Bridge
- Fish-way.

The capital cost profile for each option is outlined in Table 2.

As a further consideration, it is possible to build the dam without the bridge option, but the fish-way is a necessary element of the overall construction program. If the bridge option was to be excluded from the overall construction program, it would remove the alternative route from Tallangatta to Albury and diminish the attractiveness of rural residential development on the northern shore of the Mitta Mitta River.

The base analysis assumes that the bridge option is included in the overall construction program.

Table 2 Capital cost profile

		Total	2017	2018
Base case				
Infrastructure		$0	0%	0%
Total CAPEX		$0	**0%**	**0%**
Option 1 - Rockfill Weir (FSL 184m AHD)				
Establishment		$1,000,000	100%	0%
Temporary Works		$0	50%	50%
Weir		$28,000,000	25%	75%
Outlet		$3,330,000	0%	100%
Minor Items	20%	$6,466,000	50%	50%
Procurement & Construction Risk	10%	$3,233,000	50%	50%
Contingencies	40%	$16,811,600	50%	50%
Management	15%	$4,849,500	50%	50%
Planning Approvals		$1,000,000	100%	0%
Total CAPEX(1)		$64,690,100		
Option 2 - Zoned Earth and Rockfill Weir (FSL 184m AHD)				
Establishment		$1,000,000	100%	0%
Temporary Works		$480,000	50%	50%
Weir		$20,516,000	25%	75%
Outlet		$3,330,000	0%	100%
Minor Items	20%	$5,065,200	50%	50%
Procurement & Construction Risk	15%	$3,798,900	50%	50%
Contingencies	40%	$13,676,040	50%	50%
Management	15%	$3,798,900	50%	50%
Planning Approvals		$1,000,000	100%	0%
Total CAPEX(2)		$52,665,040		
Road Bridge (can apply to both Options)				
Construction		$20,000,000	25%	75%
Procurement & Construction Risk	10%	$2,000,000	25%	75%
Contingencies	10%	$2,200,000	25%	75%
Management	5%	$1,000,000	25%	75%
Total CAPEX(3)		$25,200,000		
Fishway (can apply to both Options)				
Construction		$4,000,000	10%	90%
procurement & Construction Risk	10%	$400,000	10%	90%
Contingencies	10%	$440,000	10%	90%
Management	5%	$200,000	10%	90%
Total CAPEX(4)		$5,040,000		
	Base Case	$0	$0	$0
	Project Case 1	$94,930,100	$31,484,050	$63,446,050
	Project Case 2	$82,905,040	$27,342,520	$55,562,520

Source: SMEC Report Appendix 8.2

Additional capital expenditure would need to be undertaken on the bridge, as there would need to be some refurbishment of the road deck after 20-25 years of operation (Table 3).

Table 3 Refurbishment requirements

Refurbishment	Effective Life Yrs	Refurbish in 30 Years	Refurbish Year	Refurb %
Weir Wall	100	No	0	0.0%
Bridge	80	Yes	25	2.0%
Fishwall	100	No	0	0.0%

Source: GHD modelling input

3.3 Operational Expenditure

Although TSC would incur operational (e.g. maintenance) costs under the Do Nothing Case, including road maintenance, parks, road furniture, the only cost that come into consideration in the comparative analysis are those costs that would be different under the three options, and those costs that relate directly to the dam construction (Table 4).

Annual maintenance estimates have been based on GHD's experience with similar infrastructure projects.

Table 4 Operation expenditure

OPEX		Annual	10 Years
OPEX for weir	%	0.10%	0.10%
OPEX for road bridge	%	0.10%	0.20%
OPEX for fishway	%	0.02%	0.02%

Source: GHD modelling input

3.4 Evaporation Loss (Water Availability)

One of the challenges of a dam structure at The Narrows is that water that would normally flow further into the Hume Weir from the Mitta Mitta River and be held at a greater water depth with a smaller surface area, would be subject to a higher evaporation rate if held in shallower water upstream from the dam.

SMEC[5] estimated that the evaporation loss will depend on dam height (quantity held), duration period and temperature (Figure 4).

Figure 4 Forecasted evaporation loss

The Narrows Crest Level	Total Average Incremental Evaporation	
(m/AHD)	ML	GL
190	10,800	10.8
188	7,800	7.8
186	4,800	4.8
184	2,800	2.8

Source: SMEC Report

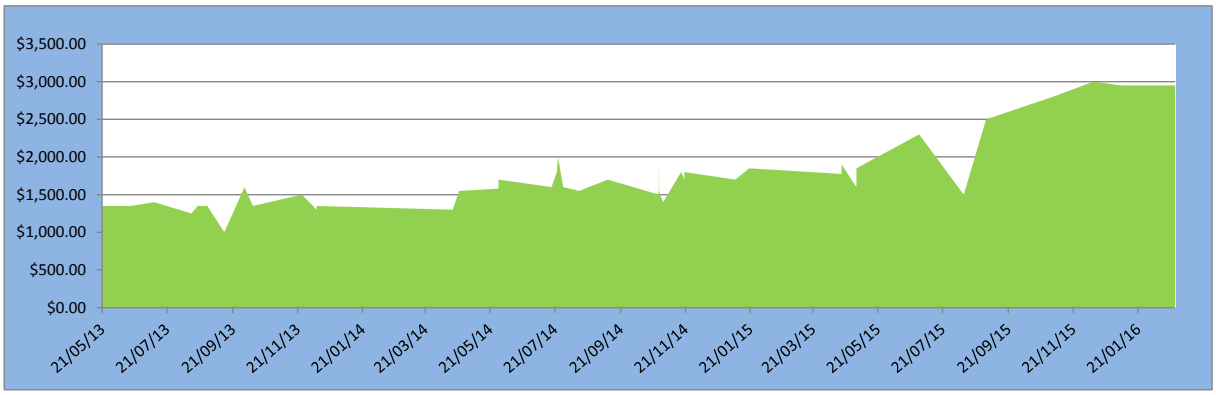
[5] SMEC Report p.16

At the proposed dam height of RL184mAHD, the forecasted incremental evaporation loss is expected to be 2,800 ML per annum, based on the historical water levels for Lake Hume 1979-2015.

The water evaporation loss forecasted has a number of impacts, as the water above the Hume Weir is shared equally between New South Wales and Victoria.

- For analysis purposes, as the increased evaporation loss represents a volume of water used in the Murray-Darling Basin, where water usage is capped, it has been assumed that the project would acquire entitlement for this usage through purchasing Victorian Murray High Reliability Water Shares from the market at the current high reliability trading rate of $2,800 per ML. This would add an additional one-off cost to the project of $7.84 million in the first year post construction of the weir.
- Purchase of the entitlement would also attract ongoing fees associated with headworks storage charges. Based on the Murray Bulk Water charge in 2015/16 of $11.80 per ML, for analysis purposes, it has been assumed that the annual charge for the 2,800 ML water share is estimated to be $33,040.

Figure 5 High Reliability Water Sales ($/ML 2012-2015)



Source: Water Trading Australia.

- Loss of production relating to irrigation activities that are supported along the Murray River. The value of the water for irrigation purposes is captured in the High Reliability price, but doesn't fully reflect the economic multiplier of water under various agricultural activities. An economic multiplier of 3.5 has been estimated for irrigation in the Murray Darling Basin.[6] This is an indicative figure only; rainfall and other indicators will have a significant impact on overall results. Due to the variability of the use of water (environmental, irrigation usage), the loss of production (potential) has not been reflected in the economic or financial modelling. If the loss of agricultural productivity value had been included in the analysis, the project viability would be lower, due to the reduction in agricultural revenue and employment.

3.5 Tourism

Destination Tallangatta forecasts that day trip visitors to the area will increase from a base of 10,000 visitors per annum to 10,840 visitors per annum, an 8.4% increase in the first year.

As a modelling base, it has been assumed that longer term demand will range between 1.0% to 5.0% on an annual basis, depending on the general trends in the economy and the relative position of inland Australian tourism (base case demand, without the attraction of increased

[6] Economic multiplier of 3.5 indicates that for every $1.00 of production revenue generated, there is an additional $3.50 of economic activity. *Meyer, WS (2005). The Irrigation Industry in the Murray and Murrumbidgee Basins. CRC For Irrigation Futures Technical Report No. 03/05.*

recreational opportunities, is unlikely to exceed population growth (forecast at 1.6% per annum)).

Tourism forecasts have been developed at three levels (Low/Medium/High) for both scenarios:

- Increased tourism demand linked solely to the initiatives undertaken as a result of Destination Tallangatta.
- Increased tourism that would result from the construction of a dam at The Narrows, increasing water (recreational) amenities at the township and further grow Tallangatta's reputation as a holiday/camping location.

Figure 6 Tourist Demand Forecasts

Tourism			
Overnight visitors (Destination Tallangatta)			29,200
Overnight visitors demand	High/Medium/Low?	1	
Average overnight spend per visitor		$ Cont/pers	$128.59
Daily Visitors (Destination Tallangatta)			10,840
Daily visitors demand	High/Medium/Low?	1	
Average spend per day visitor		$ Cont/pers	$95.05
Overnight Constraint (beds)	35,000		

Forecasted Tourism growth option		Project	Base
1	Low Demand Growth	2.5%	1.0%
2	Medium Demand Growth	4.0%	1.5%
3	High Demand Growth	5.0%	2.0%
4	High Demand Growth+Golf	5.5%	2.0%
	Demand Applied>>>>>	2.5%	1.0%

Source: GHD modelling input

Note:

1. Modelling allows for the selection of three demand profiles (Low/Medium/High).
2. Projected annual demand forecast is expected to be higher than for the Base Case, as a result in the change of recreational options.
3. Overnight and day spend – Tourism Research Australia data (2015).

3.6 Residential Development Options

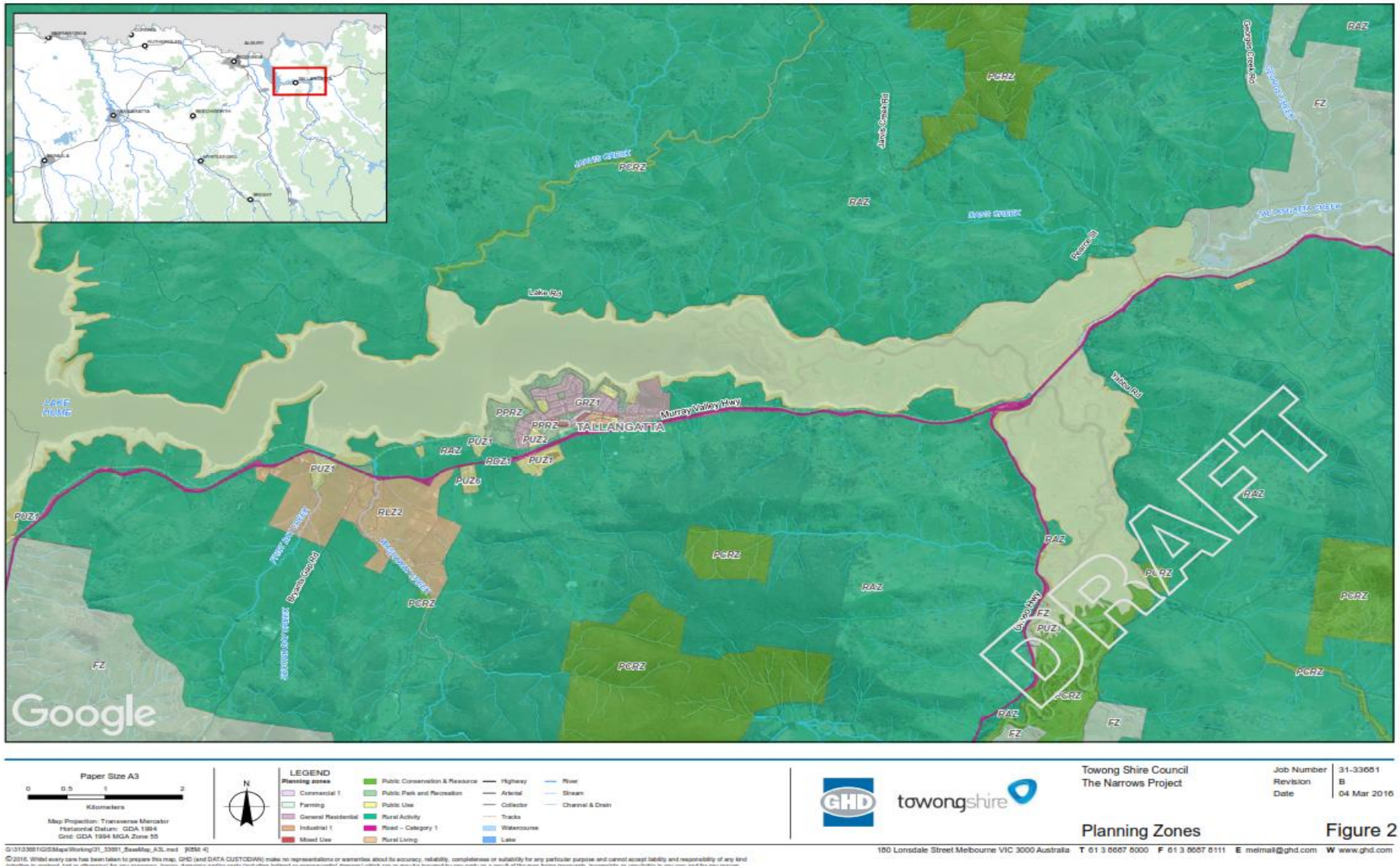
TSC is currently in the process of amending the Tallangatta Planning Scheme via Amendment C25. The proposed amendments are being put in place to allow for an ordered rural residential development in appropriate locations while implementing safeguards for landscape, amenity and environment.

The Planning Scheme amendment is being actioned now and is not reliant on the success of The Narrows project. The current planning zones are shown on Figure 7.

Eight options have been identified to demonstrate ways in which residential development could occur in and around Tallangatta. The level of take up, or buyer interest, for each expansion option is likely to be influenced by factors such as current and proposed amendments to the Tallangatta Planning Scheme, changing amenity throughout the township, proximity to the river, and recreational options that would arise if The Narrows project were to proceed.

These eight options have been described in detail below.

Figure 7 Planning Zones



Source: GHD GIS

3.6.1 Tallangatta Township residential expansion

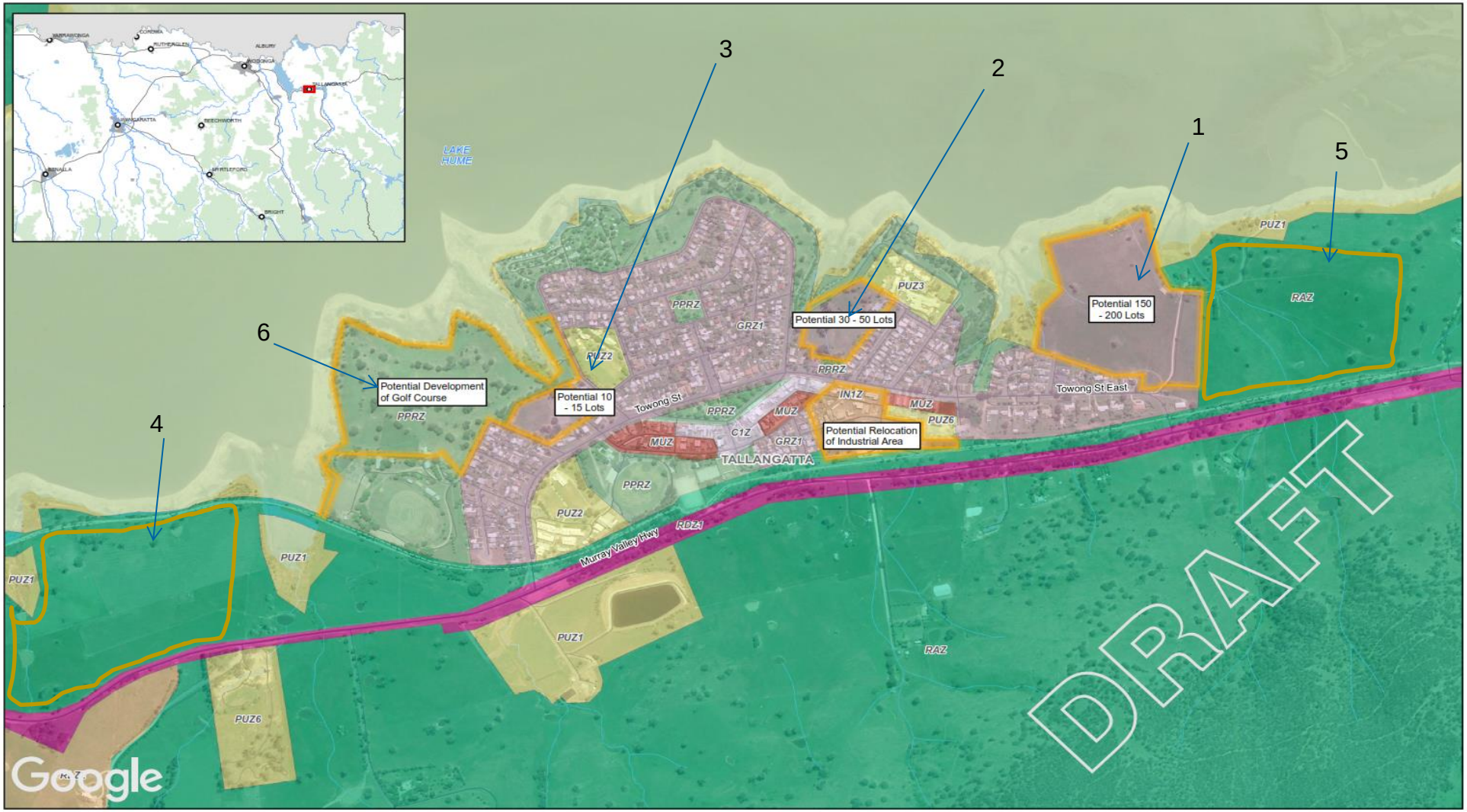
Figure 7 and Figure 8 indicate that there is scope within Tallangatta for re-zoning and further sub-divisions to cater for residential growth. The rate of expansion will be marginally impacted by the increased tourism demand driven by Destination Tallangatta, but would be more responsive to the impact that The Narrows project would have on amenities and recreational options.

Three parcels of land have been identified as potential development options, and are subject to the proposed Amendment C25 outlined above. The areas identified on Figure 8 are represented as follows:

1. Area is currently zoned as Rural Activity (RAZ) and is considered as a potential General Residential Zone (GRZ1). The current land owner has expressed interest in the rezoning, but at this stage the lack of demand has negated the need for change. The site, under careful sub-division, could cater for 150 to 200 standard residential blocks (included in Amendment C25).
2. Land is currently held by G-MW, and is deemed to be in excess of their current or future needs. Would be a prime site for residential development if The Narrows project was to proceed given the close proximity to the river. Sub-division could create 30 to 50 standard residential blocks.
3. Land is currently held by the Catholic Church and appears to be in excess of current or future needs. Sub-division of the site could give rise to 10 to 15 lots.
4. Western end development – 41-hectare site that is currently under consideration (Amendment C25) for rural living. Development options require a 150 metre set back from the Lake FSL, with a minimum lot size of 2 hectares.
5. Eastern end development – rural living residential development (200-260 sites).
6. Golf Course residential development – has potential for full or partial residential development, but would rely on strong developer interest and stakeholder engagement (80-150 sites).
7. Southern development – rural living to the south of the Murray Valley Highway (20-40 sites).
8. Northern lake edge (Lake Road) development – with increased access via the bridge development included in the weir project, increased rural living options will become available on the northern edge of the lake (30-50 sites).

The overall degree of ‘residential’ up-take will be dependent on The Narrows project proceeding, and the judgement that is made regarding the ‘recreational/amenity’ value associated with ‘water edge’ living at and around Tallangatta. SMEC report indicates that historically the water is below RL 184 m (the required level to have a functional body of water suitable for water skiing and boating at Tallangatta) 52% of the time from November to April. The construction of a dam at The Narrows at RL 184 would hold water at least at RL 184 (if sufficient supply) increasing the number of days of an adequate recreational water level at Tallangatta during November to April.

Figure 8 Tallangatta Township Development options



Source: GHD GIS

3.6.2 Rural Living to the south of Tallangatta Township

Figure 7 highlights that the area outside the township of Tallangatta to the south of the Murray Valley Highway, and the parcel of land to the far east of the town (Figure 9), is predominately zoned as Rural Activity (RAZ1).

Irrespective of the outcome of the project, any transition to increased development to the south and far east of Tallangatta is likely to be slow and only marginally impacted by the outcome of the project.

Figure 9 Proposed 'south-side' rural living re-zoning

Source: GHD GIS

3.6.3 Rural living to the north of Tallangatta Township

The Nnorth side of the Mitta Mitta arm is mainly zoned as a Rural Activity Zone (RAZ) or Public Conservation and Resource Zone (PCRZ). If The Narrows project included improved access between the Murray Valley Highway and the north side of the Mitta Mitta river due to the construction of a bridge, interest in rural living in the area could increase; especially to the east of the bridge (refer to Figure 7).

However, with the need for setbacks from water flow areas and PCRZ lands, the development options would be limited.

3.6.4 Residential expansion to the west of Tallangatta Township

Area 4 on Figure 8 identifies an area to the west of Tallangatta Township that is subject to Amendment C25 that is being put in place. Take up of this potential development site will be dependent on additional drivers that are put in place to entice development in the areas, and will be influenced by the success of The Narrows project.

3.6.5 Residential expansion to the east of Tallangatta Township

Area 5 on Figure 8 identifies an area to the east of Tallangatta Township that is subject to Amendment C25 that is being put in place. Take up of this potential development site will be dependent on additional drivers that are put in place to entice development in the areas, and will be influenced by the success of The Narrows project.

3.6.6 Golf course redevelopment

As shown on Figure 8, there is scope within Tallangatta for re-zoning and further sub-divisions to cater for residential growth. Area 6 as shown on the map cites the Tallangatta Golf Club as a potential site for future development.

Redevelopment of the golf course has not been considered in any of the planning options and would not be considered a possible ‘change’ option unless a unique set of circumstances were to arise, leading to a ‘residential/golf course’ development.

This option has been included in the financial/economic modelling to test the impact that a very high demand profile would have on the project viability. Circumstances that would need to occur before the option could be seen as a realistic option include:

- The Narrows project would need to progress.
- The ‘waterfrontage’ at Tallangatta would need to be enhanced sufficiently to offer a high quality amenity for the majority of the year; longer duration of ‘coverage’ could be as important; and December to February ‘water’.
- Private developer required that foresees the potential in the residential/golf development (as was the case in Torquay with the RACV development at the Torquay Golf Course and residential/golf development at The Sands).

3.7 Residential Development Modelling

For modelling purposes, each area has been assigned a development quantum as follows:

- Area 1, 2 and 3 – 190 potential sites within the current township.
- Area 4 – 20 potential sites, minimum lot size of 2 hectares.
- Area 5 – eastern end development – 200 potential sites.
- Area 6 – Golf course development – 80 potential sites if a ‘golf course‘ is retained.

- Area 7 – 30 rural living sites
- Area 8 – 40 potential rural living site, northern lake edge.

Each demand option (Low, Medium, High) has specific residential development uptake-rates for each area, applied in 5 year 'slots' modelled on an annual basis across the 30 year analysis period.

Figure 10 Residential Development (low demand)

	Blocks	1	2	3	4	5	6	of potential
Base Case								
Area 1,2,3	190	0.5%	0.5%	0.5%	0.5%	1.0%	1.0%	**20.0%**
Area 7- not closely linked to project	30	0.0%	0.0%	0.0%	0.5%	0.5%	0.5%	**7.5%**
Area 8-depend on bridge	40	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Area 4 -boost with Golf Course	20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Area 5 - infill to go first	200	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Golf Course - special case	80	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	560	5	5	5	6	10	10	40

		2018	2019	2020	2021	2022	2023	2024
Development Blocks Uptake	Number of	0.95	0.95	0.95	0.95	0.95	0.95	0.95

Project Case								
Area 1,2,3	190	0.5%	0.5%	1.0%	1.0%	2.0%	2.0%	**35.0%**
Area 7- not closely linked to project	30	0.0%	0.0%	0.5%	0.5%	2.0%	2.0%	**25.0%**
Area 8-depend on bridge	40	0.0%	0.0%	0.5%	0.5%	1.0%	1.0%	**15.0%**
Area 4 -boost with Golf Course	20	0.0%	0.0%	0.5%	0.5%	1.0%	1.0%	**15.0%**
Area 5 - infill to go first	200	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%	**10.0%**
Golf Course - special case	80	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	560	5	5	12	12	35	35	103

Note: Cross total differences due to rounding.

Source: GHD modelling input

Note:

1. Eight potential development areas have been identified: the planning process has already commenced for two areas (one in the township and one offering rural living to the south) which could give rise to 560 residential sites (township and rural)
2. Demand profiles have been developed for each according to five year periods across a 30-year time frame.
3. Residential development for the Base Case and the Project Case is 40 and 103 under a low demand scenario.
4. Potential site uptake as a percentage of the potential sites varies across the six locations and demand options (Low Demand – 35%, 25%, 15%, 15%, 10% and 0% for the golf course development).
5. If demand was raised to level three (High Demand), as a result of Destination Tallangatta for the Base Case and 'waterfront' and township infill developments resulting from The Narrows project, development numbers for the Base Case would increase to 79 and 213 for the Project Case.

Figure 11 Residential Development (high demand)

Project Case	Blocks	1	2	3	4	5	6	of potential
Area 1,2,3	190	0.5%	1.0%	1.0%	2.0%	3.0%	3.0%	**52.5%**
Area 7- not closely linked to project	30	0.0%	0.5%	1.0%	2.0%	2.0%	2.0%	**37.5%**
Area 8-depend on bridge	40	0.5%	0.5%	1.0%	1.0%	2.0%	2.0%	**35.0%**
Area 4 -boost with Golf Course	20	0.5%	0.5%	1.0%	2.0%	2.0%	2.0%	**40.0%**
Area 5 - infill to go first	200	0.0%	0.0%	1.0%	2.0%	2.0%	3.0%	**40.0%**
Golf Course - special case	80	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
	560	6	12	24	46	58	68	213

Note: Cross total differences due to rounding.

Source: GHD modelling input

Note:

1. Site uptake in all areas has increased reflecting the impact of The Narrows project. No development has occurred at the golf course site, as this site only comes into play under a set of special conditions.
2. Total demand has increased from 40 to 79 sites for the Base Case over the 30-year period as a result of general population growth and the stimulus from Destination Tallangatta. The Project Case (high demand), is based on the additional growth resulting from the Narrows dam development, increasing the demand from 40 to 213 sites (39 sites as a result of 'normal' growth, 174 sites due to the economic stimulus resulting from The Narrows project).

4. Economic Impact

An economic impact assessment presents estimates of regional economic impact based on the use of an extension of the conventional input-output method. The assessment is based on a comparison of a Base Case, under which no water control structure (and associated infrastructure) will be built, to two options which both involve the construction of a water control structure (and associated infrastructure) to control water levels around the township of Tallangatta.

The Base Case is modelled as the current situation and how tourism is likely to grow, in terms of visitor numbers, without the project.

The options are modelled to include both the project construction costs and the projected growth in residential development and visitor numbers with the new water levels. This approach means that the net economic contribution attributable to the project will be estimated, not the total contribution of the project which would be larger.

4.1 Categories of economic activity

A useful way to think about economic activity and economic impact (as measured by employment, contribution to GRP, etc.) is using the concept of a 'supply chain'. The supply chain, in the context of an infrastructure project, includes the planning and management of all activities involved in sourcing and procuring, conversion of materials, and all logistics management activities. It also includes coordination and collaboration with suppliers, intermediaries and third-party service providers.

Broadly speaking there are four categories of employment and contribution to GRP along the infrastructure supply chain:

1. ***Direct employment and contribution to GRP*** – this is employment in those firms, businesses and organisations that are directly engaged in project construction and their contribution to GRP.
2. ***First round employment and contribution to GRP*** – refers to employment in firms that supply inputs and services to the 'direct employment' businesses and their contribution to GRP, i.e. those categorised under #1 above.
3. ***Industrial-support employment and contribution to GRP*** – is the term 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 infrastructure expenditure. This category excludes any employment associated with increased household consumption.
4. ***Consumption-induced employment and contribution to GRP*** – is the term applied to those effects induced by increased household income associated with the original infrastructure expenditure. The expenditure of household income associated with all three categories of employment (direct, first round and industrial-support) will generate economic activity that will in itself generate jobs.

Flow-on (or indirect) economic impact is the sum of categories 2, 3 and 4. In this report direct and *flow-on* employment and contribution to GRP generated by the infrastructure supply chain have been reported.

A similar supply chain approach has been taken to estimate and report the employment and GRP impacts associated with the operational phase of the project.

The following economic impacts were assessed:

- The Narrows construction
- The Narrows project ongoing operational expenditure
- Tourism
- Residential development
    - Housing construction – new residents' expenditure.

The assessment has been undertaken based on a model that assesses activity within the Towong Local Government Area (LGA).[7]

4.2 Construction Phase Expenditure

Not all of the construction expenditure will occur in Towong (LGA), and as a result, some of the direct and flow on employment growth will occur outside the local area.

Table 5 Construction expenditure by location

	Option 1		Option 2	
	2017	2018	2017	2018
Towong	15.8	26.3	13.8	22.8
Rest of Upper Hume	10.8	29.5	9.4	26.2
Upper Hume sub total	**26.6**	**55.8**	**23.2**	**49.0**
Rest of Victoria	4.8	7.6	4.1	8.6
Grand total	**31.4**	**63.4**	**27.3**	**57.6**
		94.8		**84.9**

Source: EconSearch analysis

For Option 1, of the total project investment ($94.8 million over two years) it was assumed 44% ($42.1 million) was purchased from goods and service providers from within the Towong LGA and 87% ($82.5 million) in total (i.e. including the Towong LGA) from within the Upper Hume region.

Likewise, for Option 2, of the total Project investment ($84.9 million over two years) local expenditures were 43% ($36.6 million) for Towong LGA and 85% ($72.2 million) for the Upper Hume region.

4.2.1 Contribution to GRP

Gross Regional Product (GRP) is a measure of the net contribution of an activity or industry to the regional economy. It represents payments to the primary inputs of production (labour, capital and land) and is a regional level equivalent of gross domestic product.

Estimates of the contribution to GRP for the two-year construction period are outlined below.

[7] Data is no longer provided at a sub-LGA level by the ABS. While older data could have been used, segmentation of data at a level lower than the LGA decreases reliability of the modelling of economic impact results. The Department of Treasury have indicated that they require data at an LGA level for funding submissions. The LGAs surrounding Towong (LGA) show minimal differences between median wage and therefore, associated multipliers. It is assumed that most of the jobs (for example) would be created in the west of the LGA around Tallangatta. Source: http://stat.abs.gov.au/itt/r.jsp?databyregion#/, accessed 4 July 2016.

Towong Shire economy

For Option 1, the total contribution to GRP as a result of the project construction expenditure is forecast at approximately $7.6 million over two years; $4.9 million directly and $2.6 million in flow-on impacts.

In 2011/12 the Towong LGA GRP was approximately $189.6 million. On this basis, the projected GRP impact would boost the region's total by around 2%.

For Option 2, the total contribution to GRP as a result of the project construction expenditure is forecast at approximately $6.5 million over two years; $4.3 million directly and $2.3 million in flow-on impacts. The projected GRP impact would boost the region's total by around 1.7%.

Upper Hume regional economy

For Option 1, the total contribution to GRP as a result of the project construction expenditure is approximately $44.2 million over two years; $25.5 million directly and $18.7 million in flow-on impacts. In 2011/12 the Upper Hume region's GRP was approximately $2.4 billion. On this basis, the projected GRP impact would boost the region's total by around 0.9%.

For Option 2, the total contribution to GRP as a result of the project construction expenditure is approximately $38.7 million over two years; $22.3 million directly and $16.4 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.8%.

Table 6 Economic Impact of The Narrows – construction phase

	Option 1		Option 2	
	2017	**2018**	**2017**	**2018**
Towong				
GRP ($m)				
Direct	1.9	3.0	1.7	2.6
Flow on	1.0	1.6	0.9	1.4
Total	**2.9**	**4.6**	**2.6**	**4.0**
Employment				
Direct	18	26	16	22
Flow on	10	15	8	12
Total	**28**	**41**	**24**	**34**
Upper Hume				
GRP ($m)				
Direct	8.3	17.2	7.2	15.1
Flow on	6.0	12.7	5.3	11.1
Total	**14.3**	**29.9**	**12.5**	**26.2**
Employment				
Direct	71	144	62	126
Flow on	49	102	43	89
Total	**120**	**246**	**105**	**215**

Source: EconSearch analysis

4.2.2 Contribution to Employment

Employment is a key indicator of both regional economic activity and the welfare of regional households. Estimates of the contribution to employment for the two-year construction period are outlined for the two regions below.

Towong Shire economy

For Option 1, the total contribution to employment as a result of the project construction expenditure was estimated to be 28 full time equivalent positions (FTE) in 2017 and 41 in 2018. Over the two years, the average annual contribution to employment was approximately 34 FTE; 22 FTE directly and 12 FTE in flow-on impacts.

In 2011/12 the Towong LGA total employment was approximately 2,443 FTE. On this basis, the projected employment impact would boost the region's total by around 1.4%.

For Option 2, the total contribution to employment as a result of the project construction expenditure was approximately 24 FTE in 2017 and 34 FTE in 2018. Over the two years, the average annual contribution to employment was approximately 30 FTE; 19 FTE directly and 10 FTE in flow-on impacts.

The projected employment impact would boost the region's total by around 1.2%.

Upper Hume regional economy

For Option 1, the total contribution to employment as a result of the project construction expenditure is approximately 120 FTE in 2017 and 246 FTE in 2018. Over the two years, the average annual contribution to employment was approximately 183 FTE; 107 FTE directly and 75 FTE in flow-on impacts.

In 2011/12 the Upper Hume region's total employment was approximately 22,939 FTE. On this basis, the projected employment impact would boost the region's total by around 0.8%.

For Option 2, the total contribution to employment as a result of the project construction expenditure is approximately 105 FTE in 2017 and 215 FTE in 2018. Over the two years, the average annual contribution to employment was approximately 160 FTE; 94 FTE directly and 66 FTE in flow-on impacts. The projected employment impact would boost the region's total by around 0.7%.

A key element of the construction employment impact is that it is short term, lasting for two years. The short duration of the construction period is unlikely to have a long term residential demand unless the period can be followed up with ongoing construction work.

The CBA has assumed that the transfer to permanent residency in Tallangatta resulting from the construction period will be minimal.

4.3 Operation Phase

Additional operational expenditure (maintenance) for the new structure is minimal, except for bridge refurbishment post 20 years of operation.

Annual average employment impact of operational expenditure is likely to be 3 FTE (2 direct and 1 flow-on position) post the construction period.

4.4 Tourism

Based on the demand assumptions outlined in Section 3.5, the expected additional tourist numbers to the region as a result of The Narrows project is expected to generate the following annual expenditures in the region:

- Low demand scenario
    - $0.05 million in year 1 to $2.49 million by year 30 in the Towong LGA
    - $0.05 million in year 1 to $2.50 million by year 30 in the Upper Hume region
- Medium demand scenario
    - $0.08 million in year 1 to $5.57 million by year 30 in the Towong LGA
    - $0.08 million in year 1 to $5.60 million by year 30 in the Upper Hume region
- High demand scenario
    - $0.1 million in year 1 to $8.33 million by year 30 in the Towong LGA
    - $0.1 million in year 1 to $8.37 million by year 30 in the Upper Hume region.

Estimates of contribution to GRP from tourism in years 1 and 30 for the Towong LGA and Upper Hume regions are provided as follows.

Towong Shire economy

In year 1 for the low demand scenario, the contribution to GRP as a result of additional tourism expenditure is expected to be less than $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $1.5 million; $1.2 million directly and $0.3 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.8% by year 30.

In year 1 for the medium demand scenario, the contribution to GRP is expected to be less than $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $3.3 million; $2.7 million directly and $0.7 million in flow-on impacts. The projected GRP impact would boost the region's total by around 1.8% by year 30.

In year 1 for the high demand scenario, the contribution to GRP is expected to be $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $5.0 million; $4.0 million directly and $1.0 million in flow-on impacts. The projected GRP impact would boost the region's total by around 2.6% by year 30.

Upper Hume regional economy

In year 1 for the low demand scenario, the contribution to GRP as a result of additional tourism expenditure is expected to be less than $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $1.7 million; $1.3 million directly and $0.4 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.1% by year 30.

In year 1 for the medium demand scenario, the contribution to GRP is expected to be $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $3.8 million; $2.8 million directly and $1.0 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.2% by year 30.

In year 1 for the high demand scenario, the contribution to GRP is expected to be $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $5.7 million; $4.2 million directly and $1.5 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.2% by year 30.

Table 7 Year 1 and Year 30 economic impact of tourism

	Yr 1	Yr30	Yr1	Yr30	Yr1	Yr30
	Low Demand		Medium Demand		High Demand	
Towong						
GRP ($m)						
Direct	0.0	1.2	0.0	2.7	0.0	4.0
Flow on	0.0	0.3	0.0	0.7	0.0	1.0
Total	**0.0**	**1.5**	**0.0**	**3.4**	**0.0**	**5.0**
Employment						
Direct	0	9	0	21	1	31
Flow on	0	2	0	4	0	6
Total	**0**	**11**	**0**	**25**	**1**	**37**
Upper Hume						
GRP ($m)						
Direct	0.0	1.3	0.0	2.8	0.1	4.2
Flow on	0.0	0.4	0.0	1.0	0.0	1.5
Total	**0.0**	**1.7**	**0.0**	**3.8**	**0.1**	**5.7**
Employment						
Direct	0	9	1	21	1	31
Flow on	0	3	0	6	0	9
Total	**0**	**12**	**1**	**27**	**1**	**40**
Total Employment	**0**	**23**	**1**	**52**	**2**	**77**

Source: EconSearch analysis

4.5 Residential Development

Based on the demand assumptions outlined in Section 3.5 the expected additional residential demand will generate construction expenditure and employment. Development cost per site has been estimated at $300,000, based on the average cost across all development site and additional infrastructure expenditure to support the growth.

Residential development will impact both regional GRP and employment. Under the low demand scenario, new developments will range from 1 per year in year 10 to 7 per year by year 30. Annual residential development under the high scenario will range from 2 per year in year 10 to 13 per year by year 30. The advantage of the ongoing residential developments is that it caters for a growing labour force rather than a short term labour uplift that results from short duration construction projects. Employment demand for the region could increase by 16 EFTs by year 30.

Table 8 Economic impact of residential development

		Yr10	Yr20	Yr30	Yr10	Yr 20	Yr30	Yr10	Yr20	Yr30
		Low Demand			Medium Demand			High Demand		
Annual Res Devel.		1	3	7	1	6	9	2	9	13
Towong										
GRP ($m)										
	Direct	0.14	0.41	0.97	0.14	0.83	1.24	0.28	1.24	1.79
	Flow on	0.03	0.10	0.24	0.03	0.21	0.31	0.07	0.31	0.45
	Total	**0.17**	**0.52**	**1.21**	**0.17**	**1.04**	**1.55**	**0.35**	**1.55**	**2.24**
Employment										
	Direct	0.35	1.04	2.42	0.35	2.08	3.11	0.69	3.11	4.50
	Flow on	0.23	0.70	1.63	0.23	1.39	2.09	0.46	2.09	3.02
	Total	**0.58**	**1.73**	**4.05**	**0.58**	**3.47**	**5.20**	**1.16**	**5.20**	**7.52**
Upper Hume										
GRP ($m)										
	Direct	0.16	0.49	1.13	0.16	0.97	1.46	0.32	1.46	2.11
	Flow on	0.05	0.15	0.35	0.05	0.30	0.46	0.10	0.46	0.66
	Total	**0.21**	**0.64**	**1.49**	**0.21**	**1.28**	**1.91**	**0.43**	**1.91**	**2.76**
Employment										
	Direct	0.41	1.22	2.84	0.41	2.44	3.65	0.81	3.65	5.28
	Flow on	0.27	0.82	1.91	0.27	1.64	2.45	0.55	2.45	3.54
	Total	**0.68**	**2.04**	**4.75**	**0.68**	**4.07**	**6.11**	**1.36**	**6.11**	**8.82**
Total Employment		**1.26**	**3.77**	**8.80**	**1.26**	**7.54**	**11.31**	**2.51**	**11.31**	**16.34**

Source: EconSearch Analysis

4.5.1 New Residents

The residential development will generate ongoing expenditure by people who move into the region from outside as a result of this housing development.

It is assumed that 75% of the households came from within the Upper Hume region and 25% from outside the Hume region, i.e. that all the households were new residents to Towong LGA and 25% were new residents to the Upper Hume region. Household income was based on the median household income for Towong LGA from the ABS 2011 Census of Population and Housing of $850 per week (ABS 2012). This was adjusted to current dollars using CPI to give an annual income per household of $48,387.

Increased household income to the Towong LGA is expected to rise from $4.91 million in year 30 (low demand) to $6.62 million under the medium demand scenario and to increase to $10.15 million under the high demand scenario as a result of total households increasing by 213.

As a result of the residential development, additional household income to the Upper Hume region is expected to rise from $1.64 million in year 30 under the low demand scenario to $2.21 million under the medium scenario and to $3.38 million under the high scenario.

Table 9 Economic impact - New residents

	Yr10	Yr20	Yr30	Yr10	Yr 20	Yr30	Yr10	Yr20	Yr30
	Low Demand			Medium Demand			High Demand		
Accum new residences	**9**	**33**	**103**	**10**	**56**	**139**	**18**	**88**	**213**
Towong									
GDP ($m)									
Direct	0.33	1.20	3.74	0.36	2.03	5.04	0.65	3.19	7.73
Flow on	0.10	0.37	1.17	0.11	0.64	1.58	0.20	1.00	2.42
Total	**0.43**	**1.57**	**4.91**	**0.48**	**2.67**	**6.62**	**0.86**	**4.19**	**10.15**
Employment									
Direct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flow on	0.61	2.22	6.94	0.67	3.77	9.36	1.21	5.93	14.35
Total	**0.61**	**2.22**	**6.94**	**0.67**	**3.77**	**9.36**	**1.21**	**5.93**	**14.35**
Upper Hume									
GDP ($m)									
Direct	0.11	0.40	1.25	0.12	0.68	1.68	0.22	1.06	2.58
Flow on	0.03	0.12	0.39	0.04	0.21	0.53	0.07	0.33	0.81
Total	**0.14**	**0.52**	**1.64**	**0.16**	**0.89**	**2.21**	**0.29**	**1.40**	**3.38**
Employment									
Direct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Flow on	0.20	0.74	2.31	0.22	1.26	3.12	0.40	1.98	4.78
Total	**0.20**	**0.74**	**2.31**	**0.22**	**1.26**	**3.12**	**0.40**	**1.98**	**4.78**
Total Employment	**0.81**	**2.96**	**9.25**	**0.90**	**5.03**	**12.48**	**1.62**	**7.90**	**19.13**

Source: EconSearch Analysis

Household expenditure has a flow on impact through the economy, leading to increased employment for both Towong and the Upper Hume regions. Household expenditure would increase the local employment by 19 EFTs.

5. Financial/Economic Analysis

A two tiered financial/economic model was developed to integrate all the economic and financial information into a holistic analysis. This enables the option selection to be based on NPV and the broader economic impact of The Narrows project.

5.1 Net Present Value – option selection

The initial step was a calculation of the NPV of the project (on a cost basis) to determine which option should be preferred. Standard decision criteria for NPV analysis requires that the PV of the project needs to be greater than one.

- NPV > 1 Accept
- NPV < 1 Reject

The analysis on a cost basis without a revenue or savings stream can only be measured on a 'lower of costs' basis.

As both dam options provide a similar level of service, the decision criteria is the lower NPV on a cost basis. Although the outcome is sensitive to changes in the discount rate, the relativity of the result remains the same irrespective of changes in the discount rate, as both projects have expenditure profiles that differ according to timing.

Table 10 Net Present Value analysis

Net Present Value (2016 Dollars)		0	1	2	3	4	5	6	25	26	27	28	29	30	30
		2017	2018	2019	2020	2021	2022	2023	2042	2043	2044	2045	2046	2047	Terminal Value
Weir - Option 1 - Rockfill Weir (FSL 184 AHD)															
CAPEX															
Weir_Capex(1)		24,680,050	40,010,050	0	0	0	0	0	0	0	0	0	0	0	-45,283,070
Bridge_Capex(3)		6,300,000	18,900,000	0	0	0	0	0	0	0	0	0	0	0	-15,750,000
Fish Wall_Capex(4)		504,000	4,536,000	0	0	0	0	0	0	0	0	0	0	0	-3,528,000
OPEX															
Weir		0	0	64,690	64,690	64,690	64,690	64,690	64,690	64,690	64,690	64,690	64,690	64,690	
Bridge		0	0	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	50,400	
Fishwall		0	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	
Refurbishment															
Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	
Bridge		0	0	0	0	0	0	0	504,000	0	0	0	0	0	
Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	
Net Expenditure/Costs		31,484,050	63,446,050	90,898	90,898	90,898	90,898	90,898	594,898	90,898	90,898	90,898	90,898	116,098	-64,561,070
Present Value of Expenditure/Costs		$31,484,050	$61,005,817	$84,040	$80,808	$77,700	$74,712	$71,838	$223,156	$32,786	$31,525	$30,312	$29,147	$35,795	-$19,905,383
Prsent Value of Costs	$74,246,963														
Weir - Option 2 - Zoned Earth and Rockfill Weir (FSL 184 AHD)															
CAPEX															
Weir_Capex(2)		20,538,520	32,126,520	0	0	0	0	0	0	0	0	0	0	0	-36,865,528
Bridge_Capex(3)		6,300,000	18,900,000	0	0	0	0	0	0	0	0	0	0	0	-15,750,000
Fish Wall_Capex(4)		504,000	4,536,000	0	0	0	0	0	0	0	0	0	0	0	-3,528,000
OPEX															
Weir		0	0	52,665	52,665	52,665	52,665	52,665	52,665	52,665	52,665	52,665	52,665	52,665	
Bridge		0	0	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	50,400	
Fishwall		0	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	
Refurbishment															
Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	
Bridge		0	0	0	0	0	0	0	504,000	0	0	0	0	0	
Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	
Net Expenditure/Costs		27,342,520	55,562,520	78,873	78,873	78,873	78,873	78,873	582,873	78,873	78,873	78,873	78,873	104,073	-56,143,528
Present Value of Expenditure/Costs		$27,342,520	$53,425,500	$72,923	$70,118	$67,421	$64,828	$62,335	$218,645	$28,449	$27,354	$26,302	$25,291	$32,088	-$17,310,098
Prsent Value of Costs	$64,932,150														

Discount Rate	Option 1	Option 2
10%	$86.27	$75.35
7%	$83.42	$72.89
4%	$74.25	$64.93

Source: GHD Modelling

5.2 Cost Benefit Analysis

The Cost Benefit Analysis is a broader based analysis that considers the costs and benefits that may arise from the project, but may not be directly attributable to the proponent of the proposal. To facilitate the CBA it is necessary to:

- Quantify qualitative factors, such as the amenity value that may be derived from increased waterfrontage access or increased recreation opportunities. It has been assumed that this can be reflected though increased tourism demand.
- Include a broader analysis of the overall economic impacts – it has been assumed that this can be incorporated through the inclusion of employment and regional impacts, through the application of appropriate multipliers applied to key input (capital expenditure) data.
- Assign a valuation to secondary aspects on the overall project – it has been assumed that any water evaporation loss as a result of the construction of the water structure can be included through the valuation of water based on the water trading market, currently trading at $2,800 per ML[8]

The CBA decision criteria is that the Benefit Cost Ratio (BCR) on a present value cost basis should be greater than 1, indicating that for every dollar spent, the broader community will derive benefits that exceed the dollar spent.

In investment decisions where it is essential that one of the projects should be undertaken (critical for safety) then the decision rule may be based on the project with the highest index, irrespective of whether it satisfied the 'greater than one' criterion.

The approach adopted for this analysis is based on a seven step process:

1. Establish the Base Case (no change) – which will often be a zero/zero result, that is no additional capital or operational expenditure and no additional revenue or savings.

   For this Base Case we have included the growth that will result from the Destination Tallangatta investment (tourism) and the residential growth (residential development) that would arise from broader based population growth in the region.

2. Development of Project Case 1 (Rockfill Weir dam structure) – unique capital and operational cost profile combined with the broader economic impacts derived from construction, operation, tourism, residential development and general population growth.
3. Development of Project Case 2 (Zoned Earth and Rockfill Weir dam structure) – the same as Project Case 1 except for a slight reduction in capital and maintenance expenditure.
4. Comparison between Project Case 1 and the Base Case to identify the shift in costs and benefits.
5. Comparison between Project Case 2 and the Base Case to identify the shift in cost and benefits
6. Summary of results
7. Sensitivity analysis
   - ✓ Residential development on the golf course

[8] http//watertradingaustralia.com.au

- ✓ Removal of the bridge option in the overall construction – reducing the initial capital expenditure by $25.2 million.
- ✓ Inclusion of the loss of agricultural output due to purchase of entitlements to cover the annual increase in evaporation loss of 2,800 ML.
- ✓ Increased residential development (up-take) that would generate a BCR >1.0

5.2.1 Step 1 – Base Case – Low Demand

Cost/Benefits Base Case (2016 Dollars)																	
			0	1	2	3	4	5	6	7	23	24	25	26	27	28	29	30
			2017	2018	2019	2020	2021	2022	2023	2024	2040	2041	2042	2043	2044	2045	2046	2047
CAPEX	Weir_Capex(1)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge_Capex(3)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fish Wall_Capex(4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEX	Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refurbishment	Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Loss - Evaporation																		
	Increased Evaporation Loss				0	0	0	0	0	0	0	0	0	0	0	0	0	0
	HRWS/ML				2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
	HRW Purchase				0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tourism/Environmental/Amenities																		
Tourism	Day Visitors		1,030,342	1,040,645	1,051,052	1,061,562	1,072,178	1,082,900	1,093,729	1,104,666	1,295,308	1,308,261	1,321,344	1,334,557	1,347,903	1,361,382	1,374,995	1,388,745
	Overnight Vistors		3,754,828	3,792,376	3,830,300	3,868,603	3,907,289	3,946,362	3,985,826	4,025,684	4,720,431	4,767,635	4,815,312	4,863,465	4,912,099	4,961,220	5,010,833	5,060,941
	Direct Employment		94	95	96	97	98	99	100	101	118	119	120	122	123	124	125	126
Property Development																		
Development Blocks #				1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Construction Cost development		$300,000																
Total new Construction			0	285,000	285,000	285,000	285,000	285,000	285,000	285,000	615,000	615,000	615,000	615,000	615,000	615,000	615,000	615,000
Employment																		
Construction Impact - Direct		2.756	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction Impact - Indirect		1.851	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Opex			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refurbishment - Direct		2.756	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refurbishment - Indirect		1.851	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Property Development - Direct		2.506	0.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Property Development - Indirect		1.683	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tourism (adjusted for rate)			70.4	71.1	71.8	72.5	73.2	74.0	74.7	75.4	88.5	89.4	90.2	91.1	92.1	93.0	93.9	94.8
Annual EFT			70.4	72.3	73.0	73.7	74.4	75.2	75.9	76.6	91.0	91.9	92.8	93.7	94.6	95.6	96.5	97.4
Wages&Salaries Impact		$68,000	4,785,170	4,914,209	4,962,539	5,011,352	5,060,654	5,110,449	5,160,741	5,211,537	6,190,931	6,251,089	6,311,848	6,373,214	6,435,194	6,497,794	6,561,020	6,624,879

Source: GHD modelling

5.2.2 Step 2 – Project Case 1 – Low Demand

Cost/ Benefits Option 1 (2016 Dollars)																	
			0	1	2	3	4	5	6	7	23	24	25	26	27	28	29	30
			2017	2018	2019	2020	2021	2022	2023	2024	2040	2041	2042	2043	2044	2045	2046	2047
Weir - Option 1 - Rockfill Weir (FSL 184 AHD)																		
CAPEX	Weir_Capex(1)		24,680,050	40,010,050	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge_Capex(3)		6,300,000	18,900,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fish Wall_Capex(4)		504,000	4,536,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEX	Weir		0	0	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	129,380
	Bridge		0	0	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	50,400
	Fishwall		0	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008
Refurbishment	Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge		0	0	0	0	0	0	0	0	0	0	504,000	0	0	0	0	0
	Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Loss - Evaporation																		
	Increased Evaporation Loss				2,800	0	0	0	0	0	0	0	0	0	0	0	0	0
	HRWS/ML				2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
	HRW Purchase				7,840,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Tourism/Environmental/Amenities																		
Tourism	Day Visitors		1,030,342	1,056,101	1,082,503	1,109,566	1,137,305	1,165,737	1,194,881	1,224,753	1,818,152	1,863,606	1,910,196	1,957,951	2,006,900	2,057,073	2,108,499	2,161,212
	Overnight Vistors		3,754,828	3,848,699	3,944,916	4,043,539	4,144,628	4,248,243	4,354,449	4,463,311	6,625,810	6,791,455	6,961,241	7,135,272	7,313,654	7,496,495	7,683,908	7,876,005
	Direct Employment		94	96	99	101	104	106	109	112	166	170	174	178	183	187	192	197
Property Development																		
Development Blocks #				1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Construction Cost development		$300,000																
Total new Construction			0	285,000	285,000	285,000	285,000	285,000	285,000	285,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000
Employment																		
Construction Impact - Direct		2.756	86.8	174.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction Impact - Indirect		1.851	58.3	117.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Opex			0.0	0.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.7
Refurbishment - Direct		2.756	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Refurbishment - Indirect		1.851	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Property Development - Direct		2.506	0.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Property Development - Indirect		1.683	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Tourism (adjusted for rate)			70.4	72.1	73.9	75.8	77.7	79.6	81.6	83.6	124.2	127.3	130.5	133.7	137.1	140.5	144.0	147.6
Annual EFT			215.4	365.6	77.2	79.1	81.0	82.9	84.9	86.9	135.1	138.2	143.7	144.6	148.0	151.4	154.9	159.1
Wages&Salaries Impact		$68,000	14,648,859	24,863,102	5,251,256	5,376,942	5,505,769	5,637,818	5,773,167	5,911,900	9,184,831	9,395,930	9,770,205	9,834,092	10,061,423	10,294,437	10,533,276	10,816,224
Council - increase in rateable properties																		
Increase in Rateable Properties			0	1	2	3	4	5	6	7	54	61	68	75	82	89	96	103
Net Revenue		$800.00	0	760	1,520	2,280	3,040	3,800	4,560	5,320	43,200	48,800	54,400	60,000	65,600	71,200	76,800	82,400

Source: GHD modelling

5.2.3 Step 3 – Project Case 2 – Low Demand

Cost/Benefits Option 2 (2016 Dollars)																		
			0	1	2	3	4	5	6	7	23	24	25	26	27	28	29	30
			2017	2018	2019	2020	2021	2022	2023	2024	2040	2041	2042	2043	2044	2045	2046	2047
Weir - Option 2 - Zoned Earth and Rockfill Weir (FSL184 AHD)																		
CAPEX	Weir_Capex(1)		20,538,520	32,126,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge_Capex(3)		6,300,000	18,900,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fish Wall_Capex(4)		504,000	4,536,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEX	Weir		0	0	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	129,380
	Bridge		0	0	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	50,400
	Fishwall		0	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008
Refurbishment	Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge		0	0	0	0	0	0	0	0	0	0	504,000	0	0	0	0	0
	Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Loss - Evaporation																		
	Increased Evaporation Loss				2,800	0	0	0	0	0	0	0	0	0	0	0	0	0
	HRWS/ML				2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
	HRW Purchase				7,840,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Tourism/Environmental/Amenities																		
Tourism	Day Visitors		1,030,342	1,056,101	1,082,503	1,109,566	1,137,305	1,165,737	1,194,881	1,224,753	1,818,152	1,863,606	1,910,196	1,957,951	2,006,900	2,057,073	2,108,499	2,161,212
	Overnight Vistors		3,754,828	3,848,699	3,944,916	4,043,539	4,144,628	4,248,243	4,354,449	4,463,311	6,625,810	6,791,455	6,961,241	7,135,272	7,313,654	7,496,495	7,683,908	7,876,005
	Direct Employment		94	96	99	101	104	106	109	112	166	170	174	178	183	187	192	197
Property Development																		
Development Blocks #				1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Construction Cost development		$300,000																
Total new Construction			0	285,000	285,000	285,000	285,000	285,000	285,000	285,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000	2,100,000
Employment																		
Construction Impact - Direct		2.756	75.4	153.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction Impact - Indirect		1.851	50.6	102.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Opex			0.0	0.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.7
Refurbishment - Direct		2.756	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Refurbishment - Indirect		1.851	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Property Development - Direct		2.506	0.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Property Development - Indirect		1.683	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Tourism (adjusted for rate)			70.4	72.1	73.9	75.8	77.7	79.6	81.6	83.6	124.2	127.3	130.5	133.7	137.1	140.5	144.0	147.6
Annual EFT			196.3	329.3	77.2	79.1	81.0	82.9	84.9	86.9	135.1	138.2	143.7	144.6	148.0	151.4	154.9	159.1
Wages&Salaries Impact		$68,000	13,351,352	22,393,258	5,251,256	5,376,942	5,505,769	5,637,818	5,773,167	5,911,900	9,184,831	9,395,990	9,770,205	9,834,092	10,061,423	10,294,437	10,533,276	10,816,224
Council - increase in rateable properties																		
Increase in Rateable Properties			0	1	2	3	4	5	6	7	54	61	68	75	82	89	96	103
Net Revenue		$800.00	0	760	1,520	2,280	3,040	3,800	4,560	5,320	43,200	48,800	54,400	60,000	65,600	71,200	76,800	82,400

Source: GHD modelling

5.2.4 Step 4 – Project Comparison (Project 1 compared to Base Case – Level 2 Demand/Discount Rate–7%)

Cost/Benefits Analysis (2016 Dollars)																	
			0	1	2	3	4	5	6	7	23	24	25	26	27	28	29	30
			2017	2018	2019	2020	2021	2022	2023	2024	2040	2041	2042	2043	2044	2045	2046	2047
Porject Case (Option1) - Base Case																		
CAPEX	Weir_Capex(1)		24,680,050	40,010,050	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge_Capex(3)		6,300,000	18,900,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fish Wall_Capex(4)		504,000	4,536,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEX	Weir		0	0	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	129,380
	Bridge		0	0	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	50,400
	Fishwall		0	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008
Refurbishment	Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge		0	0	0	0	0	0	0	0	0	0	504,000	0	0	0	0	0
	Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Loss - Evaporation																		
Tourism/Environmental/Amenities																		
Property Development																		
Employment																		
Council - increase in rateable properties																		
Net Position - Summary																		
Cost		42,964,299	31,484,050	63,446,050	7,982,650	142,650	142,650	142,650	142,650	142,650	142,650	142,650	646,650	142,650	142,650	142,650	142,650	180,788
Benefits		125,342,794	0	119,629	245,838	378,917	519,167	666,904	867,575	1,031,401	6,504,439	6,878,872	7,270,660	8,312,214	8,742,616	9,192,659	9,663,169	10,155,004
Present Value of Costs		90,909,931	31,484,050	59,295,374	6,972,356	116,445	108,827	101,708	95,054	88,835	30,092	28,123	119,145	24,564	22,957	21,455	20,051	23,750
Present Value of Benefits		31,859,992	0	111,803	214,725	309,309	396,070	475,493	578,102	642,305	1,372,091	1,356,146	1,339,613	1,431,326	1,406,952	1,382,596	1,358,282	1,334,034
Benefits/Cost Ratio		0.350																
EmploymentIncrease (EFT)			145	294	6	2	2	2	2	2	5	5	8	6	6	7	7	8
Population Impact					15	20	25	30	37	43	209	223	244	260	276	292	310	329

Source: GHD modelling

5.2.5 Step 5 – Project Comparison (Project 2 compared to Base Case)

Cost/Benefits Analysis (2016 Dollars)																	
			0	1	2	3	4	5	6	7	23	24	25	26	27	28	29	30
			2017	2018	2019	2020	2021	2022	2023	2024	2040	2041	2042	2043	2044	2045	2046	2047
Porject Case (Option2) - Base Case																		
CAPEX	Weir_Capex(1)		20,538,520	32,126,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge_Capex(3)		6,300,000	18,900,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fish Wall_Capex(4)		504,000	4,536,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OPEX	Weir		0	0	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	116,442	129,380
	Bridge		0	0	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	25,200	50,400
	Fishwall		0	0	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008	1,008
Refurbishment	Weir		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bridge		0	0	0	0	0	0	0	0	0	0	504,000	0	0	0	0	0
	Fishwall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Loss - Evaporation																		
Tourism/Environmental/Amenities																		
Property Development																		
Employment																		
Council - increase in rateable properties																		
Net Position - Summary																		
Cost		39,356,781	27,342,520	55,562,520	7,982,650	142,650	142,650	142,650	142,650	142,650	142,650	142,650	646,650	142,650	142,650	142,650	142,650	180,788
Benefits		124,243,969	0	118,870	244,320	376,640	516,131	663,109	862,901	1,025,848	6,441,837	6,810,518	7,196,553	8,230,676	8,653,647	9,096,260	9,559,339	10,043,743
Present Value of Costs		80,506,404	27,342,520	51,927,589	6,972,356	116,445	108,827	101,708	95,054	88,835	30,092	28,123	119,145	24,564	22,957	21,455	20,051	23,750
Present Value of Benefits		31,609,690	0	111,094	213,399	307,450	393,754	472,787	574,987	638,846	1,358,885	1,342,671	1,325,959	1,417,285	1,392,635	1,368,098	1,343,688	1,319,418
Benefits/Cost Ratio		0.393																
Employment (EFT)			126	258	6	2	2	2	2	2	5	5	8	6	6	7	7	8
Population Impact					15	20	25	30	37	43	209	223	244	260	276	292	310	329

Source: GHD modelling

5.2.6 Step 6 – Summary of Results

Demand level 1

Benefits/Costs Ratio		
	Option 1	Option 2
10.0%	0.111	0.124
7.0%	0.186	0.207
4.0%	0.354	0.394

Demand Level 1 reflects the forecasts from Destination Tallangatta for tourism. Residential demand across the eight development areas for the 30 years is an up-take of 21% (excluding the golf course option).

Demand level 2

Benefits/Costs Ratio		
	Option 1	Option 2
10.0%	0.209	0.235
7.0%	0.350	0.393
4.0%	0.669	0.746

Demand Level 2 reflects an increase in tourist demand to 4%. Increased residential demand across the eight development areas for the 30 years results in an up-take of 29% (excluding the golf course option).

Demand level 3

Benefits/Costs Ratio		
	Option 1	Option 2
10.0%	0.289	0.324
7.0%	0.487	0.545
4.0%	0.935	1.042

Demand Level 3 reflects an increase in tourist demand to 5%. Increased residential demand across the eight development area for the 30 years is an up-take of 44% (excluding the golf course option).

.

Demand level 3 reflects the upper range of tourist growth/residential development combination, but with the high capital expenditure required for the project, the economic benefits derived from the increased activity, at any demand level, is insufficient to achieve a BCR objective of 1.0 at a cost of capital of 7%.

Figure 12 CBA Summary – Option 1

		Demand level		
		1	2	3
Discount Rate	10.0%	0.111	0.209	0.289
	7.0%	0.186	0.350	0.487
	4.0%	0.354	0.669	0.935

Source: GHD modelling

Figure 13 CBA Summary – Option 2

		Demand level		
		1	2	3
Discount Rate	10.0%	0.124	0.235	0.324
	7.0%	0.207	0.393	0.545
	4.0%	0.394	0.746	1.042

Source: GHD Modelling

Neither of the dam options are viable under the forecasted demand scenarios. Demand Level 3 forecasts an increase in the number of households of 213 (high demand), with an uptake of 44% of the potential residential/rural development sites identified. CBA calculations at 10% and 4% have been included for comparative purposes, to highlight the impact that cost of capital has on the CBA, and the unrealistic reduction required in the cost of capital to achieve a CBR >1.0.

5.2.7 Step 7 – Sensitivity Analysis

- **Residential development on the golf course**.

The golf course is well located to maximise the potential of 'water edge' development. No study was undertaken to assess the residential capacity of the golf course or how that number would change if the development was to be a mixed residential/golf course development (similar to Torquay). To verify the potential impact, a high allocation and uptake (80 sites) was assumed. Golf course redevelopment was assumed to start 5-10 years post dam construction was completed, and that 85% of the possible sites would be purchased within the 30-year analysis period.

Figure 14 Revised BCR /Golf Course Development

Demand level 4

	Benefits/Costs Ratio	
	Option 1	Option 2
10.0%	0.378	0.424
7.0%	0.650	0.727
4.0%	1.268	1.413

Increased (untested) residential development has a positive impact on the economic benefits of both options, but even an optimistic forecast of 80 residential sites is insufficient to achieve a BCR of 1.0 at a cost of capital of 7%.

- **Removal of Bridge Option (Demand Level 2)**

The analysis has been undertaken based on the assumption that a bridge would be constructed along the top of The Narrows wall, connecting the north side of the Mitta Mitta arm to Tallangatta by road, and enabling easy access to the Murray Valley Highway.

The analysis assumed bridge construction costs estimated at $25.2 million. The inclusion of the bridge would provide two benefits:

- The potential to increases rural/residential development on the north shore of the Mitta Mitta arm of Lake Hume
- The option of an alternative route to Albury.

The economic benefits derived from the increased rural/residential development were included in the initial BCR analysis, but no adjustment was allowed for the alternative road option.

Further analysis was undertaken to test the results if the bridge option were to be removed from the project. Although the capital expenditure costs would be reduced, there would also be a reduction in the benefits received by the local community from potential increases in rural/ residential development and the option of an alternative route to Albury.

Table 11 Revised capital cost profile

		Total	2017	2018
Base case				
Infrastructure		$0	0%	0%
Total CAPEX		$0	**0%**	**0%**
Option 1 - Rockfill Weir (FSL 184m AHD)				
Establishment		$1,000,000	100%	0%
Temporary Works		$0	50%	50%
Weir		$28,000,000	25%	75%
Outlet		$3,330,000	0%	100%
Minor Items	20%	$6,466,000	50%	50%
Procurement & Construction Risk	10%	$3,233,000	50%	50%
Contingencies	40%	$16,811,600	50%	50%
Management	15%	$4,849,500	50%	50%
Planning Approvals		$1,000,000	100%	0%
Total CAPEX(1)		$64,690,100		
Option 2 - Zoned Earth and Rockfill Weir (FSL 184m AHD)				
Establishment		$1,000,000	100%	0%
Temporary Works		$480,000	50%	50%
Weir		$20,516,000	25%	75%
Outlet		$3,330,000	0%	100%
Minor Items	20%	$5,065,200	50%	50%
Procurement & Construction Risk	15%	$3,798,900	50%	50%
Contingencies	40%	$13,676,040	50%	50%
Management	15%	$3,798,900	50%	50%
Planning Approvals		$1,000,000	100%	0%
Total CAPEX(2)		$52,665,040		
Road Bridge (can apply to both Options)				
Construction		$0	25%	75%
Procurement & Construction Risk	10%	$0	25%	75%
Contingencies	10%	$0	25%	75%
Management	5%	$0	25%	75%
Total CAPEX(3)		$0		
Fishway (can apply to both Options)				
Construction		$4,000,000	10%	90%
procurement & Construction Risk	10%	$400,000	10%	90%
Contingencies	10%	$440,000	10%	90%
Management	5%	$200,000	10%	90%
Total CAPEX(4)		$5,040,000		
	Base Case	$0	$0	$0
	Project Case 1	$69,730,100	$25,184,050	$44,546,050
	Project Case 2	$57,705,040	$21,042,520	$36,662,520

Source: GHD modelling input

Table 12 Revised BCR (excluding bridge capex from both construction options)

Demand Level 2		Benefits/Costs Ratio	
		Option 1	Option 2
10.0%	*With bridge*	0.209	0.235
	Without bridge	0.277	0.325
7.0%	*With bridge*	0.350	0.393
	Without bridge	0.464	0.543
4.0%	*With bridge*	0.669	0.746
	Without bridge	0.887	1.031

Based on Demand Level 2, the removal of the bridge capex and the associated residential development on the north side improves the BCR of the projects, due to the high capital cost of the bridge and the loss of minimal development options on the northern lake edge.

- ## Loss of Agricultural Output

As outlined in Section 3.4, one of the consequences of a dam structure at The Narrows is that the water held would create a larger water surface area and therefore results in higher evaporation than if it were able to flow further into the Hume Weir. The incremental evaporation loss (estimated to be 2,800 ML per annum greater than would occur if the water was held in the deeper Hume Weir) represents an increased use of water which needs to be met by the purchase of entitlement. The entitlement would most likely be purchased from a Victorian irrigation farmer on the Murray system and therefore reduce the volume of water that is available for agriculture.

As a result of a reduction in the volume of water available for production and irrigation purposes, the potential total regional agricultural output would decrease, which has the potential to significantly affect the value of agricultural contribution to the regional economy.

While difficult to quantify the overall loss of production from the irrigation activities that are supported by water out of the Mitta Mitta River, an economic multiplier of 3.5 has been estimated for irrigation in the Murray Darling Basin.

The economic multiplier indicates that for every $1 of production revenue generated, there is an additional $3.50 of economic activity. This highlights that any reduction on the volume of water that is available for use has the potential to negatively impact the economic contribution from agricultural output in and around the region.

It should however be noted that as there are other factors that will have a significant impact on agricultural production, such as rainfall, external demand and production values, and an economic or financial assessment has not been undertaken to assess the value of the loss of agricultural output as a result of The Narrows project. As the economic multiplier is considerably high, if the value of loss of agricultural output were included in the analysis, the project viability would be lower.

- **Residential Uptake, Population Growth and BCR>1.0**

The two variables that have the greatest impact on the project viability are;

- ✓ Capital cost, both in terms of the amount and the timing. The technical feasibility has reviewed the design options, and besides the removal of the bridge from the initial construction, there appears to be limited scope for further capital reduction.
- ✓ Residential Uptake – has been forecast at various rates across the eight areas that have been identified as future growth/development. The rate and the extent to which the areas are developed has an impact on the project viability. A critical element of the project modelling is the accuracy of the forecast data, especially the residential development uptake.

Towong (LGA) over the last ten years has experienced little or no population growth, with an annual growth rate of -0.58%[9] over that period. Some areas have shown higher growth rates (Bellbridge at 2.5% between 2001 and 2011), but on average, growth has been low.

Table 13 demonstrates the gap that exists between current (2015) population growth of 1.97% per annum with the growth rate that would be required to achieve a BCR at or close to 1.0. The required growth rate of 3% per annum is in excess of the high rates achieved in major development locations in Melbourne or Sydney.

Table 13 Residential Development Uptake (Option 2)

Residential Demand Uplift (1)	BCR @ 7.0% (2)	Residential Uptake % (3)	Increase in Households (4)	Forecasted Population in 2046 (5)	CAGR (6)
Do nothing				1,046	-0.58%
0.0%	0.726	56%	313	1,715	1.97%
5.0%	0.741	59%	329	1,753	2.04%
10.0%	0.757	61%	344	1,791	2.12%
15.0%	0.772	64%	360	1,829	2.19%
20.0%	0.787	67%	376	1,867	2.26%
30.0%	0.818	73%	407	1,943	2.39%
40.0%	0.848	78%	438	2,019	2.52%
50.0%	0.879	84%	470	2,095	2.65%
60.0%	0.909	89%	501	2,171	2.77%
70.0%	0.940	95%	532	2,247	2.89%
80.0%	0.971	101%	563	2,323	3.00%
90.0%	1.001	106%	595	2,399	3.11%
100.0%	1.032	112%	626	2,475	3.22%

Note:

1. Residential Demand uptake - modelling has forecast residential uptake across the eight identified development areas, in five year blocks. For Demand Level 4, when the golf course redevelopment is included in the analysis it shows that the development commences after 10 years, with 3% of the 80 potential sites being developed in year 11 through to year 15.

   = 80 sites x 3% x 5 years = 12 additional sites .

[9] ABS 3218.0 Table 2

Project Case	Blocks	1 1-5	2 6-10	3 11-15	4 16-20	5 21-25	6 26-30	of potential
Area 1,2,3	190	0.5%	0.5%	1.0%	2.0%	4.0%	4.0%	**60.0%**
Area 7- not closely linked to project	30	0.0%	0.5%	1.0%	1.0%	4.0%	4.0%	**52.5%**
Area 8-depend on bridge	40	0.5%	0.5%	1.0%	1.0%	4.0%	4.0%	**55.0%**
Area 4 -boost with Golf Course	20	0.5%	0.5%	1.0%	1.0%	4.0%	4.0%	**55.0%**
Area 5 - infill to go first	200	0.0%	0.0%	1.0%	2.0%	4.0%	4.0%	**55.0%**
Golf Course - special case	80	0.0%	0.0%	3.0%	3.0%	5.0%	4.0%	**75.0%**
	560	6	7	36	56	116	112	333

The 'zero' in the first column of the golf course row in the above table indicates that no 'uptake' adjustment has been applied in the first five-year period, whereas in the third column a 3% 'uptake' adjust has been applied for each year in the 5-year period.

2. Benefits Cost Ratio - as the uptake of residential development sites increases, the associated construction and employment expansion increases the project benefits, leading to an increase in the BCR from .350 to .650 (Demand Level 2 c/f Demand Level 4 at 7% for Option 1 and from .393 to .727 for Demand Level 2 c/f Demand Level 4 for Option 2 at 7%),

	Benefits/Costs Ratio	
	Option 1	Option 2
10.0%	0.378	0.424
7.0%	0.650	0.727
4.0%	1.268	1.413

3. Residential Uptake – as a percentage of the 560 sites identified for development.
4. Increase in households – increase from 40 in the 'Base' case to 333 due to the increased 'uptake' percentage.
5. Population forecast (2046) – increases at the rate of 2.510 persons per increase in household numbers.

To achieve a BCR >1.0, through an increase in the total residential development growth, the uptake percentage would require an increase in the underlying demand level by 80% at which stage all the 560 identified sites would be exhausted. Towong (mainly Tallangatta and the associated areas) would have to experience a population growth of 3% per year over the 30-year analysis period.

6. Planning and Regulatory Requirements

If the results of the CBA indicated that The Narrows project should proceed, consideration should be given to the relevant approvals requirements associated with accommodating township growth in Tallangatta.

SMEC provided a detailed overview of the relevant legislation and approvals requirements associated with construction of The Narrows project in the Phase One Technical Feasibility Study Report.

This section of the report outlines the actions required in order to make land available for urban growth in Tallangatta which may result from increased demand should the project succeed.

6.1 Existing conditions

As shown in Figure 7, the township of Tallangatta is predominately zoned General Residential (GRZ1). Land between the GRZ1 and Lake Hume is zoned Public Park and Recreation (PPRZ), which includes the golf course. Within the township there are smaller pockets of alternate zones including the Industrial 1 Zone (IN1Z), Public Use Zone Schedules 1, 2, 3 and 6 (for education, health and local government purposes) and the Mixed Use (MUZ) and Commercial 1 Zones (C1Z) along the main shopping and retail strip.

Lake Hume and the Mitta Mitta River are included in a Public Use Zone 1 (Service and utility).

The balance of land surrounding the township of Tallangatta, including the northern banks of Lake Hume is zoned Rural Activity (RAZ), and a large area further to the south west of the township is included within a Rural Living Zone (RLZ2).

6.2 Accommodating growth

In order to make additional land available to accommodate township growth, this would be best achieved by rezoning land around the periphery of town to provide additional land supply.

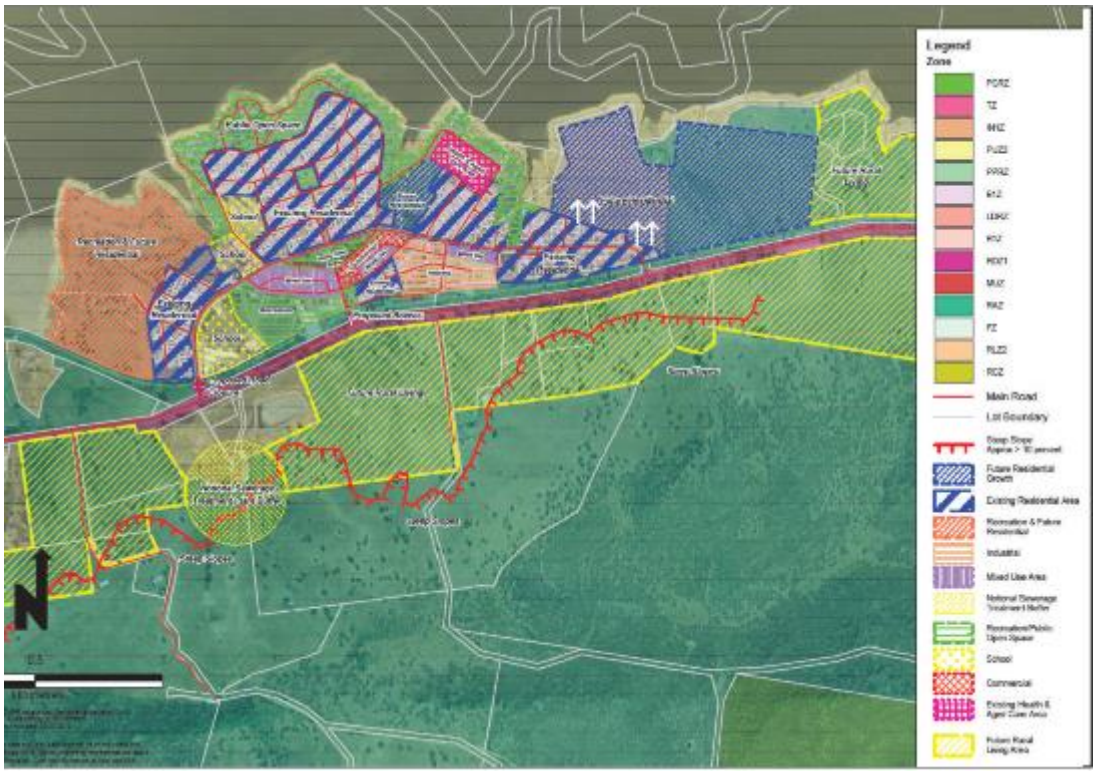
It is important to note that TSC is presently processing Planning Scheme Amendment C25 to the Towong Planning Scheme (planning scheme), which proposes (amongst other things) the rezoning of significant tracts of land from the Farming and the Rural Activity Zones to a Rural Living Zone.

Amendment C25 seeks to provide for ordered rural residential development in appropriate locations with safeguards to protect landscape, amenity and environmental values. This will help to diversify the local residential land market, with the intent of encouraging rural residential growth in and around towns such as Tallangatta, and capitalising on its proximity to the regional centres of Albury and Wodonga.

Significantly, the proposed amendment is independent of The Narrows project proceeding, and does not rely on this project for strategic justification. (Refer Appendix B – Amendment C25)

In addition, the current planning scheme also envisages growth in and around Tallangatta by way of the Tallangatta Structure Plan, which is included at Clause 21.03 Settlement.

Figure 15 Tallangatta Structure Plan



By rezoning additional land to accommodate growth by way of Amendment C25, TSC is increasing the supply of land available for private sector investment and development, as well as responding to land use strategies, including the Tallangatta Structure Plan.

6.3 Regulatory considerations

TSC will have liaised with the relevant authorities during the early preparation of documentation for the Amendment C25 process, to ensure that land proposed for rezoning was both suitable for and capable of being developed and serviced.

Detailed development approvals should have been identified and sought at the time of planning and development by the development proponents (i.e. applicants).

7. Recommendation

Based on the results of the CBA, this 'once-and-for-all' study indicates that The Narrows project as it is currently presented is (economically) unfeasible and should not proceed. The wider economic benefits that will be derived by the local community from the current proposals will be outweighed by the project costs, short term construction and longer term maintenance costs.

Although tourism and residential development have been identified as potential drivers of economic activity, further enhancement of these under The Narrows project cannot deliver the economic benefits that are necessary to support a long term viable outcome. The viability of the project is further diminished due to the loss of irrigation entitlements as a consequence of increased evaporation (2,800 ML) losses.

The Destination Tallangatta project will generate increased economic benefits to the community and region, with forecast increased contribution to GRP and employment to the local community through the following initiatives:

- Tallangatta Township Revitalisation
- Tallangatta Foreshore Redevelopment
- Tallangatta Holiday Park Redevelopment.

The benefits derived from Destination Tallangatta have been included in the Base Case to ensure that The Narrows project (Project Case 1 & Project Case 2) are assessed on an incremental basis measuring the change resulting from the economic benefits that can be assigned to the dam construction.

Appendices

Appendix A – EconSearch Economic Analysis Report

Economic Impact Assessment of The Narrows Project

A report to

GHD

Prepared by

econsearch

4 May 2016

EconSearch Pty Ltd
214 Kensington Road
Marryatville SA 5068
Tel: (08) 8431 5533
Fax: (08) 8431 7710

www.econsearch.com.au

CONTENTS

TABLES

ABBREVIATIONS

ABS	Australian Bureau of Statistics
fte	full time equivalent
GRP	gross regional product
I-O	input-output
LGA	Local Government Area
RISE	regional industry structure and employment
VIC	Victoria

DOCUMENT HISTORY AND STATUS

Doc Ver	Doc Status	Issued To	Qty elec	Qty hard	Date	Reviewed	Approved
1	Draft	Wennie van Lint	1 Word 1 PDF	-	8/4/16	JBM	JBM
2	Final	Wennie van Lint	1 Word 1 PDF	-	3/5/16	JBM	JBM

Printed:	4/05/2016 11:34:00 AM
Last Saved:	4/05/2016 11:34:00 AM
File Name:	S:\1_Projects\Current\1601_The Narrows Project\Reports\Narrows Impact Analysis_Final_160504.docx
Project Manager:	Julian Morison
Principal Author/s:	Heather Bailey and Julian Morison
Name of Client:	GHD
Name of Project:	The Narrows Project
Document Version:	2
Job Number:	1601

EXECUTIVE SUMMARY

Introduction

Towong Shire Council is investigating the feasibility of constructing a water control structure across Lake Hume, on the Mitta Mitta arm, west of Tallangatta. Colloquially this section of the Mitta Mitta River is known as the Narrows. It is understood that the lower water level in the Mitta Mitta arm of Lake Hume, between the months of November and April, impacts on potential recreation and tourism opportunities for the township of Tallangatta. To this end it is envisaged that a water control structure would enable water levels to be maintained at a functional level during this period.

GHD has been engaged by Towong Shire Council to undertake an economic analysis of the proposed Narrows Project. EconSearch was engaged by GHD to provide estimates of the likely economic contribution of the three options for the development of the dam (base case and two alternative options).

Method of analysis

Under the Base Case or 'do nothing' no water control structure would be built. Both Option 1 and 2 involve the construction of a water control structure, road bridge and fishway. The water control structure under Option 1 is a rockfill weir and under Option 2 is an earth and rockfill embankment.

The construction of the project, its operation and associated residential development and tourism impacts are likely to generate economic impacts on the local and regional economies. RISE models[1] for Towong Local Government Area (LGA) and Upper Hume region have been used for this purpose.

Results

The Narrows project is expected to generate stimulus to the local and regional economy from five activities, namely:

1. Expenditures generated from the project construction
2. Expenditures and local employment (wages) generated from the project operation
3. Additional tourism expenditures

[1] RISE (regional industry structure and employment) models are models designed for measuring the impact on regions of economic change. The models, which have at their core the input-output method, were originally constructed by EconSearch for the Victorian Department of Environment and Primary Industries (EconSearch 2013).

4. Expenditures generated from the construction of new residential development
5. Expenditures by new residents as a result of the new residential development.

Impact analysis was undertaken on these five activities and the results are reported in the following subsections.

Project construction

The expected impact as a result of the construction expenditures for the Narrows Project scenarios on the Towong Shire and Upper Hume regional economies is summarised as follows:

Towong Shire economy…

Option 1:

- Total contribution to GRP was approximately $7.6 million over two years, $4.9 million directly and $2.6 million in flow-on impacts, a contribution of 4.0 per cent to the region's total ($189.6 million in 2011/12).
- Total contribution to employment was estimated to be 27 fte in 2017 and 41 in 2018. Over the two years, the average annual contribution to employment was approximately 34 fte, 22 fte directly and 12 fte in flow-on impacts, a contribution of 1.4 per cent to the region's total (2,443 fte in 2011/12).

Option 2:

- Total contribution to GRP was approximately $6.5 million over two years, $4.3 million directly and $2.3 million in flow-on impacts, a contribution of 3.4 per cent to the region's total.
- Total contribution to employment was estimated to be 24 fte in 2017 and 35 fte in 2018. Over the two years, the average annual contribution to employment was approximately 29 fte, 19 fte directly and 10 fte in flow-on impacts, a contribution of 1.2 per cent to the region's total.

Upper Hume regional economy…

Option 1:

- Total contribution to GRP was approximately $44.2 million over two years, $25.5 million directly and $18.7 million in flow-on impacts, a contribution of 1.9 per cent to the region's total ($2.4 billion in 2011/12).
- Total contribution to employment was estimated to be 120 fte in 2017 and 245in 2018. Over the two years, the average annual contribution to employment was approximately 183 fte, 107 fte directly and 75 fte in flow-on impacts, a contribution of 0.8 per cent to the region's total (22,939 fte in 2011/12).

Option 2:

- Total contribution to GRP was approximately $38.7 million over two years, $22.3 million directly and $16.4 million in flow-on impacts, a contribution of 1.6 per cent of the region's total.
- Total contribution to employment was estimated to be 104 fte in 2017 and 215 fte in 2018. Over the two years, the average annual contribution to employment was approximately 160 fte, 94 fte directly and 66 fte in flow-on impacts, a contribution of 0.7 per cent to the region's total.

Project operation

The expected impact as a result of the operating expenditures for the Narrows Project on the Towong Shire and Upper Hume regional economies is summarised as follows:

Towong Shire economy…

- The average annual contribution to GRP is estimated to be approximately $0.1 million.
- The average annual contribution to employment as a result of the operating expenditure is estimated to be approximately 1 fte.

Upper Hume regional economy…

- The average annual contribution to GRP is estimated to be approximately $0.1 million.
- The average annual contribution to employment is estimated to be approximately 1 fte.

Additional tourism

Estimates of contribution to GRP and regional employment from three tourism demand scenarios (low, medium and high) for the Towong Shire and Upper Hume regions are as follows:

Towong Shire economy…

Low demand

- Total contribution to GRP is estimated to be less than $0.1 million in year 1 and rises to $1.5 million by year 30, $1.2 million directly and $0.3 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.8 per cent by year 30.
- Total contribution to employment is estimated to be less than 1 fte in year 1 and rises to 11 fte by year 30, 9 fte directly and 2 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.5 per cent by year 30.

Medium demand

- Total contribution to GRP is estimated to be less than $0.1 million in year 1 and rises to $3.3 million by year 30, $2.7 million directly and $0.7 million in flow-on impacts. The projected GRP impact would boost the region's total by around 1.8 per cent by year 30.

- Total contribution to employment is estimated to be 1 fte in year 1 and rises to 25 fte by year 30, 21 fte directly and 4 fte in flow-on impacts. The projected employment impact would boost the region's total by around 1.0 per cent by year 30.

High demand

- Total contribution to GRP is estimated to be $0.1 million in year 1 and rises to $5.0 million by year 30, $4.0 million directly and $1.0 million in flow-on impacts. The projected GRP impact would boost the region's total by around 2.6 per cent by year 30.
- Total contribution to employment is estimated to be 1 fte in year 1 and rises to 37 fte by year 30, 31 fte directly and 6 fte in flow-on impacts. The projected employment impact would boost the region's total by around 1.5 per cent by year 30.

Upper Hume regional economy…

Low demand

- Total contribution to GRP is estimated to be less than $0.1 million in year 1 and rises to $1.7 million by year 30, $1.3 million directly and $0.4 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.1 per cent by year 30.
- Total contribution to employment is estimated to be less than 1 fte in year 1 and rises to 12 fte by year 30, 9 fte directly and 3 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.1 per cent by year 30.

Medium demand

- Total contribution to GRP is estimated to be $0.1 million in year 1 and rises to $3.8 million by year 30, $2.8 million directly and $1.0 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.2 per cent by year 30.
- Total contribution to employment is estimated to be 1 fte in year 1 rises to 27 fte by year 30, 21 fte directly and 6 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.1 per cent by year 30.

High demand

- Total contribution to GRP is estimated to be $0.1 million in year 1 and rises to $5.7 million by year 30, $4.2 million directly and $1.5 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.2 per cent by year 30.
- Total contribution to employment is estimated to be 1 fte in year 1 rises to 40 fte by year 30, 31 fte directly and 9 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.2 per cent by year 30.

Residential development construction

Estimates of annual contribution to GRP and regional employment from the residential development construction expenditures for the Towong Shire and Upper Hume regions are as follows:

Towong Shire economy …

- Average annual contribution to GRP is estimated to be $0.2 million, $0.1 million directly and $0.1 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.1 per cent.
- Average annual contribution to employment is estimated to be 2 fte, 1 fte directly and 1 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.1 per cent.

Upper Hume regional economy …

- Average annual contribution to GRP is estimated to be $0.5 million, $0.3 million directly and $0.2 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.02 per cent.
- Average annual contribution to employment is estimated to be 4 fte, 2 fte directly and 1 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.02 per cent.

New residents

The residential development will generate ongoing expenditures by people who move into the region from outside as a result of this housing development. Estimates of contribution to GRP and regional employment from new resident expenditures in years 6 and 30 for the Towong Shire and Upper Hume regions are as follows:

Towong Shire economy …

- Total contribution to GRP is estimated to be $0.2 million in year 6 and rises to $6.3 million by year 30, $4.8 million directly and $1.5 million in flow-on impacts. The projected GRP impact would boost the region's total by around 3.3 per cent by year 30.
- Total contribution to employment is estimated to be less than 1 fte in year 6 and rises to 7 fte by year 30. The projected employment impact would boost the region's total by around 0.3 per cent by year 30.

Upper Hume regional economy …

- Total contribution to GRP is estimated to be $0.1 million in year 6 and is rises to $1.7 million by year 30, $1.2 million directly and $0.5 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.1 per cent by year 30.
- Total contribution to employment is estimated to be less than 1 fte in year 6 and rises to 2 fte by year 30.

1. INTRODUCTION

Towong Shire Council is investigating the feasibility of constructing a water control structure across Lake Hume, on the Mitta Mitta arm, west of Tallangatta. Colloquially this section of the Mitta Mitta River is known as the Narrows. It is understood that the lower water level in the Mitta Mitta arm of Lake Hume, between the months of November and April, impacts on potential recreation and tourism opportunities for the township of Tallangatta. To this end it is envisaged that a water control structure would enable water levels to be maintained at a functional level during this period.

GHD has been engaged by Towong Shire Council to undertake an economic analysis of the proposed Narrows Project. EconSearch was engaged by GHD to provide estimates of the likely economic contribution of the three options for the development of the dam (base case and two alternative options).

Under the Base Case or 'do nothing' no water control structure would be built. Both Option 1 and 2 involve the construction of a water control structure, road bridge and fishway. The water control structure under Option 1 is a rockfill weir and under Option 2 is an earth and rockfill embankment.

The construction of the project, its operation and associated residential development and tourism impacts are likely to generate economic impacts on the local and regional economies. RISE models[2] for Towong Local Government Area (LGA) and Upper Hume region have been used for this purpose.

An outline of the method, data sources and indicators of economic impact used in the analysis are provided in Section 2. Section 3 provides the estimates of the economic impacts of the proposed project options during the construction and operating phases for the local and regional economies.

[2] RISE (regional industry structure and employment) models are models designed for measuring the impact on regions of economic change. The models, which have at their core the input-output method, were originally constructed by EconSearch for the Victorian Department of Environment and Primary Industries (EconSearch 2013).

2. METHOD OF ANALYSIS AND DATA

This economic impact assessment presents estimates of regional economic impact based on the use of an extension of the conventional input-output method. Over the past decade EconSearch has developed an extended input-output model known as the RISE model (Regional Industry Structure & Employment). The RISE model provides a comprehensive economic framework that is extremely useful in the resource planning process, particularly for regional economic impact applications[3].

The assessment is based on a comparison of a base case, under which no water control structure (and associated infrastructure) will be built, and two options involving the construction of a water control structure (and associated infrastructure) to control water levels around the township of Tallangatta. The base case is modelled as the current situation and how tourism is likely to grow, in terms of visitor numbers, without the project. The options are modelled to include the project construction costs and the projected growth in residential development and visitor numbers with the new water levels. This approach means that the net economic contribution attributable to the project will be estimated, not the total contribution of the project which would be larger.

2.1 Estimation of Economic Effects – Key Concepts

2.1.1 Economic activity

Economic activity indicators: the primary focus of this report is the generation of economic activity resulting from the project. The key economic activity indicators considered in the analysis are employment and contribution to gross regional product (GRP).

Economic impact: changes in economic activity are referred to as economic impacts. Generally, changes in *economic activity indicators* result from some stimulus or external shock imposed. In this analysis the concept of *economic impact* includes the increase in economic contribution from the construction and operation of the project and the additional stimulus to residential development and tourism. This *economic impact* is measured in terms of the *economic activity indicators* referred to above.

2.1.2 Indicators of economic activity defined

Employment units: Employment numbers are usually reported in either full time equivalent (FTE) units or total job units defined as follows:

[3] RISE models have been constructed for both the South Australian and Victorian Governments at both a state and regional level (EconSearch 2013, 2015).

- *FTE*: is a way to measure a worker's involvement in a project or industry activity. An FTE of 1.0 means that the person is equivalent to a full-time worker, while an FTE of 0.5 signals that the worker is only half-time. Typically, different scales are used to calibrate this number, depending on the type of industry and scope of the analysis but the basic calculation is the total hours worked divided by average annual hours worked in full-time jobs.
- *Jobs*: is used to refer to the number of workers employed in an industry or on a project at any point in time. It typically refers to either:
    - the *maximum* number of workers required at any point over the analytical period or the duration of the project; or
    - the *average* number of workers required over the analytical period/duration of the project. This can be calculated on a daily, weekly, monthly or annual basis.

In this report employment has been reported in terms of FTE units on a per annum basis.

Gross regional product (GRP): is a measure of the contribution of an activity to the economy. Contribution to GRP is measured as value of gross output (business revenue) less the cost of goods and services (including imports) used in producing the output. In other words, it can be measured as the sum of household income, gross operating surplus and gross mixed income net of payments to owner managers and taxes less subsidies on products and production. 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.

2.1.3 Categories of economic activity

A useful way to think about economic activity and economic impact (as measured by employment, contribution to GRP, etc.) is using the concept of a 'supply chain'. The supply chain, in the context of an infrastructure project includes, the planning and management of all activities involved in sourcing and procurement, conversion of materials, and all the logistics management activities. It also includes coordination and collaboration with suppliers, intermediaries and third-party service providers.

Broadly speaking there are four categories of employment and contribution to GRP along the infrastructure supply chain.

1. *Direct employment and contribution to GRP* – this is employment in those firms, businesses and organisations that are directly engaged in project construction and their contribution to GRP. Typically this will include:
    a. construction companies
    b. construction sub-contractors
    c. planning and engineering services
    d. material supply firms.

2. *First round employment and contribution to GRP* - refers to employment in firms that supply inputs and services to the 'direct employment' businesses and their contribution to GRP, i.e. those categorised under #1 above. For example:
    a. energy
    b. raw materials
    c. logistics
    d. business support services
    e. other inputs.
3. *Industrial-support employment and contribution to GRP* - is the term 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 infrastructure expenditure. This category excludes any employment associated with increased household consumption.
4. *Consumption-induced employment and contribution to GRP* - is the term applied to those effects induced by increased household income associated with the original infrastructure expenditure. The expenditure of household income associated with all three categories of employment (direct, first round and industrial-support) will generate economic activity that will in itself generate jobs.

Flow-on (or indirect) economic impact is the sum of categories 2, 3 and 4. In this analysis *direct* and *flow-on* employment and contribution to GRP generated by the infrastructure supply chain have been reported. A similar supply chain approach has been taken to estimate and report the employment and GRP impacts associated with the operational phase.

2.2 Economic Impact Models

Input-output (I-O) models are widely used to assess the economic impact of existing or changing levels of economic activity[4], such as regional infrastructure construction. The RISE I-O models of the regional economies, constructed by EconSearch, are widely used by the Government. I-O models are available at the national, state and regional levels. RISE models for Towong Shire and Upper Hume[5] region were used in this assessment.

In addition to the assumptions embodied in the input-output model itself (see Appendix 2), it was necessary to make a number of other general assumptions in estimating the economic impacts:

[4] Called an 'exogenous shock' in model terminology.

[5] Comprising the LGAs of Indigo, Towong and Wodonga.

- The impacts were measured using models that represent the structure of the regional economy for the year in which the most recent data are available (2011/12). However, over time there are likely to be improvements in primary factor productivity in these economies. To allow for the improvements an across-the-board (all sectors) labour productivity improvement rate of 1 per cent per annum have been incorporated into the modelling.
- When new jobs are created, it should be determined where the people come from to fill those jobs. In some cases the jobs will be taken by previously unemployed locals or by someone who is currently employed locally but whose own job is taken by a previously unemployed local. In both cases the impact of the newly created job and associated income is partially offset by the fact that someone who was previously receiving unemployment benefits is no longer doing so. To calculate this effect requires estimates of the parameter *rho* (see Appendix 2), the proportion of new jobs that are likely to be filled by previously unemployed locals. Rho values of 0.50 for the region were used.

2.3 Data and Assumptions

The following economic impacts were assessed:

- The Narrows construction
- The Narrows operation
- Tourism
- Residential development:
    - Housing construction
    - New resident expenditures.

The analysis was undertaken over the same period as the cost benefit analysis undertaken by GHD, i.e. 30 years.

2.3.1 The Narrows construction

Project construction costs for Options 1 and 2 were provided by GHD. A breakdown of construction costs is provided in Table 2-1. The construction expenditures by region are provided in Table 2-2.

Table 2-1 Project construction costs ($m)

Item	Option 1		Option 2	
	2017	2018	2017	2018
Establishment	1.0	0.0	1.0	0.0
Temporary Works	0.0	0.0	0.2	0.2
Weir	7.0	21.0	5.1	15.4
Outlet	0.0	3.3	0.0	3.3
Minor Items	3.2	3.2	2.5	2.5
Construction (bridge & fishway)	5.4	18.6	5.4	18.6
Procurement & construction risk	2.2	3.5	2.4	3.8
Contingencies	9.0	10.5	7.4	8.9
Management	2.7	3.4	2.2	2.8
Planning Approvals	1.0	0.0	1.0	0.0
Total	**31.5**	**63.4**	**27.3**	**55.6**

Source: GHD.

Table 2-2 Construction expenditures by region ($m)

	Option 1		Option 2	
	2017	2018	2017	2018
Upper Hume				
Towong	15.8	26.3	13.8	22.8
Rest of Upper Hume	10.8	29.5	9.4	26.2
Upper Hume sub-total	*26.6*	*55.8*	*23.2*	*49.0*
Rest of Victoria	4.8	7.6	4.1	6.6
Grand total	**31.5**	**63.4**	**27.3**	**55.6**

Source: EconSearch analysis.

2.3.2 The Narrows operation

Project operating costs for Options 1 and 2 were provided by GHD. The project was assumed to start operating in 2019 once construction was completed in 2018. The weir and bridge were assumed to have annual operating costs of approximately 0.1 per cent of their construction costs, i.e. $64,690 and $25,200 respectively. The fishway was assumed to have annual operating costs of 0.02 per cent of its construction costs, i.e. $1,008. In years 10, 20 and 30 (2027, 2037 and 2047), annual operating costs for the bridge were doubled to $50,400. In addition to the on-going costs, a major bridge refurbishment in year 25 (2042), costing $504,000, was assumed. In most years, it was assumed that 90 per cent of the costs were spent on goods and services in Towong LGA and 100 per cent of the costs were spent on goods and services within the Upper Hume region. In year 25 (2042), it was assumed that 51 per cent of the costs were spent on goods and services in Towong LGA and 81 per cent of the costs were spent on goods and services within the Upper Hume region.

2.3.3 Tourism

The tourism impact was analysed assuming that as both Option 1 and Option 2 produce the same outcome in terms of amenity, they resulted in the same tourist numbers and mix. As per

the CBA, three tourism demand scenarios were analysed, i.e. low, medium and high demand. Assumptions regarding visitor numbers was provided by GHD and were as follows:

- In year 0 (2017) the annual number of overnight visitors was assumed to be 29,200 visitor nights for the base case and project options
- In year 0 (2017) the annual number of day visitors was assumed to be 10,840 visitors for the base case and project options
- Thereafter, tourist numbers were assumed to increase annually by:
    - Low demand scenario: base case by 1.0 per cent and project options by 2.5 per cent
    - Medium demand scenario: base case by 1.5 per cent and project options by 4 per cent
    - High demand scenario: base case by 2.0 per cent and project options by 5 per cent.

Tourism Research Australia (TRA 2015) data for the Victoria's High Country region was used to generate a profile of expenditure for the overnight and day visitors. Based on this data, $128.59 per visitor per night for overnight visitors and $95.05 per visitor for day visitors was assumed. These amounts were in purchasers' prices and were adjusted to basic prices for the analysis.

2.3.4 Residential development

As per the CBA, the analysis assumed that the project provided sufficient stimulus for the development of new residential housing to proceed, whereas it was assumed this would not occur under the base case. The residential development will generate two types of expenditures that impact upon the local and regional economies, i.e. construction expenditures and the ongoing expenditures by people who move into the region from outside as a result of this housing development.

Construction expenditures

The timing of construction and number of properties (100 properties developed over 25 years) was based on the assumptions used in the CBA and were provided by GHD. As per the CBA, it was assumed that the average cost to develop a property was $300,000. Construction commences in year 6 (2023) and the last houses are built in year 30 (2047). It was assumed that 35 per cent of the construction costs were spent on goods and services in Towong LGA and 70 per cent within the Upper Hume region.

New resident expenditures

It was assumed that 75 per cent of the households came from within the Upper Hume region and 25 per cent from outside the Hume region, i.e. that all the households were new residents to Towong LGA and 25 per cent were new residents to the Upper Hume region. Household income was based on the median household income for Towong LGA from the ABS *2011 Census*

of Population and Housing of $850 per week (ABS 2012). This was adjusted to current dollars using CPI to give an annual income per household of $48,387.

3. ECONOMIC IMPACT RESULTS

As described in Section 2.3, The Narrows project is expected to generate stimulus to the local and regional economy from five activities, namely:

6. Expenditures generated from the project construction
7. Expenditures and local employment (wages) generated from the project operation
8. Additional tourism expenditures
9. Expenditures generated from the construction of new residential development
10. Expenditures by new residents as a result of the new residential development.

Impact analysis was undertaken on these five activities and the results are reported in the following subsections.

3.1 Construction Phase

For Option 1, of the total Project investment ($94.9 million over two years, Table 2-1) it was assumed 44 per cent ($42.1 million over two years, Table 2-2) was purchased from goods and service providers from within the Towong LGA and 87 per cent ($82.5 million over two years, Table 2-2) in total (i.e. including the Towong LGA) from within the Upper Hume region. Likewise for Option 2, of the total Project investment ($82.9 million over two years, Table 2-1) local expenditures were 44 per cent ($36.7 million over two years, Table 2-2) for Towong LGA and 87 per cent ($72.2 million over two years, Table 2-2) for the Upper Hume region.

3.1.1 Contribution to gross regional product (GRP)

GRP is a measure of the net contribution of an activity or industry to the regional economy. It represents payments to the primary inputs of production (labour, capital and land) and is a regional level equivalent of gross domestic product. Estimates of the contribution to GRP for the two-year construction period are provided in Table 3-1.

Towong Shire economy …

For Option 1, the total contribution to GRP as a result of the project construction expenditure was approximately $7.6 million over two years, $4.9 million directly and $2.6 million in flow-on impacts (Table 3-1). In 2011/12 the Towong LGA GRP was approximately $189.6 million. On this basis, the projected GRP impact would boost the region's total by around 4.0 per cent.

For Option 2, the total contribution to GRP as a result of the project construction expenditure was approximately $6.5 million over two years, $4.3 million directly and $2.3 million in flow-on impacts (Table 3-1). The projected GRP impact would boost the region's total by around 3.4 per cent.

Upper Hume regional economy …

For Option 1, the total contribution to GRP as a result of the project construction expenditure is approximately $44.2 million over two years, $25.5 million directly and $18.7 million in flow-on impacts (Table 3-1). In 2011/12 the Upper Hume region's GRP was approximately $2.4 billion. On this basis, the projected GRP impact would boost the region's total by around 1.9 per cent.

For Option 2, the total contribution to GRP as a result of the project construction expenditure is approximately $38.7 million over two years, $22.3 million directly and $16.4 million in flow-on impacts (Table 3-1). The projected GRP impact would boost the region's total by around 1.6 per cent.

Table 3-1 Economic impact of The Narrows project options, construction phase

	Option 1		Option 2	
	2017	2018	2017	2018
Towong				
GRP ($m)				
Direct	1.9	3.0	1.7	2.6
Flow-on	1.0	1.6	0.9	1.4
Total	**3.0**	**4.6**	**2.6**	**3.9**
Employment (fte)				
Direct	18	26	16	22
Flow-on	10	15	8	12
Total	**27**	**41**	**24**	**35**
Upper Hume				
GRP ($m)				
Direct	8.3	17.2	7.2	15.1
Flow-on	6.0	12.7	5.3	11.1
Total	**14.3**	**29.9**	**12.5**	**26.2**
Employment (fte)				
Direct	71	144	62	126
Flow-on	49	102	43	89
Total	**120**	**245**	**104**	**215**

Source: EconSearch analysis.

3.1.2 Employment

Employment is a key indicator of both regional economic activity and the welfare of regional households. Estimates of the contribution to employment for the two-year construction period are provided in Table 3-1.

Towong Shire economy …

For Option 1, the total contribution to employment as a result of the project construction expenditure was estimated to be 27 fte in 2017 and 41 in 2018. Over the two years, the average annual contribution to employment was approximately 34 fte, 22 fte directly and 12 fte in flow-

on impacts (Table 3-1). In 2011/12 the Towong LGA total employment was approximately 2,443 fte. On this basis, the projected employment impact would boost the region's total by around 1.4 per cent.

For Option 2, the total contribution to employment as a result of the project construction expenditure was approximately 24 fte in 2017 and 35 fte in 2018. Over the two years, the average annual contribution to employment was approximately 29 fte, 19 fte directly and 10 fte in flow-on impacts (Table 3-1). The projected employment impact would boost the region's total by around 1.2 per cent.

Upper Hume regional economy …

For Option 1, the total contribution to employment as a result of the project construction expenditure is approximately 120 fte in 2017 and 245 fte in 2018. Over the two years, the average annual contribution to employment was approximately 183 fte, 107 fte directly and 75 fte in flow-on impacts (Table 3-1). In 2011/12 the Upper Hume region's total employment was approximately 22,939 fte. On this basis, the projected employment impact would boost the region's total by around 0.8 per cent.

For Option 2, the total contribution to employment as a result of the project construction expenditure is approximately 104 fte in 2017 and 215 fte in 2018. Over the two years, the average annual contribution to employment was approximately 160 fte, 94 fte directly and 66 fte in flow-on impacts (Table 3-1). The projected employment impact would boost the region's total by around 0.7 per cent.

3.2 Operation Phase

As described in Section 2.3.2, in most years, with the exception of year 25 (2042), operating costs were between a modest $0.09 million to $0.12 million, of which 90 per cent of the costs were spent on goods and services in Towong LGA and 100 per cent of the costs were spent on goods and services within the Upper Hume region. In year 25 (2042), the operating expenditure was $0.59 million, of which 51 per cent of the costs were spent on goods and services in Towong LGA and 81 per cent of the costs were spent on goods and services within the Upper Hume region.

3.2.1 Contribution to GRP

Estimates of annual contribution to GRP for the Towong LGA and Upper Hume regions during the operating phase are provided in Table 3-2.

Towong Shire economy …

The average annual contribution to GRP as a result of the operating expenditure is expected to be approximately $0.1 million (Table 3 2).

Upper Hume regional economy …

The average annual contribution to GRP as a result of the operating expenditure is expected to be approximately $0.1 million (Table 3 2).

Table 3-2 Annual economic impact of The Narrows project, operating phase

	Average annual impact
Towong	
GRP ($m)	
Direct	0.1
Flow-on	0.0
Total	**0.1**
Employment (fte)	
Direct	1
Flow-on	0
Total	**1**
Upper Hume	
GRP ($m)	
Direct	0.1
Flow-on	0.0
Total	**0.1**
Employment (fte)	
Direct	1
Flow-on	1
Total	**1**

Source: EconSearch analysis.

3.2.2 Employment

Estimates of annual contribution to employment for the Towong LGA and Upper Hume regions during the operating phase are provided in Table 3-2.

Towong Shire economy …

The average annual contribution to employment as a result of the operating expenditure is expected to be approximately 1 fte (Table 3 2).

Upper Hume regional economy …

The average annual contribution to employment as a result of the operating expenditure is expected to be approximately 1 fte (Table 3 2).

3.3 Tourism

Based on the assumptions described in Section 2.3.3, the expected additional tourist numbers to the region as a result of The Narrows project is expected to generate the following annual expenditures in the region:

Low demand scenario

- $0.05 million in year 1 to $2.49 million by year 30 in the Towong LGA
- $0.05 million in year 1 to $2.50 million by year 30 in the Upper Hume region

Medium demand scenario

- $0.08 million in year 1 to $5.57 million by year 30 in the Towong LGA
- $0.08 million in year 1 to $5.60 million by year 30 in the Upper Hume region

High demand scenario

- $0.1 million in year 1 to $8.33 million by year 30 in the Towong LGA
- $0.1 million in year 1 to $8.37 million by year 30 in the Upper Hume region.

3.3.1 Contribution to GRP

Estimates of contribution to GRP from tourism in years 1 and 30 for the Towong LGA and Upper Hume regions are provided in Table 3-3.

Towong Shire economy …

In year 1 for the low demand scenario, the contribution to GRP as a result of additional tourism expenditure is expected to be less than $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $1.5 million, $1.2 million directly and $0.3 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.8 per cent by year 30.

In year 1 for the medium demand scenario, the contribution to GRP is expected to be less than $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $3.3 million, $2.7 million directly and $0.7 million in flow-on impacts. The projected GRP impact would boost the region's total by around 1.8 per cent by year 30.

In year 1 for the high demand scenario, the contribution to GRP is expected to be $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $5.0 million, $4.0 million directly and $1.0 million in flow-on impacts. The projected GRP impact would boost the region's total by around 2.6 per cent by year 30.

Upper Hume regional economy …

In year 1 for the low demand scenario, the contribution to GRP as a result of additional tourism expenditure is expected to be less than $0.1 million. By year 30, the contribution to GRP is

expected to rise to approximately $1.7 million, $1.3 million directly and $0.4 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.1 per cent by year 30.

In year 1 for the medium demand scenario, the contribution to GRP is expected to be $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $3.8 million, $2.8 million directly and $1.0 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.2 per cent by year 30.

In year 1 for the high demand scenario, the contribution to GRP is expected to be $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $5.7 million, $4.2 million directly and $1.5 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.2 per cent by year 30.

Table 3-3 Year 1 and Year 30 economic impact of tourism

	Low demand		Medium demand		High demand	
	Year 1	Year 30	Year 1	Year 30	Year 1	Year 30
Towong						
GRP ($m)						
Direct	0.0	1.2	0.0	2.7	0.0	4.0
Flow-on	0.0	0.3	0.0	0.7	0.0	1.0
Total	**0.0**	**1.5**	**0.0**	**3.3**	**0.1**	**5.0**
Employment (fte)						
Direct	0	9	0	21	1	31
Flow-on	0	2	0	4	0	6
Total	**0**	**11**	**1**	**25**	**1**	**37**
Upper Hume						
GRP ($m)						
Direct	0.0	1.3	0.0	2.8	0.1	4.2
Flow-on	0.0	0.4	0.0	1.0	0.0	1.5
Total	**0.0**	**1.7**	**0.1**	**3.8**	**0.1**	**5.7**
Employment (fte)						
Direct	0	9	0	21	1	31
Flow-on	0	3	0	6	0	9
Total	**0**	**12**	**1**	**27**	**1**	**40**

Source: EconSearch analysis.

3.3.2 Employment

Estimates of contribution to employment from tourism in years 1 and 30 for the Towong LGA and Upper Hume regions are provided in Table 3-3.

Towong Shire economy …

In year 1 for the low demand scenario, the contribution to employment as a result of additional tourism expenditure is expected to be less than 1 fte. By year 30, the contribution to employment is expected to rise to approximately 11 fte, 9 fte directly and 2 fte in flow-on

impacts. The projected employment impact would boost the region's total by around 0.5 per cent by year 30.

In year 1 for the medium demand scenario, the contribution to employment is expected to be 1 fte. By year 30, the contribution to employment is expected to rise to approximately 25 fte, 21 fte directly and 4 fte in flow-on impacts. The projected employment impact would boost the region's total by around 1.0 per cent by year 30.

In year 1 for the high demand scenario, the contribution to employment is expected to be 1 fte. By year 30, the contribution to employment is expected to rise to approximately 37 fte, 31 fte directly and 6 fte in flow-on impacts. The projected employment impact would boost the region's total by around 1.5 per cent by year 30.

Upper Hume regional economy …

In year 1 for the low demand scenario, the contribution to employment as a result of additional tourism expenditure is expected to be less than 1 fte. By year 30, the contribution to employment is expected to rise to approximately 12 fte, 9 fte directly and 3 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.1 per cent by year 30.

In year 1 for the medium demand scenario, the contribution to employment is expected to be 1 fte. By year 30, the contribution to employment is expected to rise to approximately 27 fte, 21 fte directly and 6 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.1 per cent by year 30.

In year 1 for the high demand scenario, the contribution to employment is expected to be 1 fte. By year 30, the contribution to employment is expected to rise to approximately 40 fte, 31 fte directly and 9 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.2 per cent by year 30.

3.4 Residential Development

Based on the assumptions described in Section 2.3.4, of the total residential development costs ($30.0 million over 25 years), 35 per cent ($10.5 million) was purchased from goods and service providers from within the Towong LGA and 70 per cent ($21.0 million) from within the Upper Hume region.

3.4.1 Contribution to GRP

Estimates of annual contribution to GRP from the residential development construction expenditures for the Towong LGA and Upper Hume regions are provided in Table 3-4.

Towong Shire economy …

The average annual contribution to GRP as a result of the residential development construction expenditure is expected to be approximately $0.2 million, $0.1 million directly and $0.1 million

in flow-on impacts. The projected GRP impact would boost the region's total by around 0.1 per cent.

Upper Hume regional economy …

The average annual contribution to GRP as a result of the residential development construction expenditure is expected to be approximately $0.5 million, $0.3 million directly and $0.2 million in flow-on impacts. The projected GRP impact would boost the region's total by around 0.02 per cent.

Table 3-4 Annual economic impact of residential development construction phase

	Average annual impact
Towong	
GRP ($m)	
Direct	0.1
Flow-on	0.1
Total	**0.2**
Employment (fte)	
Direct	1
Flow-on	1
Total	**2**
Upper Hume	
GRP ($m)	
Direct	0.3
Flow-on	0.2
Total	**0.5**
Employment (fte)	
Direct	2
Flow-on	1
Total	**4**

Source: EconSearch analysis.

3.4.2 Employment

Estimates of annual contribution to employment from the residential development construction expenditures for the Towong LGA and Upper Hume regions are provided in Table 3-4.

Towong Shire economy …

The average annual contribution to employment as a result of the residential development construction expenditure is expected to be approximately 2 fte, 1 fte directly and 1 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.1 per cent.

Upper Hume regional economy …

The average annual contribution to employment as a result of the residential development construction expenditure is expected to be approximately 4 fte, 2 fte directly and 1 fte in flow-on impacts. The projected employment impact would boost the region's total by around 0.02 per cent.

3.5 New Residents

The residential development will generate ongoing expenditures by people who move into the region from outside as a result of this housing development. Based on the assumptions described in Section 2.3.4, additional household income to the Towong LGA is expected to rise from $0.1 million in year 6 (2023) to $4.8 million by year 30 (2047) as a result of the development. Additional household income to the Upper Hume region is expected to rise from $0.04 million in year 6 to $1.2 million by year 30 as a result of the development.

3.5.1 Contribution to GRP

Estimates of contribution to GRP from new resident expenditures in years 6 and 30 for the Towong LGA and Upper Hume regions are provided in Table 3-5.

Towong Shire economy …

In year 6, the contribution to GRP as a result of additional resident expenditure is expected to be $0.2 million. By year 30, the contribution to GRP is expected to rise to approximately $6.3 million, $4.8 million directly and $1.5 million in flow-on impacts (Table 3-5). The projected GRP impact would boost the region's total by around 3.3 per cent by year 30.

Upper Hume regional economy …

In year 6, the contribution to GRP as a result of additional resident expenditure is expected to be $0.1 million. By year 30, the contribution to GRP is expected to rise to approximately $1.7 million, $1.2 million directly and $0.5 million in flow-on impacts (Table 3-5). The projected GRP impact would boost the region's total by around 0.1 per cent by year 30.

3.5.2 Employment

Estimates of contribution to employment from new resident expenditures in years 6 and 30 for the Towong LGA and Upper Hume regions are provided in Table 3-5.

Towong Shire economy …

In year 6, the contribution to employment as a result of additional resident expenditure is expected to be less than 1 fte. By year 30, the contribution to employment is expected to rise to approximately 7 fte (Table 3-5). The projected employment impact would boost the region's total by around 0.3 per cent by year 30.

Upper Hume regional economy …

In year 6, the contribution to employment as a result of additional resident expenditure is expected to be less than 1 fte. By year 30, the contribution to employment is expected to rise to approximately 2 fte (Table 3-5).

Table 3-5 Year 6 and Year 30 economic impact of new residents

	Year 6	Year 30
Towong		
GRP ($m)		
Direct	0.1	4.8
Flow-on	0.0	1.5
Total	**0.2**	**6.3**
Employment (fte)		
Direct	0	0
Flow-on	0	7
Total	**0**	**7**
Upper Hume		
GRP ($m)		
Direct	0.0	1.2
Flow-on	0.0	0.5
Total	**0.1**	**1.7**
Employment (fte)		
Direct	0	0
Flow-on	0	1
Total	**0**	**2**

Source: EconSearch analysis.

REFERENCES

Australian Bureau of Statistics (ABS) 2012, *2011 Census of Population and Housing,* Canberra.

ABS 2016, *Consumer Price Index*, Cat. No. 6401.0, Canberra.

Bannock, G., Baxter, R.E., and Rees, R. 1979. The Penguin Dictionary of Economics. Penguin Books Ltd, Harmondsworth, Middlesex, U.K.

EconSearch 2013, *Local Input-Output Modelling of Victorian Primary Industries – Update: Technical Report,* report prepared for the Department of Environment and Primary Industries (Victoria), June.

EconSearch 2015, *Input-Output Tables for South Australia and its Regions 2013/14 Update: Technical Report,* report prepared for Department of the Premier and Cabinet, November.

Jensen, R.C. and West, G.R. 1986, *Input-Output for Practitioners: Theory and Applications*, Australian Government Publishing Service, Canberra.

Mangan, J. and Phibbs, P. 1989, *Demo-Economic Input-Output Modelling with Special Reference to the Wollongong Economy*, Australian Regional Developments 20, AGPS, Canberra.

Tourism Research Australia (TRA) 2015, *Regional Tourism Profiles 2013/14*, Canberra.

Disclaimer

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 INTERMEDIATE SECTOR SPECIFICATION

Appendix Table 1.1 Intermediate sector specifications for the input-output model

	119 RISE Sectors		**State & Regions, 2011/12**
1	Sheep	1	Sheep
2	Grains	2	Grains
3	Beef Cattle	3	Beef Cattle
4	Dairy Cattle	4	Dairy Cattle
5	Poultry	5	Poultry
6	Pigs	6	Pigs
7	Other Livestock	7	Other Livestock
8	Winegrapes	8	Winegrapes
9	Vegetables	9	Vegetables
10	Fruit and Nuts	10	Fruit and Nuts
11	Other Agriculture	11	Other Agriculture
12	Aquaculture	12	Aquaculture
13	Forestry and Logging	13	Forestry and Logging
14	Fishing, hunting and trapping	14	Fishing, Hunting and Trapping
15	Agriculture, Forestry and Fishing Support Services	15	Agriculture, Forestry and Fishing Support Services
16	Coal mining	16	Coal Mining
17	Oil and gas extraction	17	Oil and Gas Extraction
18	Iron Ore Mining	18	Iron & Non-ferrous Ore Mining
19	Non Ferrous Metal Ore Mining	18	
20	Non Metallic Mineral Mining	19	Non Metallic Mineral Mining
21	Exploration and Mining Support Services	20	Exploration and Mining Support Services
22	Meat and Meat product Manufacturing	21	Meat and Meat Product Manufacturing
23	Processed Seafood Manufacturing	22	Processed Seafood Manufacturing
24	Dairy Product Manufacturing	23	Dairy Product Manufacturing
25	Fruit and Vegetable Product Manufacturing	24	Fruit and Vegetable Product Manufacturing
26	Oils and Fats Manufacturing	25	Oils and Fats Manufacturing
27	Grain Mill and Cereal Product Manufacturing	26	Grain Mill and Cereal Product Manufacturing
28	Bakery Product Manufacturing	27	Other Food Product Manufacturing
29	Sugar and Confectionary Manufacturing	27	
30	Other Food Product Manufacturing	27	
31	Soft Drinks, Cordials and Syrup Manufacturing	28	Other Beverages
32	Beer Manufacturing	29	Beer, Wine, Spirits and Tobacco Manufacturing
33	Wine, Spirits and Tobacco	29	
34	Textile Manufacturing	30	Textiles, Clothing and Footwear Manufacturing

	119 RISE Sectors		State & Regions, 2011/12
35	Tanned Leather, Dressed Fur and Leather Product Manufacturing	30	
36	Textile Product Manufacturing	30	
37	Knitted Product Manufacturing	30	
38	Clothing Manufacturing	30	
39	Footwear Manufacturing	30	
40	Sawmill Product Manufacturing	31	Sawmill Product Manufacturing
41	Other Wood Product Manufacturing	32	Other Wood Product Manufacturing
42	Pulp, Paper and Paperboard Manufacturing	33	Pulp, Paper and Paperboard Manufacturing
43	Paper Stationery and Other Converted Paper Product Manufacturing	34	Paper Stationery and Other Converted Paper Product Manufacturing
44	Printing (including the reproduction of recorded media	35	Printing (including the reproduction of recorded media)
45	Petroleum and Coal Product Manufacturing	36	Petroleum and Coal Product Manufacturing
46	Human Pharmaceutical and Medicinal Product Manufacturing	37	Pharmaceutical & Other Chemical Product Manufacturing
47	Veterinary Pharmaceutical and Medicinal Product Manufacturing	37	
48	Basic Chemical Manufacturing	37	
49	Cleaning Compounds and Toiletry Preparation Manufacturing	37	
50	Polymer Product Manufacturing	37	
51	Natural Rubber Product Manufacturing	37	
52	Glass and Glass Product Manufacturing	38	Non-metallic Mineral Product Manufacturing
53	Ceramic Product Manufacturing	38	
54	Cement, Lime and Ready-Mixed Concrete Manufacturing	38	
55	Plaster and Concrete Product Manufacturing	38	
56	Other Non-Metallic Mineral Product Manufacturing	38	
57	Iron and Steel Manufacturing	39	Iron and Steel Manufacturing
58	Basic Non-Ferrous Metal Manufacturing	40	Basic Non-Ferrous Metal Manufacturing
59	Forged Iron and Steel Product Manufacturing	41	Metal Product Manufacturing
60	Structural Metal Product Manufacturing	41	
61	Metal Containers and Other Sheet Metal Product manufacturing	41	
62	Other Fabricated Metal Product manufacturing	41	
63	Motor Vehicles and Parts; Other Transport Equipment manufacturing	42	Motor Vehicles and Parts; Other Transport Equipment Manufacturing
64	Ships and Boat Manufacturing	43	Other Machinery & Equipment Manufacturing
65	Railway Rolling Stock Manufacturing	43	
66	Aircraft Manufacturing	43	
67	Professional, Scientific, Computer and Electronic Equipment Manufacturing	43	
68	Electrical Equipment Manufacturing	43	
69	Domestic Appliance Manufacturing	43	
70	Specialised and other Machinery and Equipment Manufacturing	43	

	119 RISE Sectors		State & Regions, 2011/12
71	Furniture Manufacturing	44	Furniture Manufacturing
72	Other Manufactured Products	45	Other Manufactured Products
73	Electricity Generation	46	Electricity Generation
74	Electricity Transmission, Distribution, On Selling and Electricity Market Operation	47	Electricity Supply
75	Gas Supply	48	Gas Supply
76	Water Supply, Sewerage and Drainage Services	49	Water Supply, Sewerage and Drainage Services
77	Waste Collection, Treatment and Disposal Services	50	Waste Collection, Treatment and Disposal Services
78	Residential Building Construction	51	Residential Building Construction
79	Non-Residential Building Construction	52	Other Construction
80	Heavy and Civil Engineering Construction	52	
81	Construction Services	53	Construction Services
82	Wholesale Trade	54	Wholesale Trade
83	Retail Trade	55	Retail Trade
84	Accommodation	56	Accommodation
85	Food and Beverage Services	57	Food and Beverage Services
86	Road Transport	58	Road Transport
87	Rail Transport	59	Rail Transport
88	Water, Pipeline and Other Transport	60	Water, Pipeline and Other Transport
89	Air and Space Transport	61	Air and Space Transport
90	Postal and Courier Pick-up and Delivery Service	62	Transport Support Services and Storage
91	Transport Support services and storage	62	
92	Publishing (except Internet and Music Publishing)	63	Publishing (except Internet and Music Publishing)
93	Motion Picture and Sound Recording	64	Communication Services
94	Broadcasting (except Internet)	64	
95	Internet Publishing and Broadcasting and Services Providers, Websearch Portals and Data Processing Services	64	
96	Telecommunication Services	64	
97	Library and Other Information Services	64	
98	Finance	65	Finance
99	Insurance and Superannuation Funds	66	Insurance & Other Financial Services
100	Auxiliary Finance and Insurance Services	66	
101	Rental and Hiring Services (except Real Estate)	67	Property & Business Services
102	Ownership of Dwellings	68	Ownership of Dwellings
103	Non-Residential Property Operators and Real Estate Services	67	Property & Business Services (cont.)
104	Professional, Scientific and Technical Services	67	
105	Computer Systems Design and Related Services	67	

	119 RISE Sectors		State & Regions, 2011/12
106	Building Cleaning, Pest Control, Administrative and Other Support Services	67	
107	Public Administration and Regulatory Services	69	Public Administration and Regulatory Services
108	Defence	70	Defence
109	Public Order and Safety	71	Public Order and Safety
110	Education and Training	72	Education and Training
111	Health Care Services	73	Health & Community Services
112	Residential Care and Social Assistance Services	73	
113	Heritage, Creative and Performing Arts	74	Cultural & Recreational Services
114	Sports and Recreation	74	
115	Gambling	74	
116	Automotive Repair and Maintenance	75	Personal & Other Services
117	Other Repair and Maintenance	75	
118	Personal Services	75	
119	Other Services	75	

Source: EconSearch analysis

APPENDIX 2 AN OVERVIEW OF ECONOMIC IMPACT ANALYSIS USING THE INPUT-OUTPUT METHOD

Economic impact analysis based on an input-output (I-O) model provides a comprehensive economic framework that is extremely useful in the resource planning process. Broadly, there are two ways in which the 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 model 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 database

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 database 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, I-O 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 model can be used to describe some of the important features of a state or 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 economy.

Using input-output analysis for estimation of economic impacts

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, 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.

Input-output multipliers

Input-output multipliers are an indication of the strength of the linkages between a particular sector and the rest of the state or 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:

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

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 aij, 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:

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

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:

$(I-A)X = Y$

where $(I-A)$ is termed the Leontief matrix,

or $X = (I-A)^{-1}Y$

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

The general solution is often represented by:

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

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:

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

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 gross regional product from the production of that dollar of output. The 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 gross regional product and employment effects are calculated by multiplying the first-round output effects by the appropriate gross regional 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, gross regional product and employment effects are defined as the output effects multiplied by the respective household income, 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, gross regional product and employment effects are simply the output effects multiplied by the respective household income, 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 Appendix Table 3.1. It should be noted that household income, 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, gross regional product and employment multipliers, as described above, refer to changes in household income per initial change in output, changes 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[6] + consumption induced]/initial

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
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 below for details).

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

Model assumptions

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

- Industries in the model have a linear production function, which implies constant returns to scale and fixed input proportions.
- 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. Thus it is preferable to have as many sectors as possible specified in the models and the standard models for this study were compiled with 66 sectors (see Appendix 1 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.

Extending the standard economic impact model as a DECON model

Based on work undertaken by EconSearch (2009 and 2010a) and consistent with Mangan and Phibbs (1989), the I-O model developed for this project was extended as 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.

The population 'sector'

The introduction of a population 'sector' to the standard 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 (pj) for sector j of the DECON model is represented as:

$p_j = -rho_j * e_j * family\ size_j$

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);

e_j = the employment coefficient for sector *j*; 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 intermediate sectors 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 project included the following.

- rho: little or no published data are available to assist with estimation of this variable, particularly at a regional level. The DECON models have been constructed to enable the analyst to estimate this variable on the basis of the availability superior data or assumptions.
- Family size: in order to estimate average family size by industry, relevant data were extracted from the Australian Bureau of Statistics 2006 Census of Population and Housing using the TableBuilder database. These data were modified by the consultants in order to ensure consistency with the specification and conventions of the I-O models.

The unemployed 'sector'

As outlined above, the introduction of an unemployed 'sector' to the standard 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 standard I-O model it is possible to calculate Type III multipliers (for output, gross regional product, 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 III 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:

$u_j = -\text{rho}_j * (1-ess_j) * e_j$

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);

ess_j = the proportion of employed in sector *j* who are not eligible for welfare benefits when they lose their job*; and*

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 standard I-O model.

Sources of local (i.e. state and regional) 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 were extracted from the Australian Bureau of Statistics 2006 Census of Population and Housing using the TableBuilder database. These data were modified by the consultants in order to ensure consistency with the specification and conventions of the I-O models.
- 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 2003/04 Household Expenditure Survey (ABS 2006).

Incorporating a tourism demand profile in the I-O model

Tourism expenditure is a measure of the value of sales of goods and services to visitors to the state or region. The following method and data sources were used to estimate tourism expenditure by industry sector for the region.

- The primary data were sourced from Tourism Research Australia (TRA).
- Base datasets included total tourism expenditure by TRA tourism region and average expenditure profiles, by region, across a range of goods and services (e.g. food and drink, fuel, shopping, etc.).
- Estimates were available for domestic day, domestic overnight and international visitor expenditure.
- The first adjustment to the base data was the development of a concordance between the TRA tourism regions and I-O model regions and the allocation of these base data to the relevant I-O model region. These allocations were based, in turn, on an ABS concordance between TRA tourism regions and SLAs.
- The second adjustment to the base data was the application of a more detailed expenditure breakdown from the ABS Australian National Accounts: Tourism Satellite Account for both domestic and international visitor expenditure (ABS 2010d).
- The third adjustment to the base data was the conversion of tourism expenditure estimates from purchasers' to basic prices (i.e. reallocation of net taxes (taxes minus subsidies) and marketing and transport margins) to make the data consistent with accounting conventions used in the national, state and regional I-O models. Purchasers' to basic price ratios for tourism expenditure categories were derived from ABS data.
- The final adjustment to the base data was the allocation of the tourism expenditure data in basic prices to the relevant input-output sectors (intermediate sectors, taxes less subsidies or imports) in which the expenditure occurred, thus compiling a profile of sales to final demand. This process was undertaken for each type of tourism expenditure (domestic day, domestic overnight and international visitor) and the results aggregated to form a single tourism demand profile. Profiles were developed at the state and regional levels.

Constructing a RISE v3.0 economic impact model

In the final model construction stage the data described above were incorporated into a *Microsoft Excel®* spreadsheet based economic impact model for the region and state (i.e. *RISE v3.0*)[7]. This model allows for description of the structure of the economy. It can also be used for the estimation of economic impacts over time in response to the introduction of a new industry

[7] For further details on the use and application of this type of model see EconSearch (2013a).

or a change in the final demand for the output of one or many sectors. Model assumptions can be modified to account for:

- price changes between the model construction year (2009/10) and the base year for the analysis;
- labour productivity change over time (as above and for the subsequent years);

the level of regional migration (e.g. for a positive employment impact, the proportion of new jobs filled by previously unemployed locals).

Appendix B – C25 Amendment

Memorandum

04 March 2016

To	Wennie van Lint		
Copy to	Brad George		
From	Karina Pierotti	Tel	(03) 8687 8509
Subject	Planning implications for	Job no.	31/33681

1 Introduction

GHD is conducting a cost-benefit-analysis for the construction on a water control structure across a section of the Mitta Mitta River at Tallangatta called The Narrows. The objective of the control structure is to guarantee a water frontage to Tallangatta to improve tourism and recreational opportunities for the township, as well as potentially providing a road link across the river

This memo provides planning advice on the implications of the Towong Planning Scheme and recent amendment to land use planning in the Shire, particularly in and around Tallangatta.

2 Intent of Amendment C25

Amendment C25 has been prepared by Towong Shire Council for the Planning Scheme. The amendment involves the rezoning of land from farming and rural activity to rural living to accommodate new residential growth in the Shire. The amendment seeks to provide for ordered rural residential development in appropriate locations with safeguards for landscape, amenity and the environment. This will help to diversify the residential land market, with the intent of encouraging rural residential growth in and around towns such as Tallangatta.

The amendment applies to areas of Towong Shire which are zoned as Rural Living Zones (Table 1). This is where the rural residential land use is the dominant land use. This occurs particularly in the west of the municipality and also areas adjacent to established settlements.

The Amendment revises the Municipal Strategic Statement to delete Clause 22.07 Rural Living and insert Schedule 3 to the Rural Living Zone. It also supports the Hume Regional Growth Plan. This amendment implements the recommendations of the Towong Shire Settlement Strategy, 2010 and Towong Shire Rural Land Use Study, 2010 by rezoning land and applying overlays.

The details of the amendment include:

Table 1 Changes to the Towong Shire Planning Scheme

Item	Amendment
Clause 22.07 Rural Living	Deleted and replaced with: • Design and Development Overlay (Schedule 1) • Development Plan Overlay (Schedule 6)

GHD Level 8, 180 Lonsdale Street Melbourne VIC 3000 Australia
T 61 3 8687 8000 F 61 3 8687 8111 E melmail@ghd.com W www.ghd.com

Item	Amendment
Clause 43.04 Development Plan Overlay (DPO6).	Inserts new Schedule 6.
Clause 35.03 Rural Living Zone	Inserts Schedule 3. Schedule 3 does not specify maximum building sizes and minimum setbacks. The Schedule retains the default minimum lot size of 2 hectares and sets the minimum area for which no permit is required for a dwelling to 2 hectares. Applies DP06 to land currently zoned Rural Living north of Bellbridge and west of Tallangatta, but excludes: • land affected by the Development Plan Overlay • land adjacent to Omeo Highway, Eskdale • land at Greenwattle Gap Road, Corryong • land on Donaldson Street, Corryong • established part of Tallangatta.
Clause 43.02 Design and Development Overlay (DDO1)	Amends Schedule 1 to enable a greater range of built form outcomes. Applied to all areas proposed to be rezoned Rural Living Zone (Schedule 3), excluding land already subject to Design and Development Overlay, land on Donaldson Street Corryong and the established part of Tallangatta.
Clause 61.03	Amends Schedule to include new planning scheme maps in the Towong Planning Scheme.
Planning Scheme Maps	Amendments to map numbers 1, 2, 3, 5, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 23, 24, 30, 1DDO, 2DPO, 5DDO, 10DDO, 12DDO, 12DPO and 17DDO. Inserts new map numbers 1DPO, 3DDO, 3DPO, 5DPO, 10DPO, 11DDO, 11DPO, 12DPO, 13DPO, 14DDO, 14DPO, 17DPO, 20DDO, 20DPO, 21DDO, 21DPO, 23DDO, 23DPO, 24DDO, 24DPO, 30DDO and 30DPO.

3 Current land use

3.1 Zones

The current land use within the township of Tallangatta is predominately zoned General Residential (GRZ1). Land between the GRZ1 and Lake Hume is zoned as Public Park and Recreation (PPRZ). Within the township there are smaller zones of industrial land (IN1Z); public use for education, health and

local government (PUZ2, PUZ3, PUZ6) and mixed use (MUZ). Lake Hume and the Mitta Mitta River are Public Use zones for service and utility (PUZ1).

The majority of the land surrounding the township of Tallangatta, including north of Lake Hume are zoned for Rural Activity (RAZ). There is a large area to the south west of the township used for Rural Living (RLZ2). There are also areas of Public Conservation and Resource (PCRZ) to the south of the township.

3.2 Overlays

The recreational areas surrounding the residential area of Tallangatta are predominately covered by a Significant Landscape Overlay (SLO1). The Murray Valley Highway and parts of the Residential Zone within the township are covered by a Heritage Overlay (HO69). The Rural Living Zone to the south west of the township is covered by the SLO and a Design and Development Overlay (DDO1).

Lake Hume and Mitta Mitta River are covered by an SLO and Land Subject to Inundation (Floodway) Overlay (FO). There are two areas within the township which are covered by a Development Plan Overlay (DPO5 and DPO1). A Bushfire Management Overlay (WMO) covers a majority of the land south of the township.

The land along the Mitta Mitta River to the south east of Tallangatta and part of the River are also covered by an Environmental Significance Overlay (ESO1).

4 Planning Scheme growth expectations

Towong Shire has one of the least diverse economies in Victoria, being heavily dependent on agriculture (beef farming). The Shire is located within a significant landscape at the headwaters of the Murray River. It comprises unique natural assets such as the Mitta Mitta River, Lake Hume and the Alpine National Park. The Shire understands its need to maintain a positive industry and investment attraction program to ensure that employment opportunities continue to grow for the area. There is a need for a wider range of housing types to support residential diversity and amenity.

The Towong Planning Scheme describes the vision to provide a range of lifestyle choices whilst continuing the heavily dependent agricultural activities occurring in the Shire. There is a demand for rural living lots, particularly adjacent to Lake Hume and its environs. The Shire seeks to protect the significant landscapes and encourage tourism to the area. There is scope for streetscape improvements to create a more vibrant and attractive town and improve public facilities within the township to strengthen both visitor and resident amenity.

The vision to promote rural land use diversity recognises the multifunctional nature of the landscape. The Shire has taken a spatially differentiated planning approach based on land capability. Three main spatial planning policy units focus on:

- Production – which protects the high quality agricultural land for agricultural use only
- Transitional – which uses the low to moderate quality agricultural land for rural planning outcomes
- ‘Peri Urban’ - where rural development is encouraged within 40 minutes travel of Albury/Wodonga.

The Shire seeks to encourage timber plantations to locate outside areas of high quality agricultural land, riverine environments and areas containing significant landscapes.

Figure 1 below is the Tallangatta Structure Plan, extracted from the Clause 21.03 of the Towong Planning Scheme showing scope for rural living opportunities in and around the township of Tallangatta. Rural living areas are proposed for south of the township and Murray Valley Highway as well as north east of the township. Areas of existing land zoned as Public Park and Recreation is proposed for future residential use, providing lakeside frontage to housing.

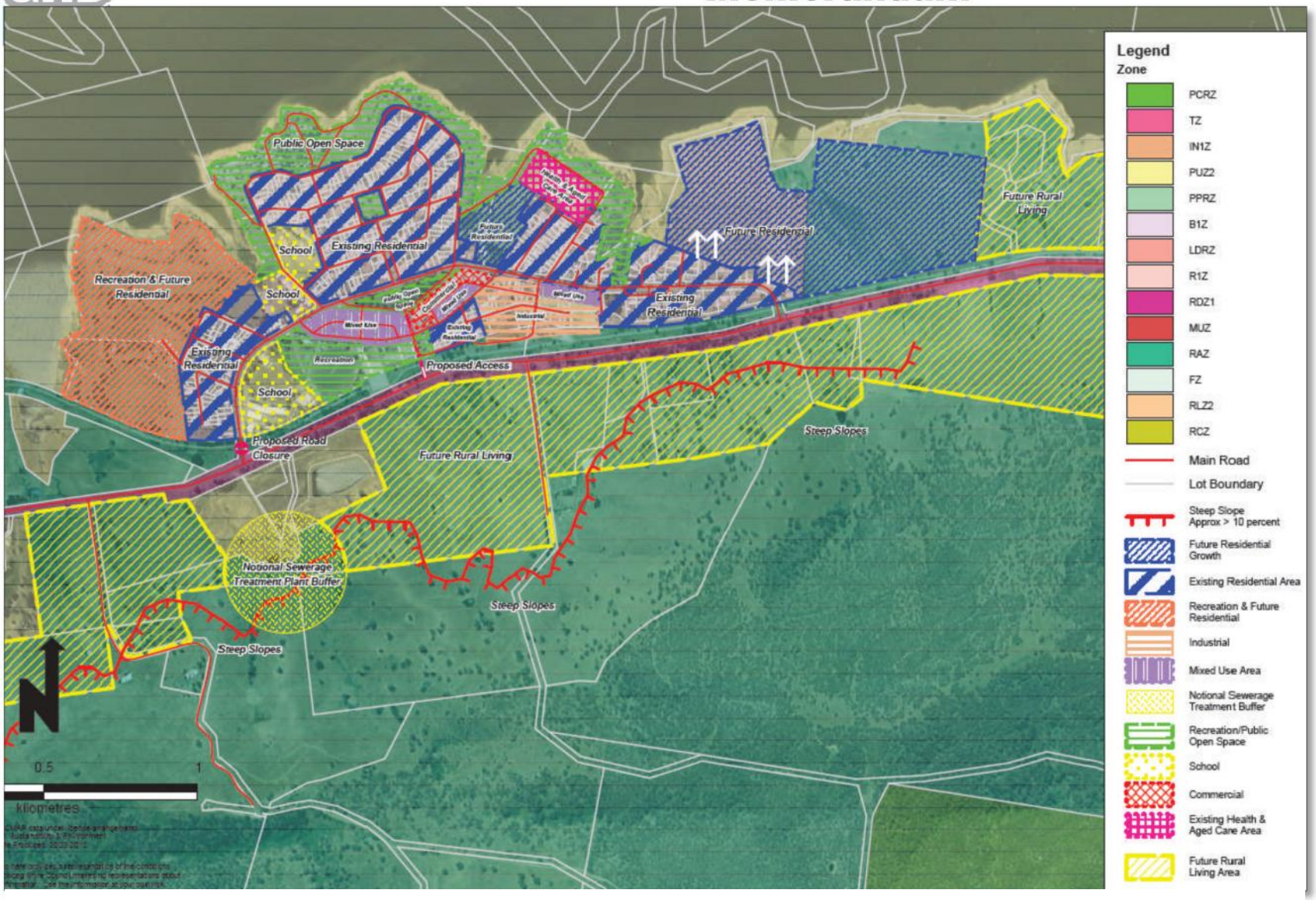


Figure 1 Tallangatta Structure Plan (Towong Planning Scheme Clause 21.03)

GHD Level 8, 180 Lonsdale Street Melbourne VIC 3000 Australia
T 61 3 8687 8000 **F** 61 3 8687 8111 **E** melmail@ghd.com **W** www.ghd.com

Regards

Karina Pierotti
Environmental Scientist

Appendix C – Analysis (Excel) Model

Forwarded to client separately

The Narrows Project

Economic and financial model

Draft Version 3.0
1 February 2017

Prepared by GHD for the Towong Shire Council

As with any analysis, there are limitations to this model given the broad assumptions adopted.
This model has been developed based on a combination of qualitative and quantitative inputs provided by Councul and key stakeholders.
Model ouptut will depend on the accuracy of the date/forecasts provided, espacially in terms of the length of the forecast perios
Users of the model should bear these limitations in mind when entering inputs and interpreting outputs.

Water Level - AHD(metres)	
192.0	100% of capacity - maximum Hume Wier level
189.5	85 % of capacity -full use of boat ramp at Tallangatta
188.0	76% cpacity
184.0	water at the bottom of the boat ramp at Tallangatta
	SMEC recommend dam height
182.0	50% caapcity - boat ramp not usable at Talangatta

22.7%	Weir capacity - 11/04/2016 gap from boat ramp to Mitta Miita 'River' - approx 150 metres

www.ghd.com