

Apsley Dam Economic Benefit Study

1. Executive Summary

This study indicates there is significant scope for additional water to diversify and grow Walcha's economy, attracting new enterprises (intensive agriculture and processing), increasing the output of existing enterprises (livestock, fodder and aged-care facilities), and therefore increasing local gross regional product and employment.

A case study scenario for a 25GL dam, which results in increased production in beef, dairy, aged care, and fishing tourism, plus an expansion into glasshouse vegetables, turf and potato growing resulted in a 12% increase in employment (156 new jobs) and an 11% increase in gross regional product (\$22.5M) for the Walcha economy.

Walcha presently has a town water supply from the Macdonald River (part of the Murray Darling Basin) which fails to meet town water security parameters. Total town water demand is 0.206GL in an average year and 0.23GL in a dry year. This exceeds the historical secure yield of 0.108GL/pa available to the Walcha water supply system. Residents are concerned lack of water security is holding the town back in terms of economic development and population growth.

Moreover, climate change is impacting negatively on existing agricultural enterprises which are the mainstay of the Walcha economy. Access to secure water with the potential to irrigate on existing farms, and attract new water-dependant enterprises to the region is viewed as critical to halt the decline in population in the LGA, especially amongst the working-age population.

In this study, the economic returns (gross revenue, gross margins where possible, regional flow-on effects) per ML of additional water have been estimated for several existing and potential new enterprises. Results are summarised in Figures i to iv below.

There are a number of intensive activities (glasshouse and outdoor horticulture, poultry grow-out farms, piggeries, a softwood mill, turf farming, medicinal cannabis) which bring very high returns per ML of water (in the range of \$4,500 - \$2.3M of gross revenue/ML and 0.02 – 10 jobs/ML). In each case, there are a range of other factors to be considered for before pursuing these activities which are set out in the report.

Remaining water can be used on existing enterprises (improved perennial pasture for grazing and fodder crops). In reality, these will probably be the largest water users in terms of volume as only a small number of 'new' enterprises using small amounts of water are likely to be established. Irrigation of existing enterprises could provide earlier (albeit smaller) returns to the Walcha economy while new enterprises are being sought.

However, the total amount of grazing/cropping land adjacent to the river is small (21,401ha) and not all would be suitable or accessible to irrigation. Irrigating just 25% of this land at typical pasture or fodder irrigation rates (3.5ML/ha) would use approximately 19GL per annum – the majority of the water in the community-proposed 25GL dam.

Amongst the existing extensive livestock grazing activities, dairy cattle produce the best returns. Potential new extensive activities which provide higher returns than dairy include turf farming and perhaps summer potatoes. Lucerne growing does not appear to be more financially attractive than irrigating improved perennial pastures, a result of the shorter growing season and lower yields than at nearby lucerne growing areas like Tamworth.

Securing the Walcha water supply is a priority which has been acknowledged by DPI Water. A dam on the Apsley River would ensure permanence of the Walcha supply, and eliminate current extraction from the western-flowing Macdonald river which is part of the Murray Darling Basin.

Putting a smaller weir on a second-order stream or gully which runs into the Apsley River may be a less expensive and less environmentally challenging option for Walcha's water supply, with fewer regulatory issues to be dealt with and achievable in shorter timeframe.

Never-the-less, the fact remains that boosting the socio-economic performance of the Walcha LGA is critically linked to having additional water for non-residential uses. A dam on the Apsley River could assist in that regard if it were used as a drawcard to attract new intensive enterprises to the area which produce high economic returns per ML of water, and are more job-intensive compared to existing activities.

More water-secure grazing/fodder businesses would also be a welcome adjunct to new intensive enterprises, as would additional tourism based around trout fishing in a new dam, something which could be achieved at relatively low cost.

Figure i. Gross Returns per ML of Additional Water

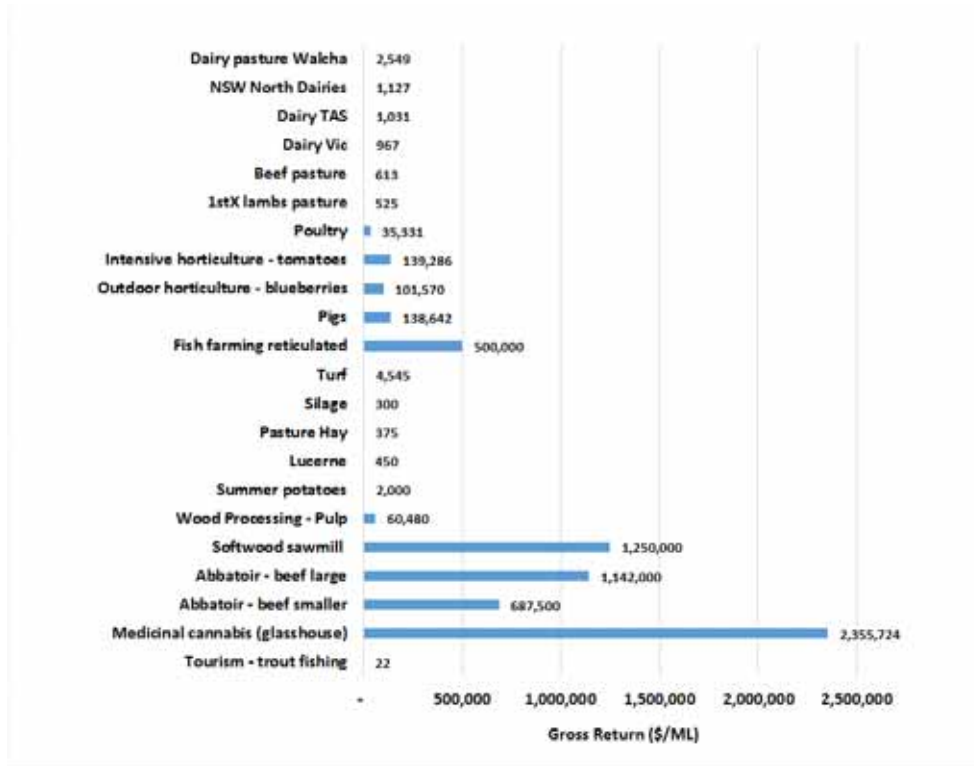


Figure ii. Gross Margins per ML of Additional Water

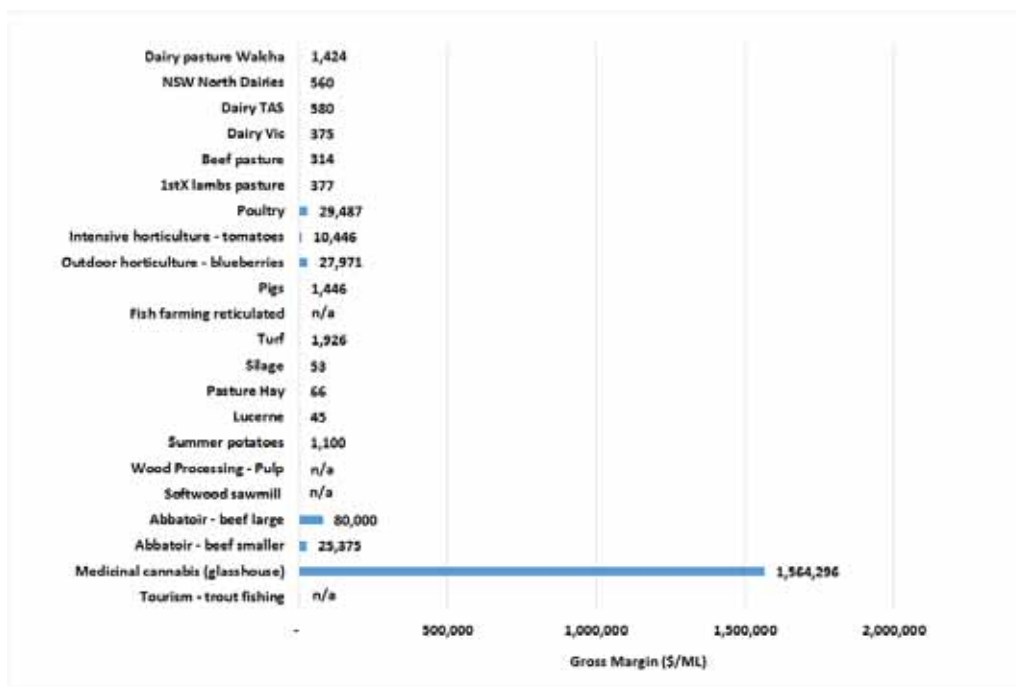


Figure iii. Extra Jobs per ML of Additional Water

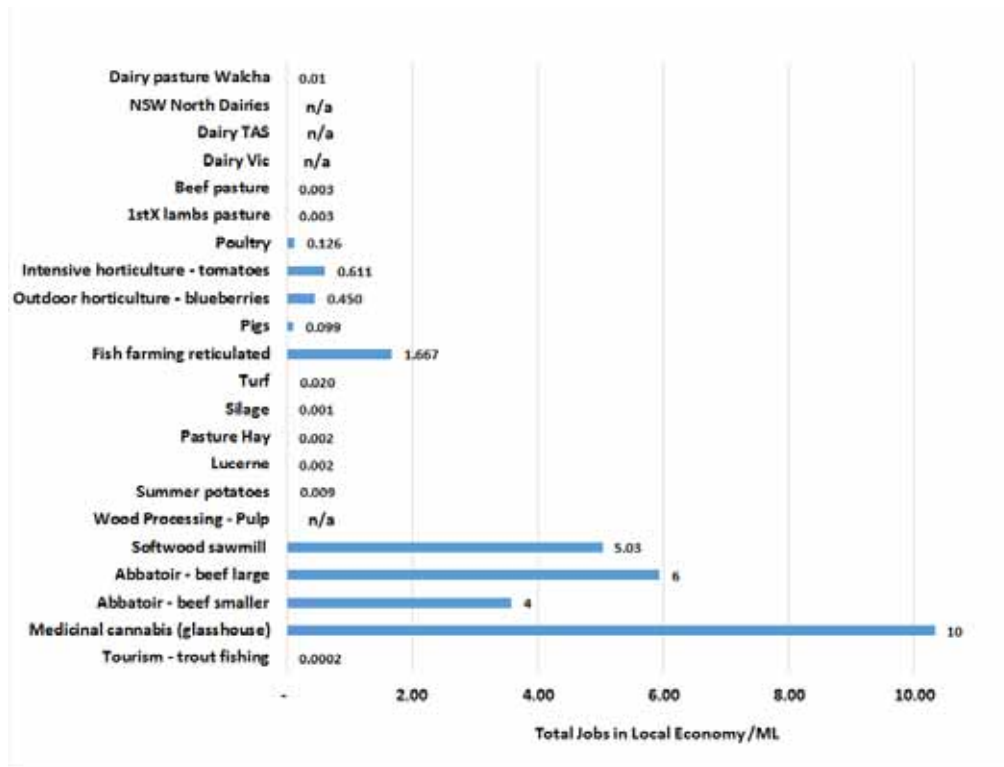
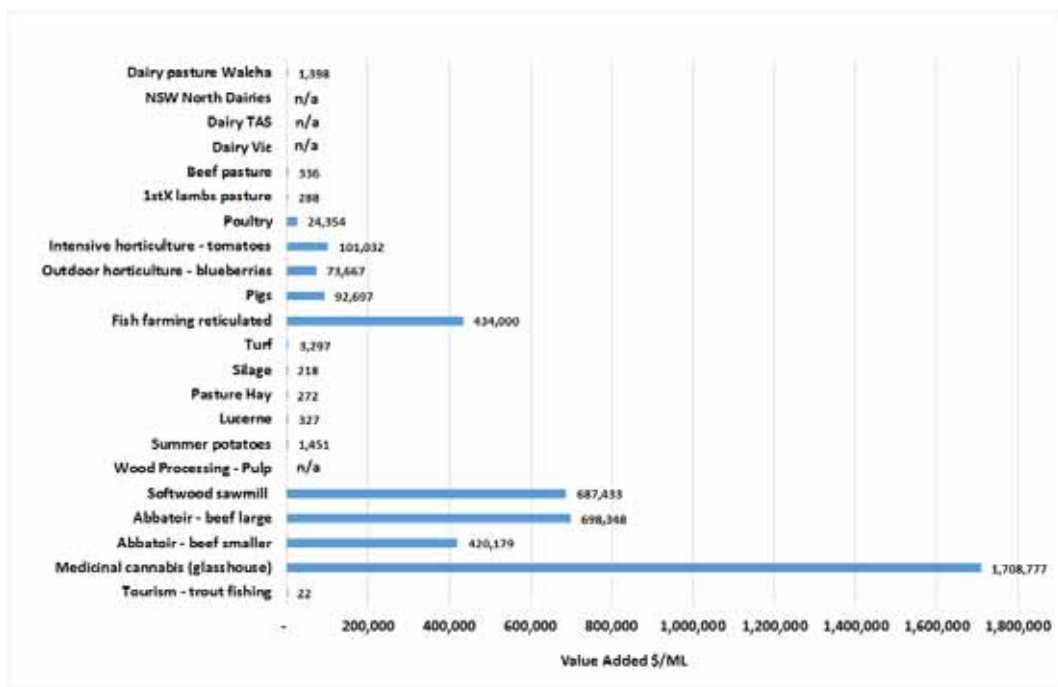


Figure iv. Extra Value-Added per ML of Additional Water



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2. Background to the Problem

Water security has become a critical issue for the township of Walcha, located in the New England Region of Northern NSW (Figure 1). The imposition of water restrictions in the town is frequent, a result of the limited supply and storage capacity associated with the Macdonald River - the towns current water supply.

In the past 10 years, the following water restrictions have been imposed (Walcha Council, 2010, 2016):

- Feb 2007 – Level 2 for 13 days
- Feb 2007 – Level 1, not officially removed
- Dec 2009 - Level 1, not officially removed
- Jan 2014 – Level 3 for 2 months
- Mar 2014 – Level 2 for 2 months
- May 2014 – Level 1 for 6 months
- Nov 2014 – Level 3 for 20 days
- Nov 2014 – Level 3 for 7 months
- June 2015 – Level 2 for 5 months
- Dec 2015 – Level 3 for 1 month
- Jan 2016 – Level 2 for 2 months
- Mar 2016 – Level 3 for 1 month
- April 2016 – Level 2 for 2 months
- June 2016 – Level 1, still in force as of Jan 2017

Figure 1. The Walcha Township and Local Government Area



Permanent water restrictions are significantly impacting the attractiveness of the town to potential new residents and businesses. Maintaining a residential garden or vegetable patch has become increasingly difficult as level 3 restrictions mean that fixed watering systems/sprinklers or hand held hoses are not to be used (Figure 2).

Figure 2. Walcha Water Restrictions Policy 2016

Category	P Permanent	1 Low	2 Moderate	3 High	4 Very High	5 Emergency
Residential Gardens & Lawn Watering	Minimise watering during heat of the day.	Sprinklers restricted to 2hrs per day.	No Sprinklers. Drippers & hoses restricted to 2hrs per day.	No sprinklers, drippers or hoses. Buckets restricted to 2hrs per day.	No watering at any time.	No watering at any time.
Washing Down (including vehicles)	Wash down hard / paved surfaces with high pressure hose only.	Wash down hard / paved surfaces with high pressure hose only.	Hoses restricted to 2hrs per day.	Hoses restricted to 15 mins per day. Buckets restricted to 2hrs per day.	No washing down at any time.	No washing down at any time. Truck Wash Bay closed.
Swimming Pools & Spas	Use pool cover to reduce evaporation.	Permit required for filling pools over 2,000L.	Permit required for filling pools over 2,000L. Top up via hoses only 2hrs per day.	No filling of pools over 2,000L. Top up via buckets only 2hrs per day.	No filling or topping up pools.	No filling or topping up pools.

Source: Walcha Council (2017)

Moreover, there are important business and non-residential users of water in the town whose current activities and scope for expansion are negatively impacted by uncertain future water supply (Figure 3). Many of these perform critical social functions in the town (health, aged care, recreation, maintenance of key facilities).

Figure 3. Large and Residential Water Use in Walcha



In 2014 the Australia government produced a Water Infrastructure White Paper, which resurrected the idea for a dam on the Apsley River as one of 63 potential water related developments (a dam on the Apsley was previously proposed in 1983 but did not proceed, (Shepard 1983)). The Apsley proposal was classified as “**Likely to be suitable for further consideration for possible assistance to accelerate feasibility studies, cost benefit analysis or design**”.

The previously proposed dam site from 1983 is now in a National Park. A new site and the scale of the storage is yet to be finalised, but it would be closer to Walcha and out of the National Park.

Walcha Council has a licence to pump 0.379GL of water from the Macdonald River for town water supply. At present, total water demand (filtered and unfiltered) in Walcha township is 0.206GL in an average year and 0.23GL in a dry year. However, this is above the historical secure yield of 0.108GL/pa available to Walcha from the Macdonald River, which is limited by storage capacity and pumping arrangements (Fernandes 2016).

Secure yield is the amount of water which can be supplied to adhere to the 5/10/10 water supply design system rule which states that:

- Water restrictions are in place for no more than 5% of the time;
- Water restrictions occur on average once every 10 years; and
- During water restrictions, demand is reduced by 10%.

Because secure yield at 0.108GL/pa is well below current demand of 0.206GL/pa, this means water restrictions are likely to be more frequent and thus breach the 5/10/10 rule.

An additional 0.172GL is required for Walcha water supply security to cover dry year situations. Walcha Council had proposed building an additional 0.172GL storage for the existing system, but the recent secure water yield study indicated this would not be sufficient under a 1% climate warming scenario (Fernandes 2016). Hence the community is looking at other options – combined with Councils’ desire to grow the local population by attracting new (and potentially water-dependent) activities to the area.

In terms of irrigation water supply, the total licenced surface water entitlement in the Apsley River Water Source is currently 330.5ML/year (DPI 2014) with just 114 ha authorised for irrigation (Walcha Council 2016). As there is little irrigation in the region, much of this water is used for stock and domestic purposes.

Preliminary estimates indicate a dam on the Apsley River could provide additional water of around 25GL, well in excess of the amount needed to ensure the Walcha township supply security, and an amount which opens the possibility of further water-dependent economic development opportunities for the LGA.

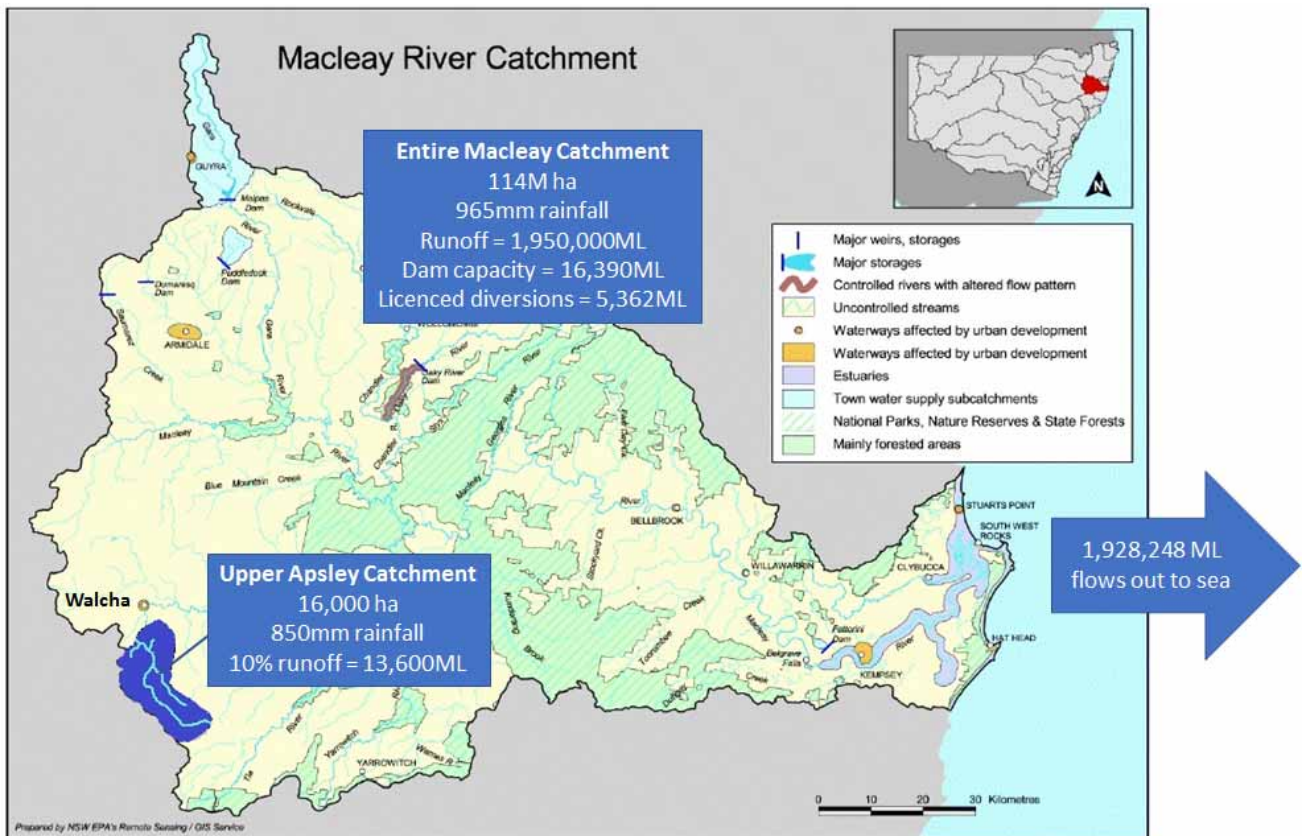
The aim of this study is to explore the potential economic benefits which could arise from that additional water.

3. Study Area

Walcha township is located almost on the dividing range. This means that the small headwater flows in both the Macdonald and Apsley Rivers are inadequate quantities of water for the town's supply. The Macdonald River was initially chosen for the water supply, requiring pumping a limited supply of potable water. A large dam to the south of the town on the Apsley River is now viewed as a possible solution to the supply problem.

Figure 4 shows the Upper Apsley River Catchment where a dam is proposed in relation to the much larger Macleay catchment. There are very few diversions for irrigation and other purposes in the Macleay catchment, with just 0.27% of the water diverted. A 25,000ML (25GL) dam on the Apsley River would have minimal impact on the large volumes of water flowing out to sea at the end of the catchment.

Figure 4. The Apsley and Macleay River Catchments

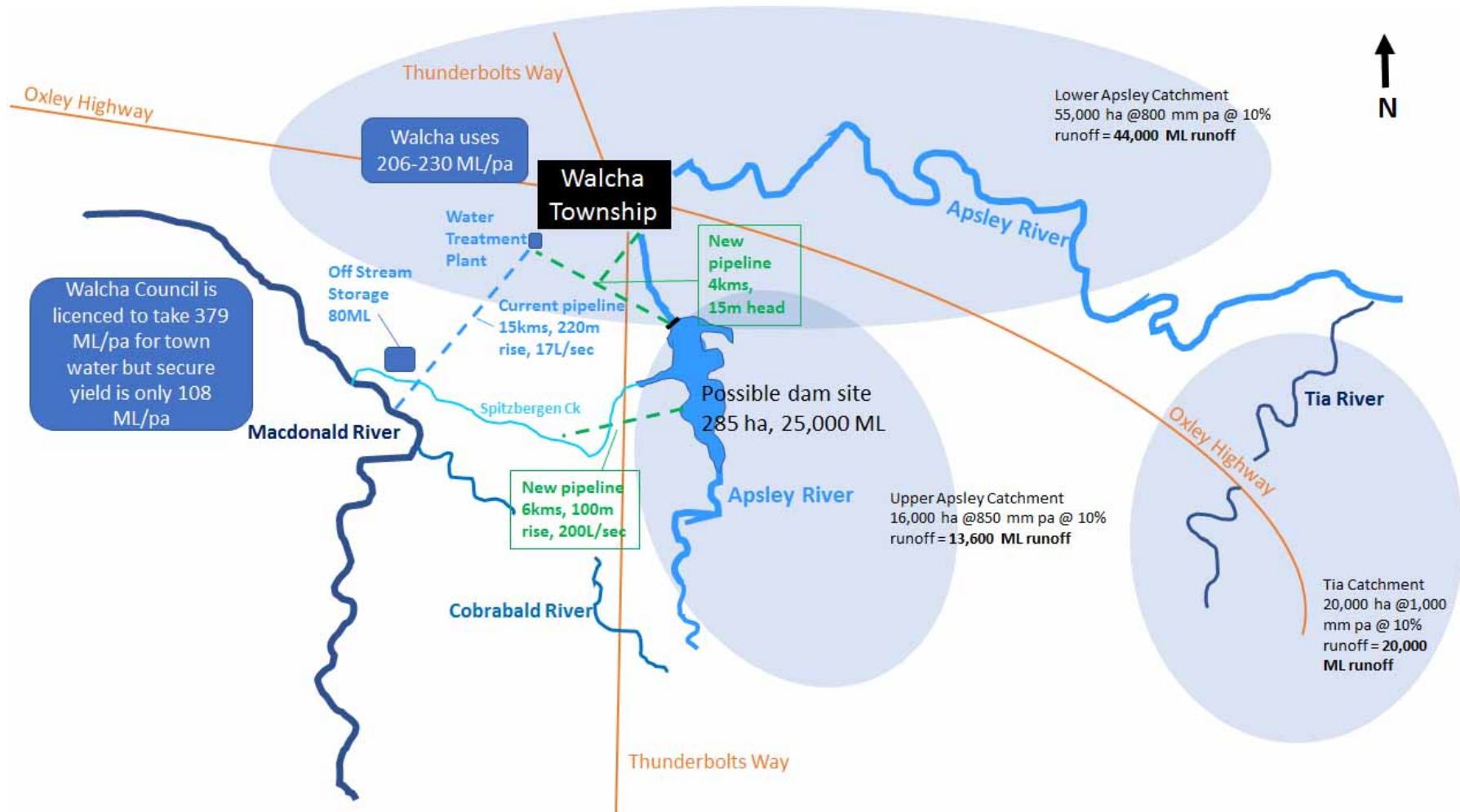


3.1 Community Dam Proposal

Since shelving the original Apsley Dam project in 1983 (see Shepard 1983 for details), a group of local landholders have been investigating alternative dam sites and the possible location of weirs, pumping stations and pipelines to rectify the Walcha water supply problem while at the same time providing additional water for economic expansion – both agricultural (more irrigation, further processing of agricultural commodities) and non-agricultural (industrial/manufacturing activities, expansion of existing businesses such as aged-care facilities). The key features include:

- A dam on the Apsley River just south of the Walcha township which could hold up to 25GL of water;
- Two pipelines from the new dam. One of 4kms length which would gravity feed back into the Walcha Water Treatment plant to become the main source of town water supply, and one of 6kms length feeding into the Spitzbergen Creek, which ultimately flows into the Macdonald river below the current town water supply offtake, thus supplementing flows into the Namoi (Murray Darling Basin). This second pipeline is a more speculative idea, as it does not directly improve the Walcha town water supply problem.

Figure 5. Potential Solutions to the Walcha Water Supply Problem



Source: Rob Blomfield personal communication, 2017

4. Methods

The study is based upon the compilation of desktop data where available (particularly for the Walcha socio-economic profile work and the economic data for new/expanded enterprises based upon an additional water supply.). This is supplemented by interviews and data from local and other sources including:

- Rob and Peter Blomfield – local landholders who have scoped out potential dam and pipeline;
- Tess Dawson - Senior Manager – Water, Sewer & Waste Walcha Council;
- Peter Notman – Walcha Dairy;
- David Miller – DPI Water;
- Lew Hyson – Water and Irrigation consultant, Moonbi;
- Damien Timbs – Walcha agronomist;
- Lewis Kahn – Associate Professor Animal Science UNE, Armidale;
- Todd Andrews – DPI Beef Officer, Armidale;
- Peter Havrlant – DPI Dairy officer, Wagga Wagga;
- Louise Cordina – Cordina Poultry Farms, Sydney;
- Johann Havenga – Green Camel horticulture, Sydney;
- Peter Fitzgerald – UNE;
- Ken Davey – Gwydir Shire Council;
- Peter Smith – Sapphire Irrigation Consultants, Tamworth;
- Jayce Morgan – DPI Piggeries Officer, Tamworth;
- Kerry Kempton – DPI Dairy Officer, Hunter Valley;
- Mick Duncan – Agronomist Armidale;
- Sam Newsome – Agricultural Consultant, Agripath, Tamworth;
- Warwick Fletcher – dryland Lucerne grower, Walcha;
- Wayne Symonds – Nundle Sawmill, Nundle;
- Geoff Duddy – SheepSolutions, Leeton;
- Mike Faulkner – landholder and ex-lucerne grower, Walcha;
- Peter Bennett – lucerne grower, Tamworth;
- Richard Campbell – Potato grower, Guyra;
- David Raison – Turf NSW;
- Chris Sheppard – ex-berry grower, Armidale;
- Barbara Kalz – Koolkuna Berries, Niangala;
- Mal Peters – beef producer, Ashford.

Economic data at the enterprise level was collected to estimate gross and (where available) net returns per ML of water. This provides an indication of the increased economic output which various water-dependent business activities could provide to the Walcha economy.

These figures are then related to the increased ML of water available to estimate total potential increase in direct economic output. The increased gross value of production associated with this output are entered into the REMPLAN software to estimate likely flow-on (indirect) effects.

This is supplemented by IBISWorld industry data and other sources which summarise the key economic features and drivers of potential new industries which could be developed in the Walcha shire.

5. Study Findings

5.1 How much economic stress is Walcha experiencing?

5.5.1 Structure of the Local Economy

The Walcha LGA has an economy which is historically and currently highly dependent upon the fortunes of the agricultural sector– particularly beef and sheep/wool (The comparative socio-economic situation for the Walcha LGA is also reflected in the Australian Bureau of Statistics (ABS) Socio-Economic Indexes for Areas (SEIFA). Walcha is doing marginally better than LGAs of similar population. This was last calculated during the 2011 Census and the results for the comparable LGAs plus the best and worst ranked LGAs in NSW are shown in Figure 8.

The index of socio-economic disadvantage is based upon parameters such as:

- Household income;
- Education/qualifications;
- High or low skilled occupations;
- English proficiency;
- Car ownership;
- Marital status;
- Disability and health conditions;
- Employment status;
- Rent paid.

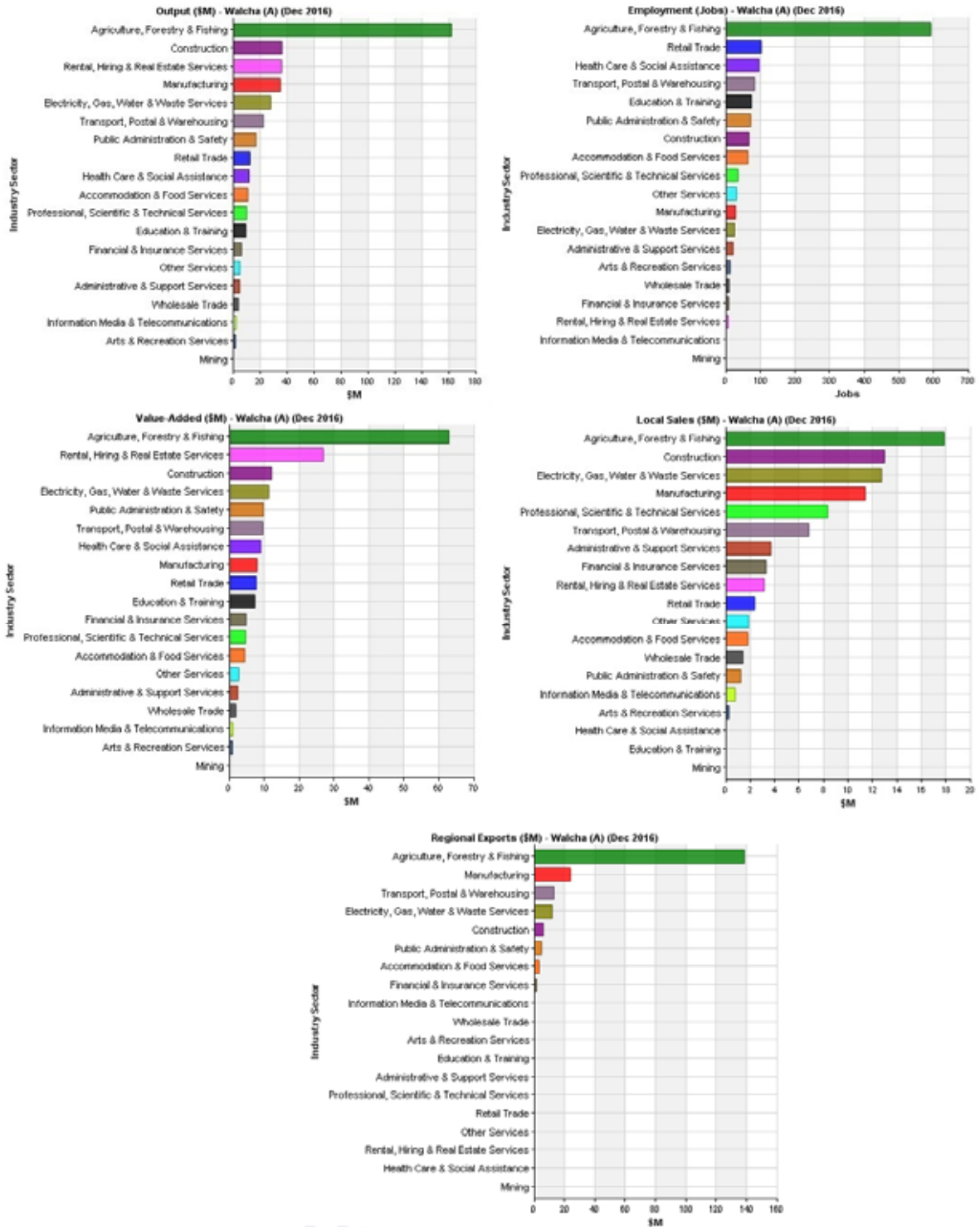
). Drought, climate change and commodity prices have a significant impact on the economy of Walcha.

For this reason, Walcha Shire Council (like councils from most similar sized communities in the region) are seeking ways to diversify the local economy and provide insulation against the vagaries of agriculture.

For some councils (e.g. Gwydir Shire Council), this includes looking for opportunities to value-add agriculture, capturing more economic benefits from the value chain locally, and to use agricultural residues as the basis for renewable energy thus reducing the flow of 'energy dollars' out of the local economy. Similarly, the Walcha community is seeking to generate more agricultural production, and agricultural/non-agricultural manufacturing to diversity the existing commodity base.

Potentially with a new dam, the Walcha LGA could emulate the Gwydir renewable energy direction, though using hydroelectricity instead of biomass energy. Hydroelectricity was in fact the main objective of the original dam in 1983 (Shepard 1983). The only storage option with a proven track record at the utility scale is pumped storage hydropower. It can provide both base load, as well as plugging generation gaps when the wind is not blowing or the sun shining (West 2016). However, this is dependent upon the differential between off-peak and peak/shoulder electricity prices, with the objective being to pump back up to an elevated storage using off-peak electricity, and run the water back downhill to generate electricity for sale at peak/shoulder rates.

Figure 6. Selected Economic Indicators by Sector for the Walcha Shire LGA



Source: REMPLAN (2016)

5.5.2 Comparisons with Similar Size LGAs

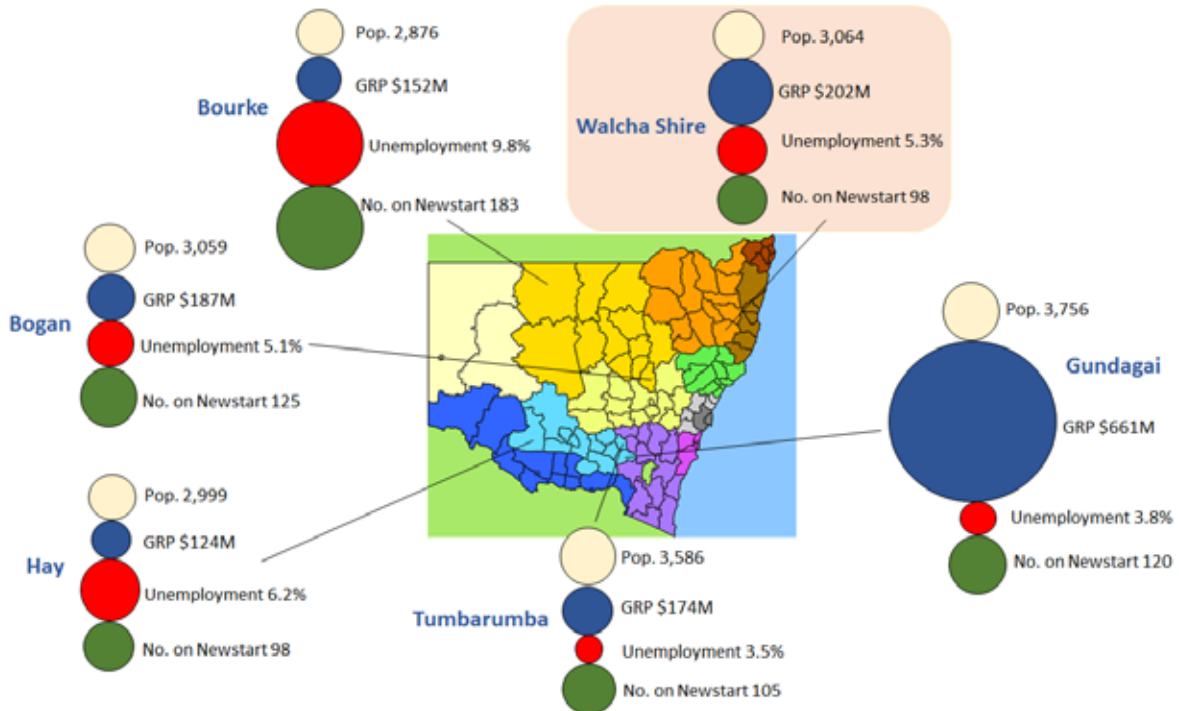
Figure 7 displays some key economic characteristics of the Walcha LGA compared to NSW LGAs with similar populations. It indicates that Walcha is performing quite well in comparison in terms of GRP, unemployment rate and those seeking work (Newstart recipients). However, the standout comparison is GRP for Gundagai which is around 3 times higher than for Walcha. This is likely due to Gundagai's proximity to the Murrumbidgee Irrigation Areas (MIA), and its location on the Murrumbidgee River which receives water from several large dams in the Snowy Mountains Region (Blowering and Burrinjuck). Although limited irrigation occurs in Gundagai itself, it is likely that Gundagai residents have irrigation interests in the MIA areas which provide additional income to the LGA.

The comparative socio-economic situation for the Walcha LGA is also reflected in the Australian Bureau of Statistics (ABS) Socio-Economic Indexes for Areas (SEIFA). Walcha is doing marginally better than LGAs of similar population. This was last calculated during the 2011 Census and the results for the comparable LGAs plus the best and worst ranked LGAs in NSW are shown in Figure 8.

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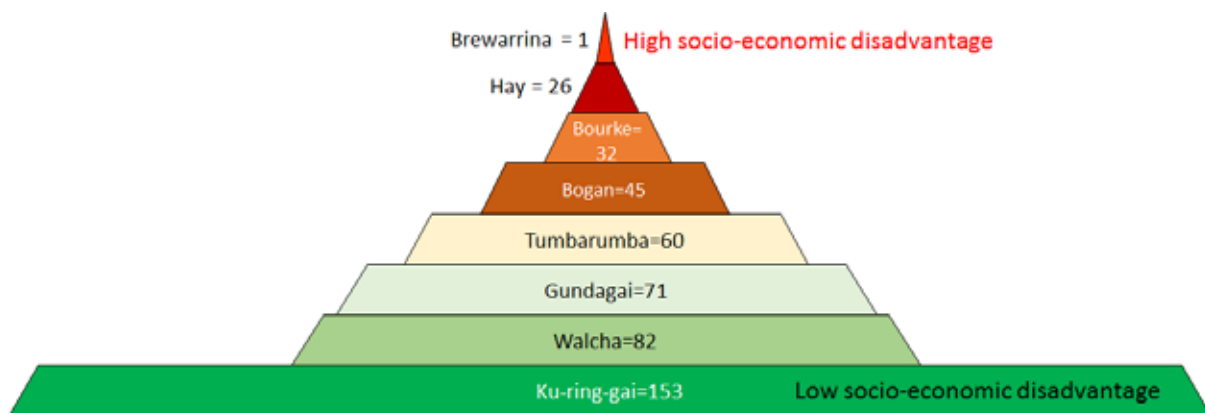
- Household income;
- Education/qualifications;
- High or low skilled occupations;
- English proficiency;
- Car ownership;
- Marital status;
- Disability and health conditions;
- Employment status;
- Rent paid.

Figure 7. Comparison of Walcha Shire with Shires of Similar Population



Sources: .idEconomics (2016), Department of Employment (2016), Australian Government (2016)

Figure 8. Index of Relative Socio-Economic Disadvantage for Selected NSW LGAs

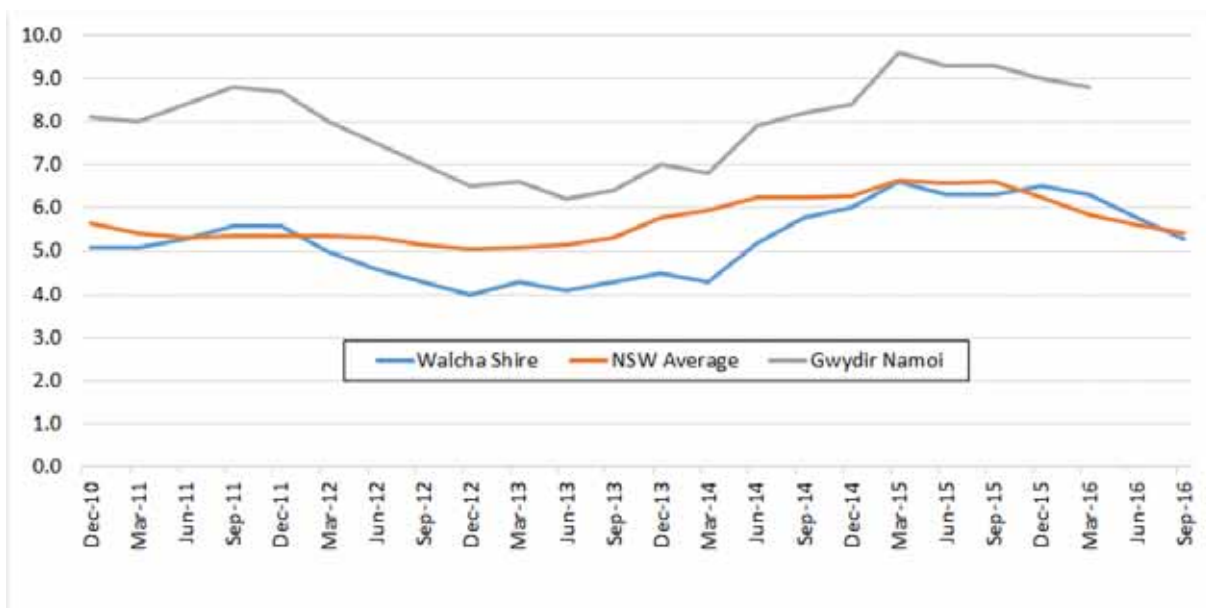


Source: ABS (2013)

5.5.3 Unemployment

Figure 9 indicates the unemployment rate in the Walcha LGA has been similar to the NSW rate for about half of the past 6-year period, but lower during the period March 2012- March 2015. However, it has been consistently below the rate for the broader Gwydir-Namoi region which includes Moree, Narrabri, Lightning Ridge, Walgett and Bingara.

Figure 9. Unemployment Rates (%)



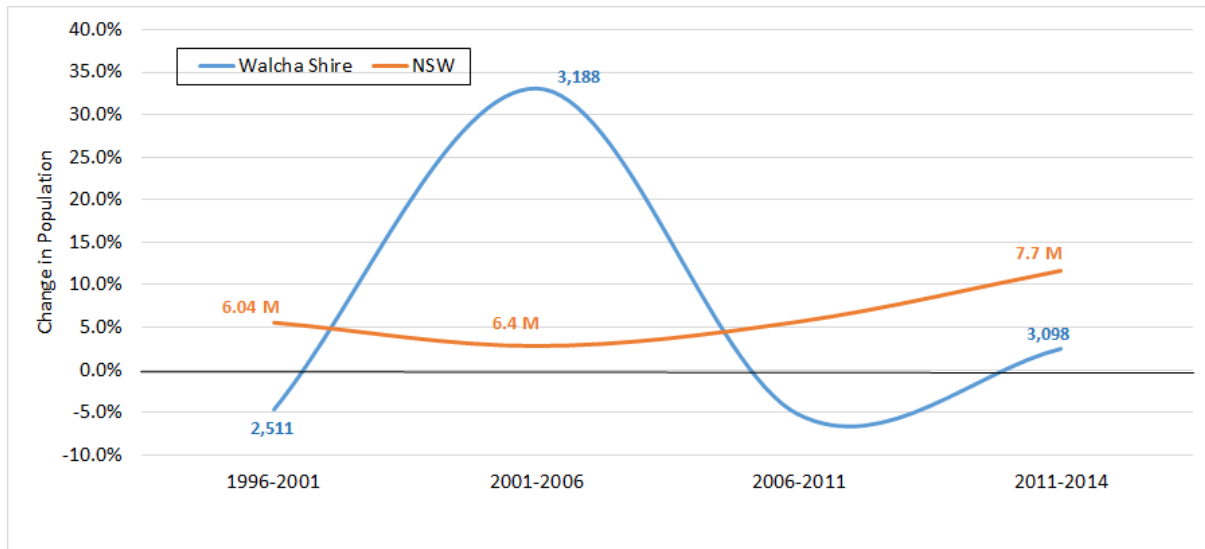
Source: Department of Employment (2016)

5.5.3 Population and Age Cohorts

Compared to NSW which has seen a constant increase (growth always positive) in population between 1996 and 2014, Walcha experienced an increase in population between 2001 and 2006 of a high 33% before the population fell again in 2006-2011 by 5.2%. Recently, there has been a small recovery with population increasing 2.5% (

Figure 10).

Figure 10. Percentage Change in Total Population 1996-2014



Sources: ABS (1996, 2001, 2006, 2011, 2014, 2016)

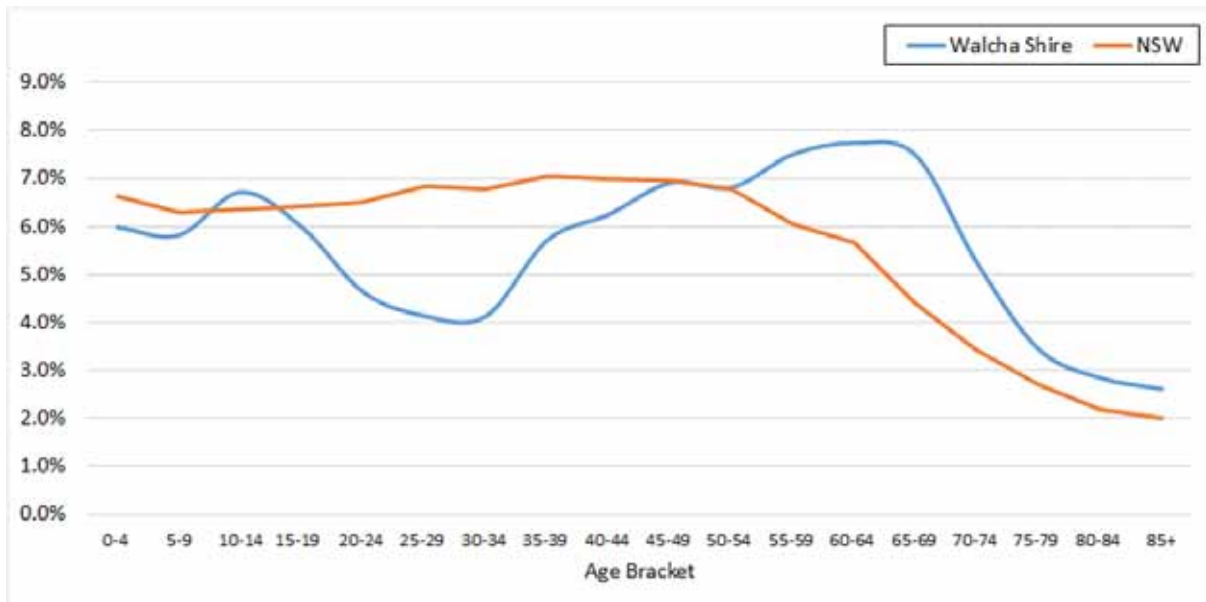
Relative to NSW, the Walcha LGA has a much lower proportion of its population in the key working age categories from 15-45 years of age, and a markedly higher proportion in the older 55-70 (

Figure 11).

This generates socio-economic stress via loss of working-age population from the region, and a smaller number of tax-paying working aged residents left to support the younger and older residents who are not in the workforce. This phenomenon is known as the '**dependency ratio**' and at 46%, that ratio is much higher than for NSW at 32%. Expanding local industry output and diversifying the economy is the primary method for dealing with this problem and generating more local jobs to retain younger age groups.

This situation is probably also the reason for the comparatively low unemployment rate (Figure 9). Younger working-age people are leaving the region and finding employment elsewhere, thus the reported unemployment rate is not as high as might be expected.

Figure 11. Population by Age



Source: ABS (2011)

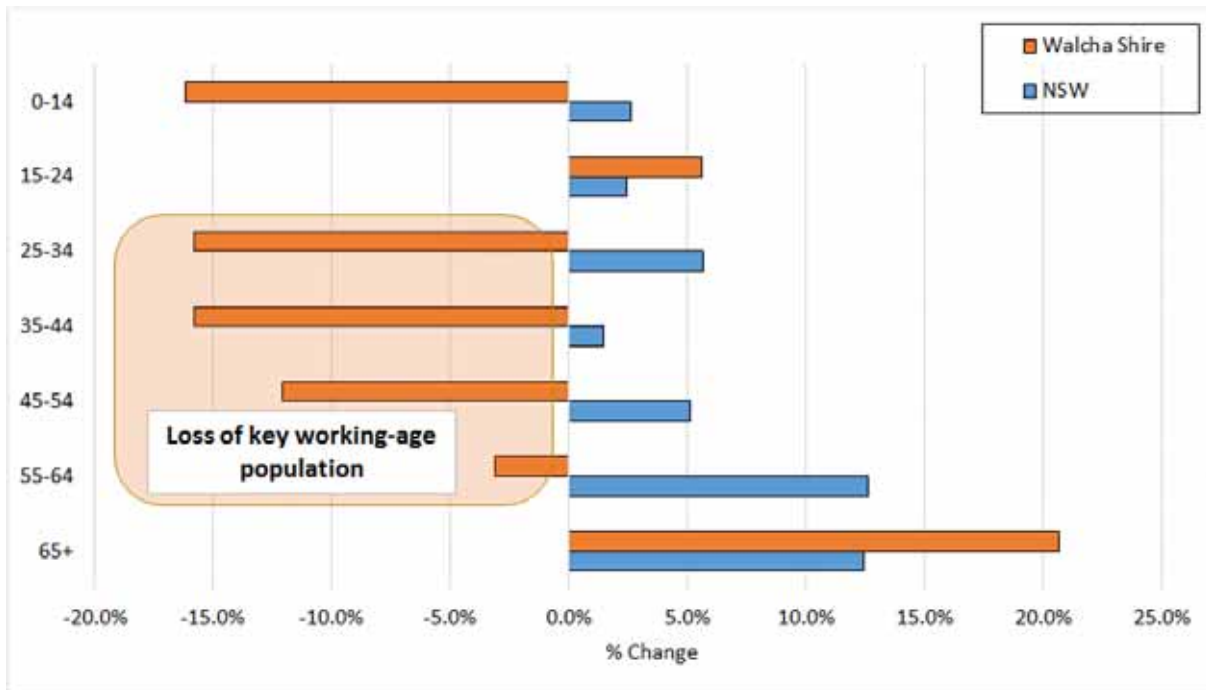
Over the period 2006 to 2011, this loss of key working age people has been quite pronounced with a 15.8% reduction in the 25-34 and 34-44 age categories, a loss of 12.1% in the 45-54 category and the net loss of 170 people in the working age range of 15 to 65 (

Figure 12).

Interestingly, there has been an increase of 17 people in the 15-24 age group during this period, an age group where losses might be expected as young people move away for further education. There has also been an increase in the number of people aged 65 and over.

The loss of working age people from the area is a negative factor for employees seeking staff in their businesses, and an issue that must be addressed should additional water supplies lead to economic expansion. In the nearby Guyra Shire, the issue of finding labour for the newly developed tomato greenhouses has been solved in part by importing overseas workers, mostly from the Pacific Islands.

Figure 12. Change in Population by Age from 2006 to 2011

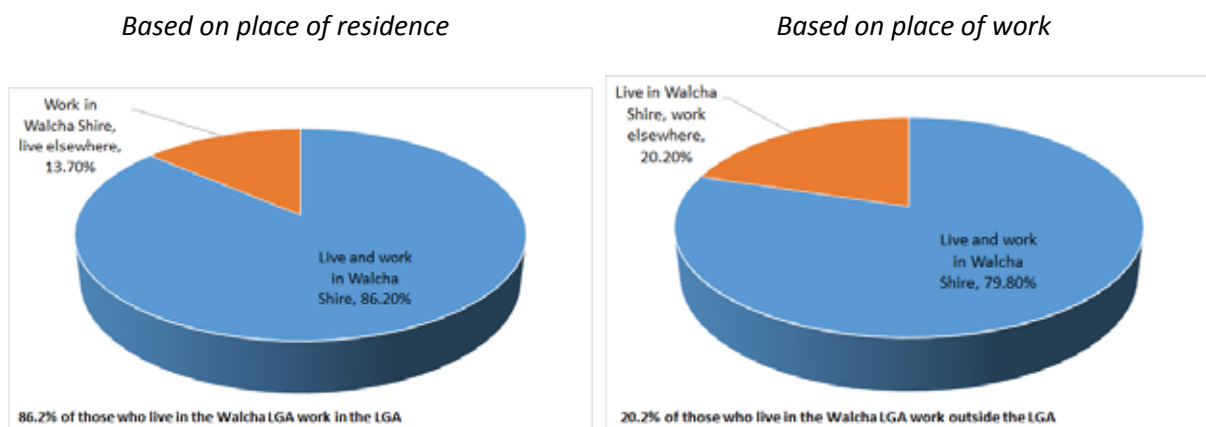


Source: ABS (2011)

5.5.4 Location Factors

There are people who travel into Walcha for work from outside the LGA, and an even higher number who travel out of Walcha to work in other LGAs (Figure 13).

Figure 13. Working In and Out of the Region



Source: REMPLAN (2016)

There may be opportunities to capture the skills of the 20.2% who live in the Walcha LGA but work outside the LGA? Expanding and diversifying the economy through improved water security may assist in this regard.

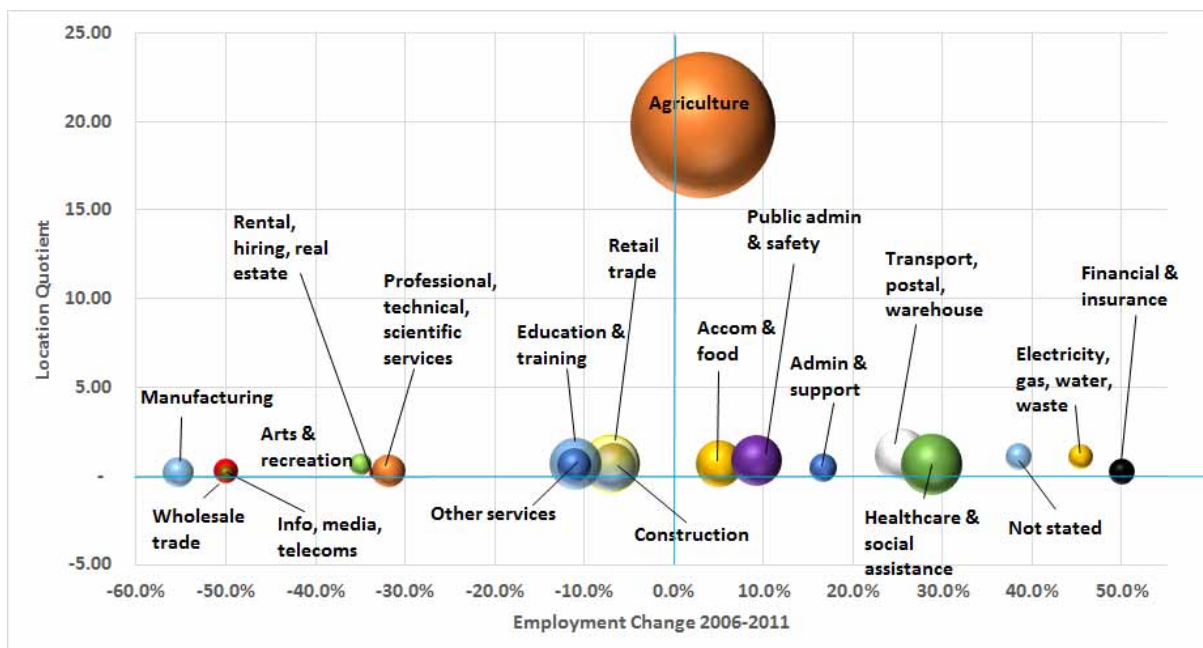
5.2 Recent Industry Trends

Changes in employment by industry are one way of gaining insights into changing industry fortunes.

Figure 14 describes three different elements of the Walcha labour economy:

1. The Location Quotient (LQ) shows the concentration of industry employment relative to NSW as a whole. A high LQ (e.g. agriculture) means there is a high concentration of employment in that industry compared to NSW. An LQ of 1.0 would indicate the same concentration of employment as for NSW;
2. The number of people employed in an industry is indicated by the size of the sphere. A larger sphere means more people employed (agriculture);
3. Employment change 2006-2011. Industries on the left-hand side have lost jobs (e.g. manufacturing and wholesale trade), while those on the right have gained jobs (e.g. financial & insurance).

Figure 14. Walcha Employment by Industry and Changes from 2006 to 2011



Source: ABS (2011)

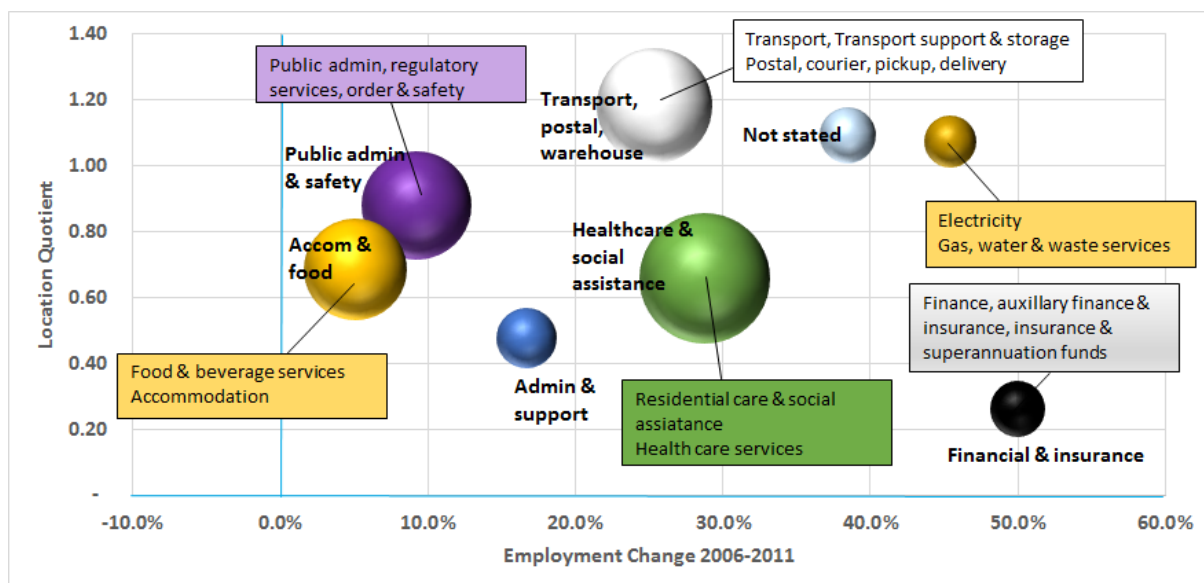
Of interest from a water security perspective is the fact that manufacturing has declined. Manufacturing is one of the key sectors with the potential to diversify the Walcha economy away from its obvious dependence on agricultural commodities. This could include further processing of agricultural commodities (e.g. an abattoir).

In terms of future demand for water, it is the growth industries which are of major interest – those to the right of the 0% line in Figure 14.

These growth industries have been further highlighted in

Figure 15. Most notable from a water perspective is the growing healthcare and social assistance sector which, when combined with an aging population, means increased demand for aged care facilities, which in turn need a reliable water supply (see Figure 3 – the existing nursing home is a major water user).

Figure 15. Industries Which Increased Employment in Walcha from 2006-2011



Source: ABS (2011)

The goal of attracting more processing firms to Walcha will increase the need for a larger, more reliable water supply, as will the development of more intensive agricultural enterprises such as protected horticulture and poultry.

In summary, the Walcha LGA is performing relatively well on the basis of some economic parameters (e.g. GRP, unemployment rate) compared to LGAs of similar population. However, population growth has stalled and is going backwards, and the loss of the younger working-age people from the community is a particular concern. Combined with an aging population, this had led to a significant increase in the dependency ratio. Ultimately, this can lead to economic decline as business turnover falls and they fail to secure suitable labour.

Walcha requires economic diversification and growth to reverse this trend. Water security will be a positive contributor in this regard. A continuing reliance on commodity-based agriculture is not the solution to population loss, which if it continues will see further erosion of services in the town.

Fixing the unreliable town water situation while at the same time providing a larger volume of additional water to attract new water-intensive enterprises and to underpin existing agricultural businesses is a potential solution to reversing population and economic decline.

5.3 Opportunities, Drivers, and Economic Potential

This section documents the potential economic benefits which could be derived for Walcha from new or expanded enterprises and industries which rely on enhanced water supply.

These have been rated based on:

- Gross return per ML of water – in this context, the study refers to the *additional* ML of water supplied from a new dam, not existing water such as rainfall and existing dams;
- Gross margin per ML of water (also based on *additional* water) where available;
- Flow-on effects to the rest of the economy from new/expanded gross output and jobs;

The study also touches on other relevant issues such as:

- Likely capital costs of the infrastructure required to use the additional water;
- Potential water access (licence) and use costs;
- Pumping costs;
- Regulatory issues;
- Alternatives for the Walcha water supply.

A range of agricultural (irrigation) and processing/manufacturing opportunities were examined. Some of the key parameters for these opportunities are provided in Table 1.

The attractiveness of the opportunities has been colour-coded in Table 1 where:

Green = Best returns per ML of water used, likely suited to the area, an opportunity worthy of further consideration;

Orange = Moderate returns per ML of water used, and perhaps suited to the area. May represent an economic opportunity;

Red = Lowest returns per ML of water used, regardless of suitability to the area, or not feasible due to other factors. Unlikely to occur if this is a new industry. Unlikely to provide a large economic boost to Walcha if it is an existing industry.

Table 1. Opportunity Summary

Opportunity Green = most likely Orange = perhaps Red = unlikely/low return	Dairy with irrigation ¹	Steers irrigated perennial pasture ²	1stX lambs irrigated perennial pasture ³	Meat chickens ⁴	Intensive horticulture indoor tomatoes ⁵	Intensive piggery ⁶	Barramundi farming (reticulated tanks) ⁷	Turf farming ⁸
Production or production increase	30L/cow/day	600kg/ha extra beef	600kg/ha extra beef	0.97M birds/ha	600t/ha	1,278kg/ha ^F	33.3t/ha	10,000m ² /ha
Farm gate price	\$0.57/litre	\$3.50/kg	\$3.00/kg	\$0.52/bird ^D	\$3,250/t	\$2.00-3.80/kg	\$9/t	\$5/m ²
Typical water use (ML/ha/pa)	4.52	3.5	3.5	10.98	14	4.79	0.6	11
Gross return	\$11,514/ha	\$2,146/ha	\$2,146/ha	\$387,944/ha	\$1.95M/ha	\$664,725/ha	\$300,000/ha	\$50,000/ha
Gross return per ML of additional water	\$2,549	\$613	\$525	\$35,331	\$139,286	\$138,642	\$500,000	\$4,545
Gross margin	\$6,345/ha	\$1.43/kg of weight gain	\$2.15/kg of weight gain	\$323,784	\$146,250	\$6,932	n/a	\$21,187
Gross margin per ML from additional water	\$1,425	\$314	\$377	\$29,487	\$10,446	\$1,446	n/a	\$1,926
Capital cost of infrastructure (\$/ha)	\$2,500-9,000	\$2,500-9,000	\$2,500-9,000	\$3.86M ^E	\$6M	\$6,000	?	\$2,500-9,000
Capital cost of water licence (\$/ML) ^C	400	400	400	400	400	400	400	400
Water use charges (\$/ML) ^A	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04
Water fixed charges (\$/ML) ^A	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25
Pumping cost (\$/ML) ^B	\$47.50-189.60	\$47.50-189.60	\$47.50-189.60	?	?	?	?	\$47.50-189.60

Table 2. Opportunity Summary (contd)

Opportunity Green = most likely Orange = perhaps Red = unlikely/low return	Silage/hay/ lucerne production⁹	Abattoir – large beef¹⁰	Abattoir – small beef¹¹	Pulp Mill (wood processing)¹²	Summer Potatoes¹³	Medicinal cannabis (in glasshouse)¹⁴	Tourism – trout fishing¹⁵	Intensive horticulture outdoor blueberries¹⁶
Production or production increase	Extra 5t DM/ha	1,000 hd/day, 5 days/wk	177 hd/day, 5 days/wk	262,000 t of paper (Albury)	10t/ha	7.2t/ha	5,500 extra trips for fishing	13t/ha
Farm gate price	313/t	n/a	n/a	n/a	\$600/t	\$4.58M/t	\$172/trip	\$23,333/t
Typical water use (ML/ha/pa)	4.5	3.64 ^G	1.78 ^H	73	3	1.8	88ML/ha in dam	3
Gross return	\$1,563/ha	\$3.99M/ha	\$1.22M/ha	\$4.4M/ha	\$6,000/ha	\$33M/ha	\$946,000	\$304,710/ha
Gross return per ML of additional water	\$300-450	\$1.14M	\$687,500	\$76,923	\$2,000	\$18.3M	\$22	\$101,570
Gross margin	\$180-263/ha	\$279,720/ha	\$45,054/ha	n/a	\$3,300/ha	\$21.9M/ha	n/a	\$83,916/ha
Gross margin per ML of additional water	\$45-66	\$80,000	\$25,375	n/a	1,100	\$12.1M	n/a	\$27,971/ha
Capital cost of infrastructure (\$/ha)	\$2,500-9,000	?	\$682,000	\$3.7M	\$2,500-9,000	\$317,778	n/a	\$105,000
Capital cost of water licence (\$/ML) ^C	400	400	400	400	400	400	n/a	400
Water use charges (\$/ML) ^A	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04	5.80-45.04	n/a	5.80-45.04
Water fixed charges (\$/ML) ^A	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25	3.76-7.25	n/a	3.76-7.25
Pumping cost (\$/ML) ^B	\$47.50-189.60	?	?	?	\$47.50-189.60	?	n/a	?

Sources & Notes for Table 1

1. Peter Notman Walcha Dairy, personal communication (2017), Herbert, L. (2013), Dairy Australia (2017), Notman, P. (2013), Smith (2012).
2. Lew Hyson irrigation specialist personal communication (2017), Auction Plus (2017), DPI (2016a), Lewis Kahn Associate Professor Animal Science UNE personal communication (2017), Damien Timbs Walcha Agronomist, personal communication (2017), AuctionsPlus (2017).
3. Geoff Duddy Sheep Solutions personal communication (2017), Damien Timbs Walcha Agronomist, personal communication (2017), Lew Hyson irrigation specialist personal communication (2017), DPI (2016b), AuctionsPlus (2017)
4. Louise Cordina, Cordina Farms Pty Ltd, personal communication (2017), Qld Government (2016), Ken Davey Gwydir Shire Council, personal communication (2017).
5. Godfrey Dol personal communication (2017), Carruthers (2005), White (2015), Freshlogic (2012).
6. DPI (2005), Australian Pork (2017), Australian Pork (2016a), DPI (2006), Jayce Morgan NSW DPI Piggeries Officer, personal communication (2017).
7. Green Camel Organic Produce (2017), DPI (2017c).
8. DPI (2014), Dave Raison Turf Services Pty Ltd personal communication 2017, Johnston (2013)
9. Damien Timbs Walcha Agronomist, Peter Bennett lucerne grower, Warwick Fletcher lucerne grower (all personal communication 2017), Notman 2009
10. AFR (2015), Hanlon (2013)
11. Hanlon (2013), Felix Domus P/L (2013), ABS (2012)
12. Mullaly (2016), Norske Skog (2014), Insight Economics (2011)
13. Peter Campbell personal communication (2017)
14. Deloitte (2016), Cannabis Benchmarks (2017), Chaitanya (2015)
15. McIlgorm and Pepperell (2013)
16. Wilk and Simpson (2015)
 - A. There is a large variation in the charge depending on whether the system is classified as regulated or unregulated
 - B. Depends of irrigation system and energy source. Assumes electricity costs 35c/kWh and diesel costs \$1.50/litre (from Smith 2012).
 - C. There have been no recent permanent trades in the Apsley system, so this is based on a recent trade in the Belubula system, which is of similar size
 - D. Contract grower rate from Qld Government (2016).
 - E. Grower sheds of 2,250m² @ construction cost of \$386/m², NSW DPI (2015).
 - F. Assumes piggery is on a 100ha site to provide appropriate buffer zones.
 - G. Based on Bindaree Beef 143ha site, Source Hanlon (2013).
 - H. Based on Bindaree Beef and King Island studies (Hanlon 2013, Felix Domus P/L 2013), Walcha cattle numbers and estimated slaughter numbers (ABS 2012) and assuming a 50ha site

5.3.1 Fish (Barramundi/Trout) Farming in Recirculating Aquaculture Systems

Farmed fish represent a niche-market product and although the potential returns per ML of water are very high (\$500,000/ML estimated in Table 1), the risks associated with the technology and market are also high. While the aquaculture industry in Australia is regarded as ‘mature’ (Caruthers 2016), the industry revolves around pond and cage-farmed salmon/trout and tuna, and wild caught fish (Figure 16). Only a small volume of fish is produced in recirculating systems. However, these systems are now being integrated with protected horticulture where the fish waste products can be used as plant fertiliser.

Figure 16. Australian Aquaculture Industry Sectors

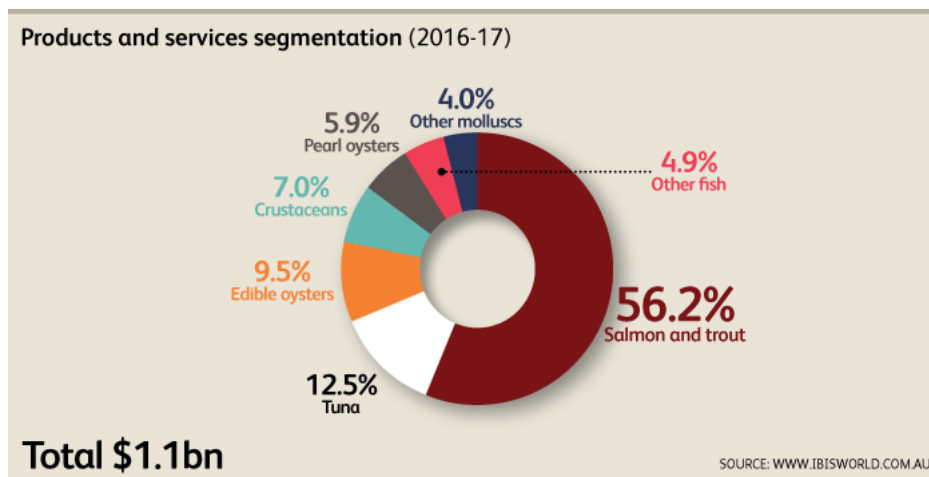


Figure 17 summarises key features of the Australian aquaculture industry. While the analysis indicates the potential for very high returns per ML of water used, this opportunity would require considerable expertise to bring to fruition due to the inherent technical, supply chain and market obstacles which must be dealt with.

Employing the expertise of a company such as Green Camel Organics Pty Ltd who have experience in the industry, and can leverage the economic impacts by combining fish farming with protected horticulture crops would be an option for pursuing the opportunity should sufficient quantities/quality of water be secured.

Figure 17. Key Features of the Aquaculture Industry

Critical features:

- Water quality/temperature paramount else large mortalities
- A high level of time-dependent fixed costs which are independent of biomass
- Sufficient suitable transport from our region
- Finding profitable niche markets (probably not seafood processors)
- No well structured supply chain like cattle & sheep meat
- Inherently complex
- Under-capitalisation a common problem
- Declining wild stocks favour aquaculture
- Increasing competition has been countered by technology/efficiency gains

Major Australian Players:

- **Tassal Group Ltd** – Tasmania, Atlantic Salmon, \$273.1M revenue in 2016-17, 25.1% market share
- **Huon Aquaculture Group Ltd** – Tasmania, Salmon 17,000t fresh pa, vertically integrated with own processing, \$155.8M revenue in 2016-17, 14.3% market share
- The majority of players in the industry are family-owned businesses that do not employ any staff

Economic Drivers:

- Domestic price of fish/seafood
- Seafood consumption
- Demand from seafood processing
- Real household disposable income
- Domestic price of poultry
- Trade-weighted exchange rate
- To compete with imports, often have to seel to speciality markets
- Competing with low-cost imported fish fillets is difficult
- Rising disposable incomes and health perceptions likely to increase demand



Industry Performance:

Revenue – \$1.1B
Profit – \$128.3M
Businesses – 1,121
Exports – \$16.7M
Expected annual growth 2017-22 – 1.7%

Success Factors:

- Site selection – constant access to high quality water
- Site selection – low cost means of treating/discharging effluent
- Must meet production targets to keep customers
- Insufficient or unbalanced filtration the major cause of supply failure
- Prefabricated systems often cheaper, but not reliable, flexible or of sufficient capacity
- Skilled multidisciplinary staff
- Checklists and standard operating procedures
- Must avoid accumulation of flavour-modifying bacteria in the water
- Finding premium (profitable) markets (e.g. live fish for Asian market, restaurant trade)
- Must know not just production but also supply chain costs
- Reliability and quality of inputs
- Processing – where?
- Rising cheap import pressures restricting Australian growth

Sources: Goldman (2014), Cloutman (2016)

Finding: Fish farming, while giving high returns per ML of water used, is a highly technical enterprise which operates in a niche market and requires significant expertise. A critical issue will be access to fish feed and the transport costs to Walcha. It represents a high risk-high return economic opportunity for Walcha.

5.3.2 Irrigated Pastures for Beef Production

Beef production is already a major enterprise in the Walcha region. Local agronomists and irrigation specialists have indicated production volumes could be increased by 600-750kg/ha of live weight gain by adding irrigation (3.5ML/ha) to well-fertilised perennial (improved) pastures.

The relationship between providing additional water to pastures (along with sufficient nutrients) and cattle weight gain has been demonstrated at the Armidale Water Treatment plant, where effluent water is applied via a centre pivot irrigation system to perennial pasture for beef cattle production.

Ten years of data has been collected for this site (Lewis Kahn, personal communication 2017) and the relationship is shown in Burgess 2008) where sheep carrying capacity was at least doubled in converting from native to perennial pasture.

However, as shown in Table 1, the economic benefits of applying the additional irrigation water are low compared to other more intensive agricultural production and manufacturing enterprises. The extra gross revenue from irrigation water is \$613/ML and gross margin \$314/ML. When the cost of a water licence, water delivery and irrigation infrastructure are considered (see Table 4), this may not warrant the investment in irrigated pasture.

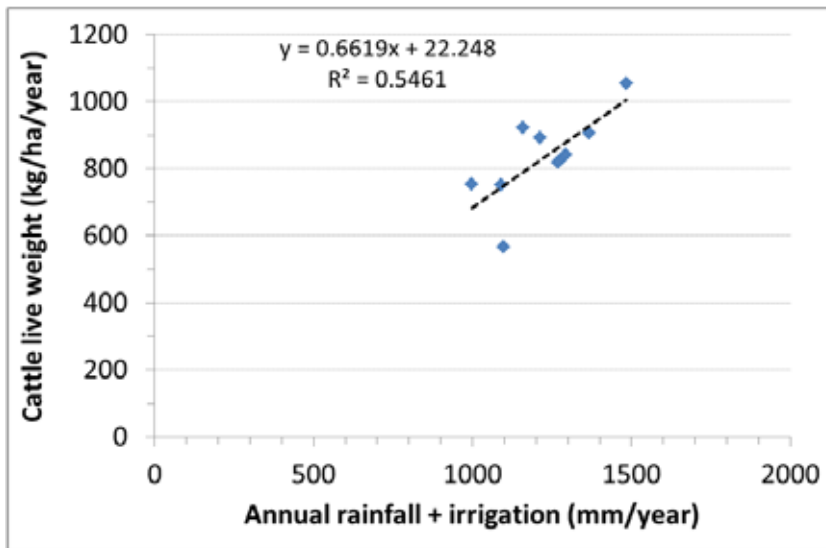
Figure 18. The data showed an average weight gain of around 600kg/ha and this has been used as the basis of the economic return calculation from irrigation at Walcha (a similar climate to Armidale).

On average around 500mm (5ML/ha) was applied annually. Note that this was nutrient laden effluent water, and Dr Kahn estimates this boosted production some 25% over applying straight water. Thus, irrigation of pastures in the Walcha situation would also rely on the landholder supplying sufficient nutrients (fertilizer) to the pastures.

The live weight/carrying capacity response from perennial pastures (though non-irrigated) has also been documented in a Walcha study (Burgess 2008) where sheep carrying capacity was at least doubled in converting from native to perennial pasture.

However, as shown in Table 1, the economic benefits of applying the additional irrigation water are low compared to other more intensive agricultural production and manufacturing enterprises. The extra gross revenue from irrigation water is \$613/ML and gross margin \$314/ML. When the cost of a water licence, water delivery and irrigation infrastructure are considered (see Table 4), this may not warrant the investment in irrigated pasture.

Figure 18. Armidale Water Treatment Plant Cattle Weight Gain



Source: Lewis Kahn, personal communication 2017

The industry is regarded as mature with a well-developed supply chain and a limited ability for product differentiation.

Figure 19 summarises key features of the Australian beef production industry.

Figure 19. Key Features of the Beef Production Industry



Critical features:

- Costs of irrigation relative to returns
- Recent surging export demand
- Live cattle export politics/policy within Asian & Middle East markets
- Fluctuating profit margins due to weather and international prices
- Many producers driven by lifestyle choice as much as profitability
- Health perceptions of red meat compared to fish & poultry
- Rapidly growing organic beef demand, with higher margins for producers
- Labour intensive, but increasing electronic monitoring being applied
- A shift to industry consolidation with larger enterprises and more intensive (feedlotting) techniques
- Product differentiation largely restricted to improving quality, and varying flavours and selective blood lines

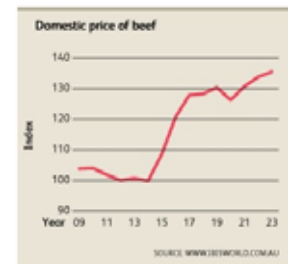


Economic Drivers:

- Annual rainfall
- Trade-weighted exchange rate
- Domestic price of beef (very high lately)
- Beef & veal production
- Demand from meat processing
- Supplementary feed prices
- Rising affluence in Asia
- Recent China, Korea, Japan free-trade agreements

Success Factors:

- **Achieving sufficient production gains**
- **Cost of water (both licence costs and operating and capital costs)**
- Proximity to feed suppliers
- Proximity to markets - access to processing facilities (transport costs)
- Pasture management
- Drought management strategies
- Beef prices – expected to remain strong for next 5 years:



Major Australian Players:

- None – a large number of producers, many small family businesses
- Even large corporate farms are less than 1% of market share

Industry Performance:

Revenue – \$13.4B
Profit – \$5.1B
Businesses – 37,100
Exports – \$1.5B
Expected annual growth 2017-22 – 3.4%

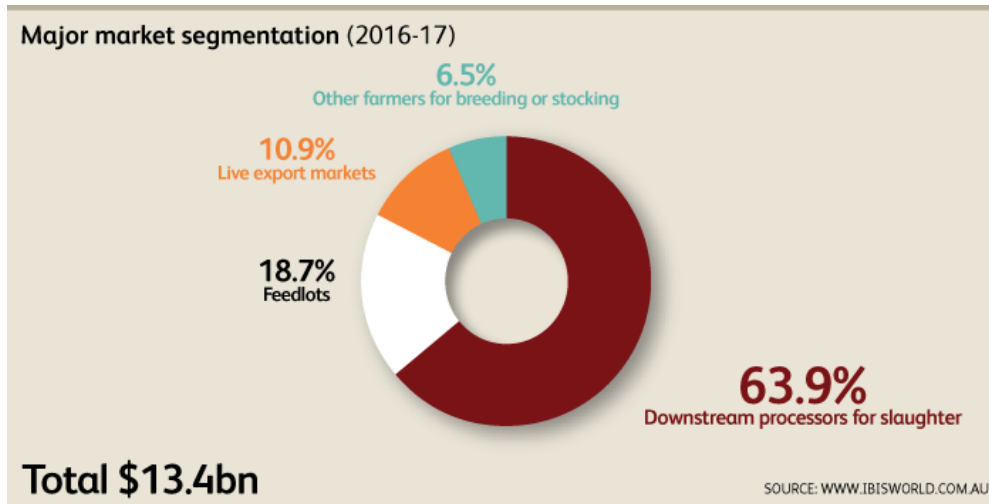
- Food safety standards – important for exports
- Economies of scale to spread fixed costs and reduce per unit costs

Sources: Tonkin (2017)

Most beef cattle produced are sold to processors for slaughter (

Figure 20). Increasingly in the Walcha region this has become a problem, with abattoirs closing and producers lamenting the lack of competition for processor sales and longer transport distances.

Figure 20. Market Segments for Beef



Finding: Irrigating improved pastures on a regular basis to boost beef production (assuming a 600kg/ha liveweight gain production increase) by applying significant volumes of water (3.5ML/ha) appears economically marginal. The additional licencing and irrigation operation costs may exceed the revenue gains unless water can be applied more cheaply, high saleyard prices persist, and weight gains around 750kg/ha can be achieved (which may be possible with high pasture inputs). HOWEVER, opportunistic irrigation of improved pastures to finish cattle when rainfall is poor may have economic merit, so long as irrigation costs are not too high. This would particularly be the case where water costs are low, and/or the landholder already had an irrigation system being used for other purposes on-farm.

5.3.3. Irrigated Pastures for Lamb Production

The lamb situation is similar to beef. It is already a significant enterprise in the Walcha region and local agronomists estimate that access to irrigation on improved pastures with high inputs could increase production by a similar amount to beef cattle. In fact, as sheep are more effective grazers than cattle, the live weight gain of lambs in kg/ha may be higher (Geoff Duddy - Sheep Solutions, personal communication 2017).

However, as shown in Table 1, the economic benefits of applying the additional irrigation water are low compared to other more intensive agricultural production and manufacturing enterprises. Using recent Walcha lamb saleyard prices (\$3.00/kg) the extra gross revenue from irrigation water is \$525/ML and gross margin \$377/ML. When the cost of a water licence, water delivery and irrigation infrastructure are considered (see Table 4), this may not warrant the investment in irrigated pasture.

Indeed, other studies investigating the economics of irrigated pastures for prime lamb production reach a similar conclusion (Davey undated, Ellis and Duddy 2015). Their key findings are:

- It may be economically worthwhile if lamb gross margins are very high;
- It may be economically worthwhile if water costs are very low;
- It may be economically worthwhile if the farmer already has sunk costs in an irrigation system, is using it for other forms of production, and can use it in an opportunistic manner to finish livestock.

The industry is regarded as being in the mature phase of its lifecycle. Figure 21 shows key market segments. Meat processors have expanded as a share of revenue over the past five years, due to strong demand for Australian meat in export markets.

Figure 21. Market Segments for Lamb

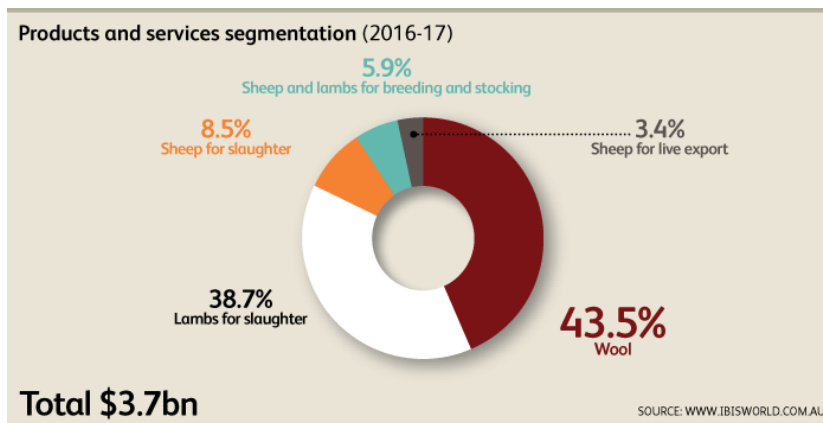


Figure 22. Key Features of the Lamb Production Industry

Critical features:

- Costs of irrigation relative to returns
- Free trade agreements with Japan, Korea and China will boost export demand
- Increasing efficiency means lambs are now heavier at sale
- Increasing preference for lamb over mutton in domestic market
- Farmers can grow lamb out for wool production if wool prices become more favourable than lamb
- Revenue volatile
- Approximately 60% of industry participants are non-employing farms
- Rising disposable incomes overseas, particularly in the Middle East and Asia, will help lift demand for Australian lamb and mutton exports
- High capital intensity relative to labour

Major Australian Players:

- None – a large number of producers, many small family businesses
- The 10 largest sheep flocks account for less than 5% of the national sheep flock

Economic Drivers:

- Wool prices (high = less lambs to market = higher lamb price)
- Lamb prices
- Annual rainfall
- Trade-weighted index
- Sheep meat production
- Relative consumer price of competing meats



Industry Performance (sheep in total, not just lambs):

Revenue – \$3.7B
Profit – \$796.7M
Businesses – 11.710
Exports – \$3.0B
Expected annual growth 2017-22 – 2.0%

Success Factors:

- Achieving suitable liveweight gain
- Cost of water (both licence cost and on-going costs)
- Climatic conditions and cost of supplementary feed
- Online management systems to boost productivity/efficiency
- Superior financial management and debt management
- Proximity to key suppliers
- Proximity to key markets – lower transport costs
- Ability to switch between wool and sheep production in response to fluctuating conditions in the livestock and fibre markets
- Farmers producing premium lambs (e.g. heavyweights) and fine-grade wool can secure higher prices in livestock and fibre markets than those producing lightweight lambs and coarse wool
- Output is sold under contract - incorporate long-term sales contracts from a reliable source of demand

Sources: IbisWorld (2016), Tonkin (2017b)

Finding: Irrigating improved pastures on a regular basis to boost lamb production (assuming a 600kg/ha liveweight gain production increase) by applying significant volumes of water (3.5ML/ha) appears economically marginal. The additional licencing and irrigation operation costs may exceed the revenue gains. **HOWEVER**, opportunistic irrigation of improved pastures to finish lambs when rainfall is poor may have economic merit, so long as the irrigation costs are not too high. This would particularly be the case where water costs are low, and/or the landholder already had an irrigation system being used for other purposes on-farm.

5.3.4 Chickens for Meat

Poultry for meat production in NSW is dominated by a small number of large vertically integrated companies. Most chickens are grown-out by smaller family owned farms on contract for these large companies. Conventional chicken farming in cages in sheds still dominates the industry (

Figure 23).

The growing demand for poultry has created a situation where NSW alone requires another 70M birds produced by 2021 to meet domestic demand. This represents a significant opportunity for contract (or non-contract) growers to grow-out day old chicks to slaughter weight over a 39-45-day period.

Due to the nature of contractual arrangements, contracted growers face lower profit risk than those not on a contract as the company for whom they are growing the birds provides the chicks, food and veterinary supplies, and often technical support. Growers receive a known fixed price for each bird they raise.

However, smaller growers are likely to lose contracts to larger growers as the industry consolidates and bigger operators gain a larger share of the market. The industry is in a mature phase of its lifecycle, with smaller firms being purchased by large operators (Cloutman 2017).

Figure 23. Poultry Meat Market Segments

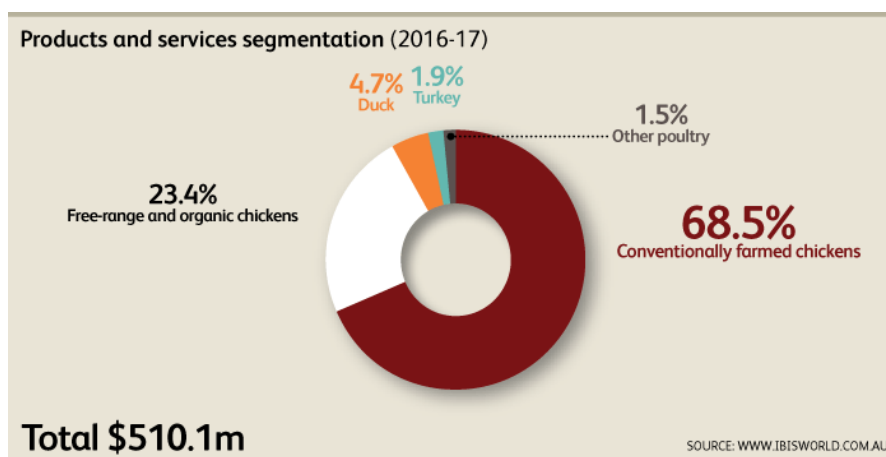


Figure 24 summarises key features of the Australian chicken meat production industry.

Figure 24. Key Features of the Chicken Meat Industry

Critical features:

- Most production dominated by a small number of vertically integrated companies from breeding to processing
- However most growing is conducted on contract basis on family farms
- Biosecurity/disease control – separation of breeding, hatchery and growing locations
- 96% consumed domestically
- Poultry consumption rising due to demand for leaner meat – NSW supply can't meet forecast demand, another 240 sheds (70M birds) needed by 2021
- Aggressive price discounting by major supermarkets has slowed price growth to growers
- Significant growth in free-range production = lower bird densities
- Landuse conflict (odour, noise) an increasing problem
- Typically 6-8 sheds per grow-out farm but now a trend towards large farming complexes owned by corporate growing companies
- Contract growers do not have to pay for feed or health supplies
- Increased automation
- Industry revenue growth will be constrained by supermarket price war
- Very capital intensive

Economic Drivers:

- Demand from processors
- Domestic price of poultry
- Poultry consumption
- Beef price
- Price of feed wheat
- Supermarkets have strong price setting influence
- Grower contracts = less profit risk



Industry Performance:

Revenue – \$510.1M

Profit – \$47.9M

Businesses – 1,047 (318 contract growers in NSW)

Exports – Minimal

Expected annual growth 2017-22 – 1.6%

Sources: Cloutman (2017a), DPI (2015)

Success Factors:

- **Access to feed supplies at the right price**
- Securing long-term supply contracts
- Secure water and electricity supplies are critical
- Achieving suitable liveweight gain
- Disease control & biosecurity
- Grower contract rate – price rises will be constrained
- Growers paid per bird (65-85c) or per square meter (\$63-74)
- Premiums paid to growers who achieve good efficiency and mortality rates
- Maximum 200kms (2hrs) from grower farm to processing plant
- Growers relocating to SA due to difficulties and cost of doing business in NSW (e.g. Inghams)
- For uncontracted growers, price of feed is critical
- Quick adoption of new technologies
- Superior financial & debt management
- Economies of scale

Major Australian Players:

- **Proten Ltd** – 7.7% market share, \$39.1M revenue 2016-17
- **RFM Poultry** – 5% market share, \$25.6M revenue 2016-17
- Inghams and Baiada Poultry are major processors

Finding: Intensive chicken meat production represents a high economic return per ML of water used. The critical issue will be feed supply for the birds. Walcha is not a renowned cereal and coarse grain growing area, so the costs of transporting these items may make it less desirable than areas closer to crop sources. However, there is a concentration of poultry production in the Hunter and Greater Sydney areas, so feed transport costs may not be so critical.

5.3.5 Piggeries

Although the gross return per ML of water used for a piggery is high compared to the other intensive agricultural enterprises examined, the gross margin per ML is lower due to the high level of variable costs involved (Table 1). The gross margin is typically around 5% of the gross return (DPI 2005).

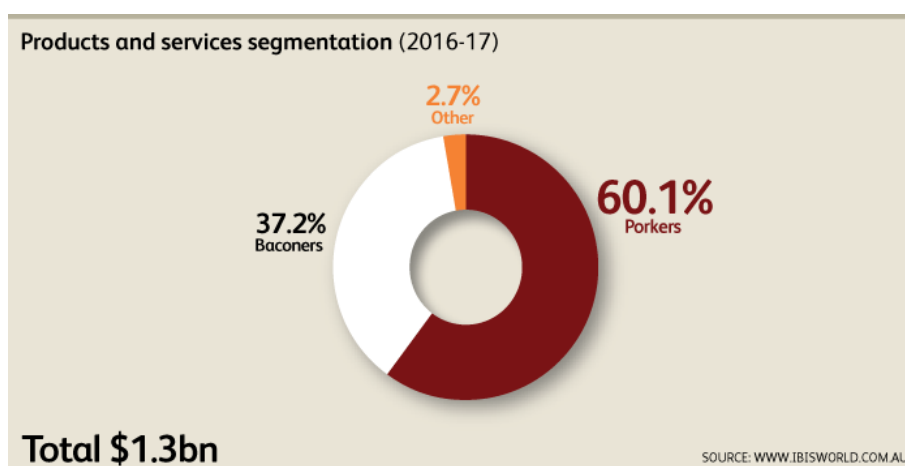
One of the key factors impacting on profitability is the transport distance/cost to a pig abattoir. The closest pig abattoirs to Walcha are in Frederickton (221kms away) and Cowra (565kms). Access to feed supplies within a competitive transport distance is also a major factor.

The increasing demand for Halal certification has become a problem for abattoirs wanting to operate a pig-kill chain, as there are minimum standards for separation of pig and sheep/cattle chains. Many abattoirs find this onerous and costly, and place more importance on retaining their Halal certification, hence drop the pig chain.

Growing consumer concern over pig housing conditions – in particular ‘sow stalls’ which see pregnant sows confined in small cages to avoid fighting – has seen the industry move to phase out sow-stalls by 2017 (Jayce Morgan, personal communication 2017).

The industry is regarded as mature, with little further scope for product differential other than free-range and organic offerings (Cloutman 2017b). The porker segment of the market is increasing at the expense of baconers (used for smallgoods), due to competition from cheaper imported smallgoods products (Figure 25).

Figure 25. Pig Meat Market Segments



Over 60% of industry operators are sole proprietors who employ no additional staff. Just under 35% of industry players are anticipated to hire fewer than 20 staff. Many grow pigs under a contract from

larger food processing companies and other companies in the industry, such as Rivalea Australia (Cloutman 2017b).

Figure 26 summarises key features of the Australian pig meat production industry.

Figure 26. Key Features of the Pig Meat Industry

Critical features:

- Increased pig meat consumption over past 5 years
- Farm prices rising in line with rising feed costs
- Trend towards larger more commercialised production systems for economies of scale
- Many small farms exited the industry as could not secure supply contracts
- Industry concentration will increase
- Consumers expected to buy more fresh as opposed to processed pork
- Rising demand for porkers, slowing demand for baconers due in part to import competition for processed meats (baconer meat)
- Difficult to compete with Canada, the United States and Denmark who benefit from subsidies and economies of scale
- Sow-stall free push will increase costs
- Increased automation, reduced labour
- Pig meat processors increasingly sell directly to retailers, bypassing wholesalers
- Imports of fresh pigmeat heavily regulated due to disease concerns
- High capital intensity

Economic Drivers:

- Domestic price of pig meat
- Pig meat consumption
- Demand from cured meat and smallgoods manufacturing
- Demand from meat processing
- Domestic price of poultry (major competitor)
- Rising feed input costs



Industry Performance:

Revenue – \$1.3B
Profit – \$185.6M
Businesses – 1,063
Exports – \$135.7M
Expected annual growth 2017-22 – 2.1%

Success Factors:

- **Access to feed supplies at the right price**
- High piglet weaning rates (aim for 22-25 piglets/sow/year)
- Feed cost control & scope to pass on rising costs to buyers
- Labour cost control
- Economies of scale
- Domestic pig prices
- Vertical integration
- Access to most recent technology for efficiency
- Proximity to grain suppliers
- Production of a premium product for higher prices

Major Australian Players:

- **Hamsdale Australia Pty Ltd** – 16.3% market share, \$219.3M revenue 2016-17
- **Craig Mostyn & Co Pty Ltd** – 9.9% market share, \$133.1M revenue 2016-17
- **Food Investments Pty Limited** – 6.5% market share, \$87.8M revenue 2016-17

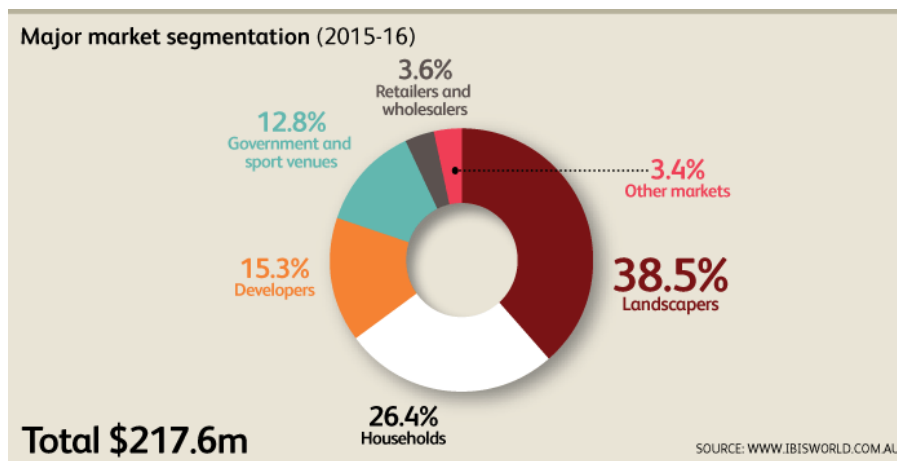
Sources: Cloutman (2017b), Australian Pork (2016b), Jayce Morgan DPI Piggery Officer personal communication 2017

Finding: As for chickens, pig meat represents a high economic return per ML of water used. Again, the critical issue will be feed supply. Walcha is not a renowned cereal and coarse grain growing area, so the costs of transporting these items in may make it less desirable than areas further west. Finding sites which meet environmental requirements will also be important.

5.3.6 Turf Farming

Despite a seemingly favourable gross return per ML of \$4,545 and a gross margin of \$1,926/ML, turf farming is an industry facing many challenges with loss of market demand/share due to changing dwelling preferences and fierce price competition. Figure 27 shows the key turf market segments, and the main ones are highly dependent upon new stand-alone housing commencements and the willingness of the buyer to invest in turf.

Figure 27. Turf Farm Market Segments



Access to large residential and government markets with small transport distances is a key driver of success (Figure 28) and within these parameters, Walcha may be able to service the larger Tamworth (91kms) and Armidale (66kms) markets.

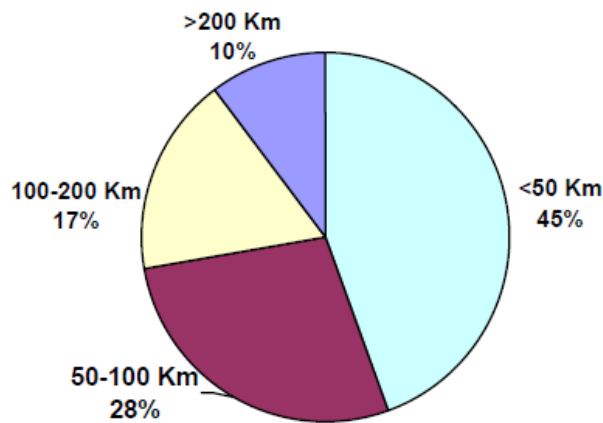
However, there are already established turf suppliers in Tamworth (Thermal Turf King Armidale, Peel Valley Turf, Tamworth Premium Turf in Tamworth). Peel Valley Turf will deliver up to 350kms from Tamworth.

Many in the industry are sole traders with no employees, so the likely economic impact for Walcha could be small.

In recent years, price competition has become fierce with operators undercutting one another, and some unscrupulous activities have emerged with incorrect grass varieties being delivered to uneducated customers etc.

Marketing models brought in from overseas have brought increasing pressure to bear on Australia turf farmers. Erosion of the Plant Breeders Rights system is also a concern (Dave Raison, Turf Services Pty Ltd, personal communication 2017).

Figure 28. Australian Turf Farmer Distance to Market



Source: Haydu et. al. 2008

Figure 29. Key Features of the Turf Industry

Critical features:

- Industry has performed poorly recently with revenue declining at 2.4% pa over 5 years
- Trend to high density living has negatively affected demand
- Artificial turf taking market share
- Small players exiting the industry as profits fall
- Councils encouraging water-saving reduces turf demand
- Revenue has fallen from \$353.6M in 2003-04 to 217.6M in 2015-16
- Industry is 'declining' with little room for product innovation and declining demand
- Turf growers locate near concentrations of residential properties, sporting venues and government institutional buildings to service those populations
- Industry concentration low – four largest growers account for less than 10% of industry revenue
- Half the industry are no-employing sole traders
- Highly competitive industry
- High degree of price-based competition due to the difficulty in differentiating turf products
- Viable area for turf farmer has increased from 2ha to 8ha

Economic Drivers:

- **Availability and cost of water**
- Dwelling commencements
- Consumer sentiment index (discretionary spending)
- Real household discretionary income
- Domestic price of fertiliser
- Tend to be small enterprises and focus on regional markets



Industry Performance:

Revenue – \$217.6M
Profit – \$17M
Businesses – 247
Exports – n/a
Expected annual growth 2016-21 – 1.4%

Success Factors:

- Market price
- Intellectual property over breeding rights
- Water cost
- Access to markets – high demand
- Climate – popular varieties such as Sir Walter grow faster in warmer climates
- A low value by weight product, so can't work with long transport distances
- Perishable, so can't remain on ground or in transit long
- Economies of scale are difficult to achieve
- Quality of the lawn, delivery timeliness and level of customer service provided
- Start-up turf growers must focus on growing marketing presence online to gain market share

Major Australian Players:

- None – 51% of firms employ less than 20 people
- 46.5% employ no-one and are sole traders

Sources: Tonkin (2016), Dave Raison personal communication 2017

Finding: This is a small scale industry facing plenty of challenges. It would not provide a large economic boost for Walcha unless production was of considerable scale. However, in terms of using irrigation water in an extensive situation, it provides relatively good economic returns. An operator in Walcha could find it difficult to service large distant markets, but may find markets in Armidale and Tamworth.

5.3.7 Wood Processing (Pulp Mill)

Paper and cardboard production requires significant amounts of water in the production process (the Norske Skog mill at Albury uses up to 10ML per day to produce 262,000t of paper and cardboard).

Walcha has a substantial softwood timber resource to the east of the region, with softwood being suitable for pulp and paper production. At present, there are supply contracts for 66,000m³ of sawlog out of the Walcha resource (NSW Forestry Corporation, undated).

The total volume of wood (sawlog and pulp) available from the Walcha resource is more than 150,000m³ per year from the public softwood plantations (EDS Consulting 2005) and 60,000m³ per years for 10-12 years from private softwood plantations (Jay 2008). The Albury mill currently uses 374,000m³ of wood per year, which is supplemented with 98,000t of recovered paper (Norske Skog 2014), so it is likely the Walcha softwood resource alone is not large enough to support a world scale competitive pulp mill.

The industry is described as declining due to declining consumer demand (Mullaly 2016). Market segments are shown in

Figure 30.

Figure 30. Pulp Market Products

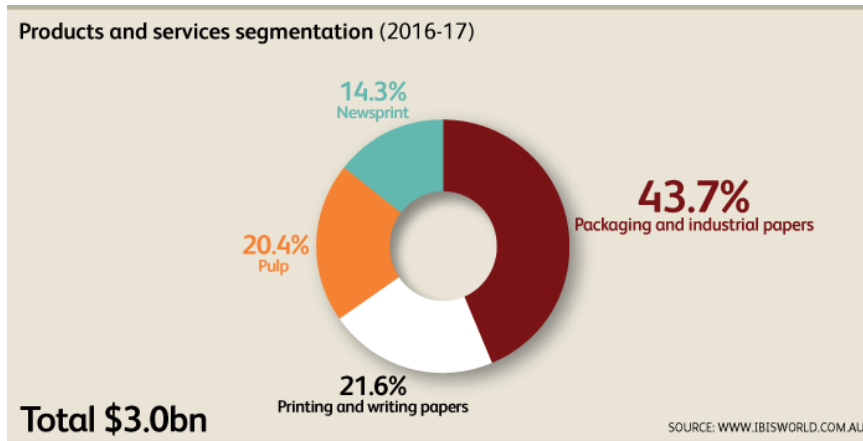


Figure 31. Key Features of the Pulp & Paper Industry

Critical features:

- Demand for products declining especially newsprint paper with digital communication
- Demand for wood pulp in places like China expected to increase, raising pulp prices
- Australian mills use a large quantity of recycled paper instead of wood pulp
- Imports account for a significant proportion (47.8%) of all pulp, paper and paperboard consumed in Australia
- Profit margins have declined over past 5 years due to inability to pass on rising costs
- Upgrades have reduced wages
- Industry is forecast to contract
- Mills using wood located close to forest resources, those using wastepaper situated near major metropolitan areas with easy access to markets and ports
- High barriers to entry
- Difficult to raise finance for this declining industry
- Highly skilled staff needed
- High degree of technological change
- Revenue volatile

Economic Drivers:

- World price of wood pulp
- Demand from printing & packaging
- Trade weighted index
- Environmental issues (government regulation)
- One of the most highly regulated pulp and paper industries in the world = high costs



Industry Performance:

Revenue – \$3.0B
Profit – \$138.7M
Businesses – 136
Exports – \$1.1B
Expected annual growth 2016-21 – minus 0.2%

Success Factors:

- Economies of scale
- Availability of resource
- Contacts in the market
- Reasonably price electricity and water
- Match changing customer requirements
- Investment in R&D
- Recent upgrades and restructuring to stay competitive internationally
- Moving into higher value-added products so as not to compete with cheap Chinese imports (e.g. paper backing for Gyprock)
- Use of recycled material has helped maintain competitiveness in the fact of import competition

Major Australian Players:

- **Pratt Holdings PL (Visy)** – Aust wide & international, \$739.3M revenue in 2016-17, 25% market share
- **Paper Australia Pty Ltd** – Japanese owned, mill in Vic, \$638.6M revenue in 2016-17, 21.6% market share
- **Norske Skog Industries Australia Limited** – Norwegian owned, mill in Albury, \$408.8M revenue in 2016-17, 14.3% market share

Source: Mullaly (2016a)

Finding: This is a very capital intensive industry facing declining demand for its core products. Product innovation and new markets have been essential to the industries survival. It seems unlikely that the softwood plantation resource near Walcha would be sufficient to support a world class competitive pulp and paper mill, unless significant resource could be sourced from recycled paper.

5.3.8 Fodder (Hay, Silage) Production from Pasture or Lucerne

The industry is regarded as mature, with less efficient operators exiting the industry and consolidation of fodder producing enterprises occurring. It is also becoming increasingly mechanised and less labour-intensive (Johnson 2016).

Assuming access to irrigation (4ML/ha) in the Walcha district would increase dry matter production from improved pasture from 10t/ha to 15t/ha (Damien Timbs Walcha Agronomist, personal communication 2017), at current fodder prices this represent a gross revenue gain of \$300/ML for silage and \$375/ML for hay, if the fodder is produced for sale off-farm. As with other extensive farming enterprises, these are low returns compared to more intensive activities.

Information from a Walcha lucerne grower (Warwick Fletcher, personal communication 2017) and a Tamworth Grower (Peter Bennett, personal communication 2017) indicated a similar improvement in yields for lucerne (around 4.5t/ha – lower yields than Tamworth due to cooler climate) from irrigation as indicated above for pasture. It was estimated irrigation requirement would be about half that of Tamworth, so 4ML/ha on average. This would represent a gross revenue of around \$450/ML for prime quality lucerne.

Figure 32. Pasture Fodder Markets

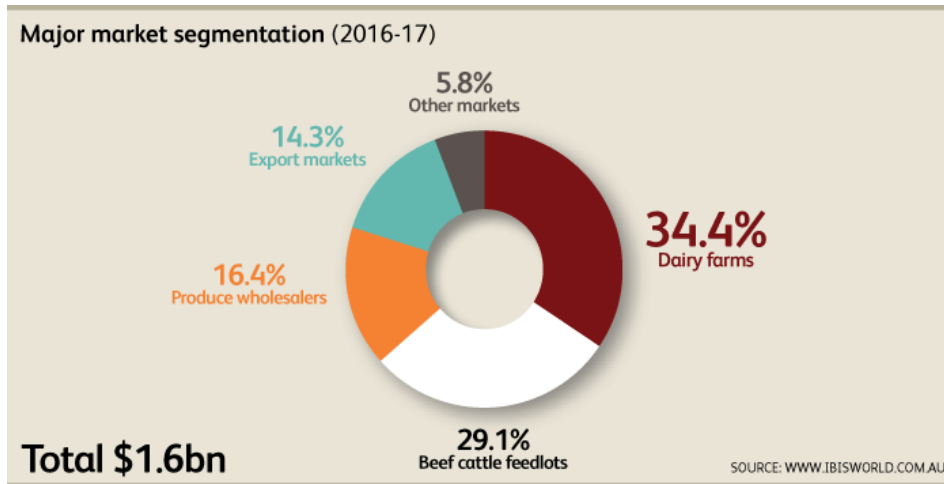


Figure 33. Key Features of the Pasture Fodder Industry

Critical features:

- Demand peaks during adverse weather conditions
- Demand for quality beef and dairy exports among a growing Asian middle class will drive fodder demand
- Feedlots becoming an increasingly important market
- Industry revenue extremely sensitive to amount and timing of rainfall
- Export markets for fodder in Saudi Arabia, United States and Japan developed over the past five years
- Saudi Arabia now the largest destination for industry exports
- Non-employing businesses account for approximately three-quarters of the industry. Farms rely on owner-operators and their families to carry out labour functions
- Consolidation and falling enterprise numbers
- Farm profitability is typically volatile
- Farmers are typically price-takers in the market
- Profit is volatile
- High capital intensity

Economic Drivers:

- Domestic price of wheat feed
- Demand from beef feedlots
- Annual rainfall
- Trade-weighted index
- Demand from dairy farming



Industry Performance:

Revenue – \$1.6B
Profit – \$248.7M
Businesses – 2,111
Exports – 14.3% (\$229M)
Expected annual growth 2016-21 – 7.6%

Success Factors:

- Economies of scale in production to reduce unit costs
- Increased efficiency through investment in capital equipment or better growing techniques is projected to continue, benefiting industry profitability
- Trend toward improved water use efficiency as water allocations are restricted due to environmental concerns
- Growers producing higher crop quality will gain access to growing exports markets, which can significantly boost revenue
- Farmers producing fodder crops of consistent high quality can receive higher prices on wholesale markets
- Farmers that have supply contracts in place with wholesalers or processors can sell crops at a predetermined price during low-quality or low-yield harvest seasons
- Lower production costs

Major Australian Players:

- None – no grower has more than 1% market share

Source: Johnson (2016a)

Finding: Farmers in Walcha have indicated irrigation would allow them to produce more fodder for storage to get them through bad seasons. While this might boost the productivity of individual farms, and provide some additional fodder for sale, it does not represent a 'new' enterprise with the potential to significantly increase employment in the region. However, the gross return per hectare, particularly from growing prime lucerne for sale is on a par with boosting beef and lamb production, though the gross margins appear lower.

There is also concern that the impacts of climate change will mean that irrigation and fodder production are the only means by which existing extensive grazing enterprises can remain viable in the area.

5.3.9 Beef Abattoir

There are potentially around 44,000 head of beef cattle available for slaughter each year from the Walcha LGA, based on beef cattle number from the 2011 Agricultural Census (ABS 2012) and assuming a replacement time for bulls of 4 years, cows 9 years, and a 90% calving rate. While this is an insufficient number to support a large abattoir such as Bindaree Beef at Inverell which processes 250,000 head per year, it could support a smaller local operation, though profitability would be lower as the substantial capital investment and fixed operating costs are not spread over such a large throughput.

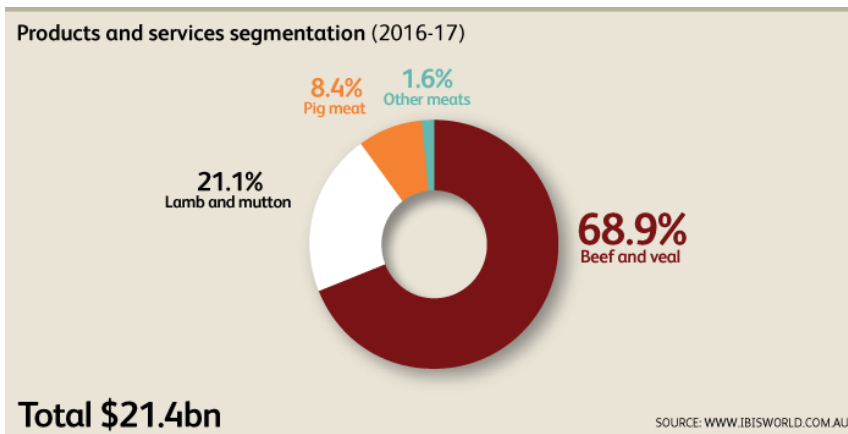
The success of the operation would depend in part on local beef growers processing their stock through the local works, rather than transporting them elsewhere. Reduced transport costs would be an incentive to do so, with typical transport costs being around 8.2cents/km/head on a B-double truck (Stockmaster Tamworth, personal communication 2015).

Although the beef processing industry is regarded as mature, it is experiencing a demand growth cycle as new Asian export markets are emerging which demand a higher quality product and high food safety standards (Tonkin 2017c).

The gross return and gross margin per ML of water used from an abattoir are amongst the highest of the opportunities examined at \$687,500/ML and \$25,375/ML respectively. However, the capital investment required is also high, though not as high as some other intensive processing industries examined here. There is also the cost of obtaining export licences.

Beef and veal production is the cornerstone of the meat processing industry (Figure 34). Demand for beef and veal has soared since 2013-14, underpinned by strong export demand from Asia.

Figure 34. Meat Processing Products



This has pushed up the price for beef and veal products, encouraging farmers to increase turn-off rates to capitalise on higher prices. Despite price increases, export demand has continued to grow overall for the past five years, assisting growth in this segment (Figure 35).

Figure 35. Major Markets for Processed Meat

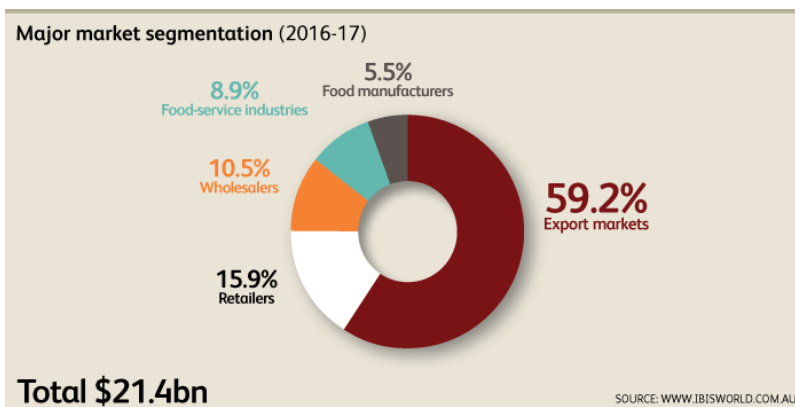


Figure 36. Key Features of the Meat Processing Industry

Critical features:

- Surging export demand has aided the industry recently
- 60% of production exported, largely beef
- New export markets growing in China and the Middle East as meat demand in those countries rises with growing disposable incomes
- Export markets expected to drive growth for next 5 years
- Domestic market will remain stable
- Free-trade agreements signed with China, Japan and South Korea should boost local meat exports to these nations as tariffs are reduced
- Major cafe, restaurant and takeaway chains typically purchase meat directly from large processors
- Small, independent food-service establishments tend to purchase meat through wholesalers
- Supermarkets dominate meat sales at retail level
- Seasonal conditions can mean large variations in stock available for slaughter
- Growing consumer demand for product tracking = more vertical integration from paddock to plate

Source: Tonkin (2017c)

Economic Drivers:

- Domestic price of beef
- Trade-weighted index
- Domestic price of lamb
- Beef-veal production
- Global supply expected to increase over next 5 years increasing competition and reducing revenues
- Established firms will aggressively defend their market shares - can lead to price reductions that are difficult for newly established meat processors to match.



Industry Performance:

Revenue – \$21.4B
Profit – \$2.4B
Businesses – 704
Exports – 12.7B
Expected annual growth 2017-22 – 2.0%

Success Factors:

- Economies of scale
- Raise quality standards and tailor meat cuts to the needs of different market segments
- Access premium export markets
- Value adding through enhanced packaging, premium cuts and leaner selections of meat
- Recently, industry value-added has risen due to rising revenue which has allowed for capital upgrades, and rising beef demand which has increased profits
- Automation reduces costs, particularly those associated with labour
- Contacts within key markets to facilitate favourable deals
- Compliance with required product standards
- Production of goods currently favoured by the market

Major Australian Players:

- **JBS Australia P/L**– International and Australia, revenue \$5.6B in 2016-17, 26.1% market share
- **Teys P/L**– Qld, NSW, SA, revenue \$2.9B in 2016-17, 13.7% market share
- **Thomas Foods International P/L**– Australia & International, revenue \$1.4B in 2016-17, 6.4% market share

Finding: Attracting a beef (or perhaps lamb/pig) processing abattoir to Walcha would provide a very high return on the additional water. However, the capital cost is high and consistent animal throughput would be critical to the success of the operation, meaning local producers would have to commit to supply. With export demand for protein rising rapidly as Asian affluence grows, the market for processed meat is certainly expanding. One problem for an abattoir also wishing to kill pigs is the extra costs associated with meeting the Halal regulations. Consequently, a mixed-species abattoir which includes pigs is more problematic.

5.3.10 Softwood Sawmill

While the Walcha softwood resource is probably too small to support a pulp mill, it may support a smaller softwood sawmill producing seasoned structural pine products as occurs at Bombala in Southern NSW, a town of similar size to Walcha. The Bombala mills uses 300,000m³ of logs per annum (TimberBiz 2013), and it is debatable whether the Walcha/Nundle plantation source could meet this volume, without supplementary logs being brought in from elsewhere.

However, the feasibility of such an enterprise is critically dependent upon the quality of the pine resource. The experience with the Quirindi softwood mill which closed not long after opening indicates the resource may not be of sufficient quality to support a medium-scale mill, particularly one which competes with world-scale heavily automated mills in other parts of Australia and overseas (Wayne Symonds, Nundle Sawmill, personal communication 2017).

The potential gross return per ML of water used is the high at \$1.25M/ML. It was not possible to estimate a gross margin return.

The industry is described as ‘declining’ with businesses exiting and considerable consolidation occurring, especially amongst mid-sized firms who are seeking economies of scale to remain competitive. However, demand for industry assets is still high (Ledovskikh 2016).

Figure 37 shows the growing dominance of softwood in the market as areas available for native hardwood harvest have been removed from production for environmental reasons.

Figure 37. Major Sawnwood Products

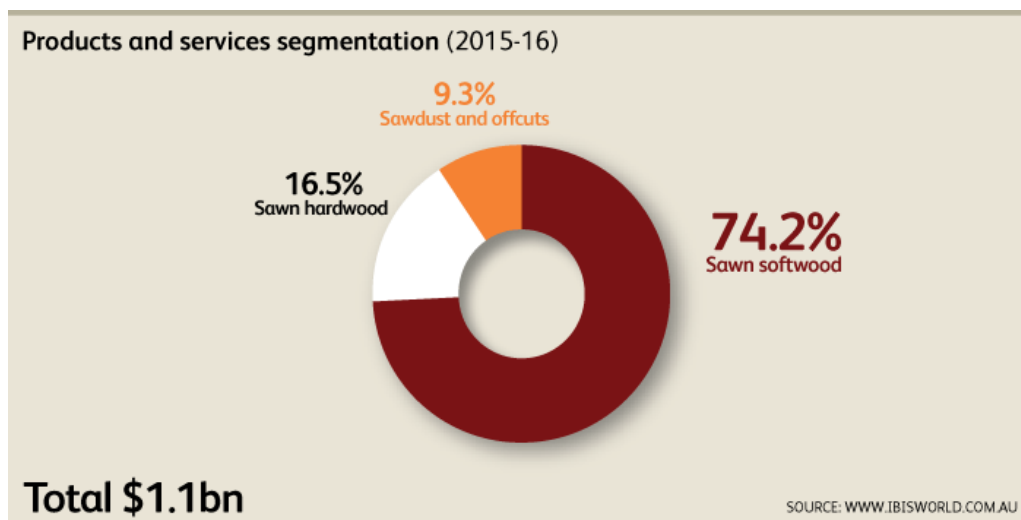


Figure 38. Key Features of the Softwood Sawmilling Industry

Critical features:

- Recent upturn due to more building activity
- More market concentration as Gunns and Elders have exited the industry
- Mid-sized firms have bought assets of failed operators to increase scale
- Greater demand from wood structural component manufacturing firms anticipated
- Higher sawn softwood prices have boosted revenue and profit margins
- Increased competition from timber exporters in New Zealand and North America has reduced export revenue
- A shift away from processing native timbers toward plantation-grown timbers
- Declining log supply likely to drive higher prices
- Declining local sawn timber supply likely to see more imports, especially from NZ
- Increased competition from alternative building products (metals)
- Sawn softwood favoured by downstream industries that use softwood timber due to shorter maturing period for softwood compared to hardwood
- A shift from numerous small hardwood mills to fewer very large softwood mills
- Future log volumes could be a problem
- Medium capital intensity

Source: Ledovskikh (2016)

Economic Drivers:

- Demand from house construction
- Demand from commercial construction
- Demand from timber resawing and dressing
- Domestic price of timber
- Volume of wood harvested
- Weak \$A likely to support exports to Asia



Industry Performance:

Revenue – \$1.1B
Profit – \$157.1M
Businesses – 708
Exports – 63.1B
Expected annual growth 2016-21 – 1.7%

Success Factors:

- Economies of scale
- Sawlog quality (useable recovery)
- The need for an on-going plantation resource (plantation expansion has stalled since the collapse of MIS)
- Increasing automation to reduce labour costs
- Proximity to key markets – transport costs
- Access to logs via long-term supply contracts
- Access to efficient technology
- Access to efficient road/rail transport
- Integrated operations – plantations and mills
- Access to own log supply usually means lower input costs than relying on external suppliers
- Competition is largely on the basis of price
- New entrants must compete on price and quality, unless they can find a regional niche market

Major Australian Players:

- **Carter Holt Harvey P/L** – NZ and Australia, revenue \$105.6M in 2016, 10% market share
- **Hyne & Son P/L** – Qld, NSW, Vic, revenue \$625.6M in 2015-16, 5.9% market share

Finding: Walcha and surrounding areas have a history of softwood and hardwood sawmilling, but restrictions in log supply (hardwoods) and the inability to compete with very large processors (softwoods) has seen the demise of the industry. Attracting a new softwood milling operation to the area would be less about water supply and more about a reliable supply of suitable quality radiata pine logs from the NSW Forestry Corporation. Despite the very high returns and employment prospects for the region, it seems unlikely the resource will support such a mill. However, it may support a mill targeting lower grade (e.g. landscaping) products.

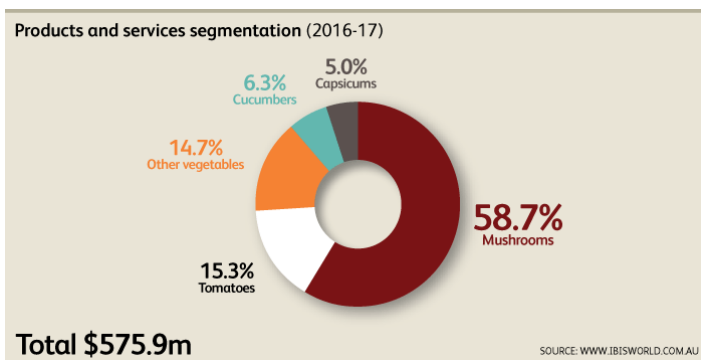
5.3.11 Intensive Horticulture (Tomatoes - Indoors, Blueberries - Outdoors)

Intensive horticulture is already a successful new enterprise in the region with the Costa's Tomato Farm at Guyra. This activity has recently added another 20ha glasshouse to their business and is a significant local employer and boost to the economy.

The examples investigated here is for a similar 20ha tomato glasshouse operation (Godfrey Dol, personal communication 2017) and 20ha of outdoor blueberries (Wilk and Simpson 2015). The returns per ML of water are comparatively favourable - gross revenue \$139,286/ML and gross margin of \$10,446/ML for tomatoes, and gross revenue \$101,570/ML and gross margin of \$27,971/ML for blueberries.

The industry is regarded as mature, but with the potential to build on new technology and product range expansions (Mullaly 2016b).

Figure 39. Major Protected Crops





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Figure 40. Key Features of the Horticulture Industry

Critical features:

- The industry has flourished in the past 5 years
- Closed system provide water and energy efficiencies
- Can produce more constant supply compared to outdoors
- Consumer health consciousness has supported increased vegetable production
- Coles and Woolworths are major customers of large growers
- Wholesalers are being excluded from the supply chain
- Consumer demand trends to be relatively insensitive to price fluctuations
- High technology production system
- Scope for incorporating renewables (bioenergy, solar)
- Large companies are forward-integrated with their own packing and storage facilities and logistics divisions
- Small owner-operated or family-run establishments still dominate the industry
- Hydroponic production is expanding
- Expansion of low-cost retailers (e.g. Aldi) is anticipated to increase competition in supermarkets sector
- The industry's four largest players together account for 66.4% of industry revenue in 2016-17

Source: Mullaly (2016b)

Economic Drivers:

- Demand from supermarkets and grocery stores
- Level of annual rainfall
- Apparent fruit and vegetable consumption
- Domestic price of fertiliser
- Domestic price of vegetables
- Higher price than outdoor vegetables/fruit
- Capital intensive industry



Industry Performance (all indoor crops):

Revenue – \$575.9M
Profit – \$39.7M
Businesses – 843
Exports – n/a
Expected annual growth 2017-22 – 1.9%

Success Factors:

- Economies of scale
- Able to supply reliably to large supermarkets
- Strict quota and quality guidelines if supplying supermarkets
- Proximity to major markets to reduce transport costs
- Ability to pass on cost increase
- Downstream ownership links
- Long-term sales contracts
- Access to a highly skilled workforce

Major Australian Players:

- **Costa Group Holdings Ltd** – Vic, WA, SA, NSW, Qld, revenue \$243.4M in 2016-17, 42.3% market share
- **Perfection Fresh Australia P/L** – Vic, SA, NSW, Qld, revenue \$61.5M in 2016-17, 10.7% market share
- **Flavorite Hydroponic Tomatoes P/L** – Vic, revenue \$48.9M in 2016-17, 8.5% market share
- **Sundrop Farms P/L** – SA, revenue \$28.9M in 2016-17, 5% market share

Finding: Intensive horticulture appears to be one of the most promising options for Walcha, assuming the climatic conditions and transport links are suitable. The return per ML is very high, and the fact that a successful indoor operation already exists at Guyra is encouraging. Berries have also been grown nearby at Niangala and in Armidale. Suitable land close to transport would be required. There may also be a niche for organic horticulture should a site be available that meets the requirements.

5.3.12 Summer Potatoes

Summer potatoes are grown at nearby Guyra which has a similar climate to Walcha. Typically, they are planted in Oct-Nov for harvest in Feb-May.

There are three main markets for potatoes:

1. Whole potatoes, mostly grown for supermarkets;
2. Processing potatoes, mostly used for chip production;
3. Seed potatoes, grown as source-stock for either whole or processed potato growers.

The market for Guyra growers has changed significantly in recent times with the high-quality Sebago variety which used to be the staple for supermarket potatoes now being replaced by several higher yielding varieties (but lower quality in terms of taste). Unlike the Sebago variety where seed was freely available, these new varieties have tightly controlled plant breeding rights, hence seed is difficult for smaller growers to source (Richard Campbell, personal communication 2017).

Consequently, local growers have switched to growing the seed potatoes of the Snowden variety, a processing potato used to make potato chips. These have a similar yield and farm-gate price to whole supermarket potatoes. They can also be grown on lighter granite soils, unlike the Sebago potato which prefers the rich red soils around Guyra.

In terms of irrigation water, timing of rain/water application is more important to yield than the volume. In an average season, potatoes will yield 30t/ha (though as low as 7t/ha in a very poor 1 in 50 type season). With three good watering's of 100mm each over the summer of an average season, the expected yield is 40t/ha. So 3ML/ha of irrigation water would boost production on average by 10t/ha (Richard Campbell, personal communication 2017).

For an extensive crop, the returns from water use are comparatively good at \$2,000/ML gross return and \$1,100/ML gross margin. These returns are based on boosting the yield of a rain-fed crop from 30t/ha to 40t/ha by applying 3ML/ha/pa of irrigation water. However, soil suitability along the irrigable river frontage areas would need to be considered.

Potatoes represent around 18% of all outdoor grown vegetables in Australia (Figure 41).

Figure 41. Key Features of Outdoor Vegetable Industry

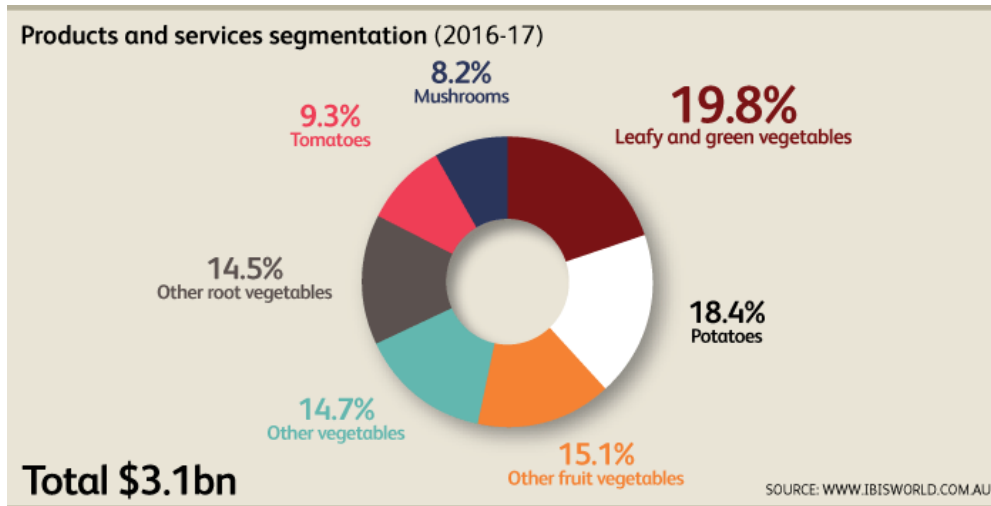


Figure 42. Key Features of Potato and Outdoor Vegetable Industry

Critical features:

- Whole potato market which is dominated by supermarkets has changed to favour high yielding varieties
- Demand dominated by Coles & Woolworths which constrains price and profit
- Increased competition from imports
- Industry consolidation occurring – more large players
- Free trade agreements with Japan, Korea and China will boost export demand
- Increased cool-room storage (3-4mths) has limited supply-induced price spikes
- Potential higher returns from organic potatoes
- Consumer health consciousness has supported increased vegetable production
- Many small family-owned enterprises are non-employing businesses
- Expansion of low-cost retailers (e.g. Aldi) is anticipated to increase competition in supermarkets sector
- Income growth in Asia expected to continue driving growth in vegetable exports over next five years.
- Players compete internally on availability and reliability of supply, and quality and price of produce
- High capital intensity

Economic Drivers:

- Apparent fruit and vegetable consumption
- Demand from supermarkets and grocery stores
- Health consciousness
- Level of annual rainfall
- Domestic price of fertiliser
- Domestic price of vegetables



Industry Performance (all outdoor vegetables):

Revenue – \$3.1B
Profit – \$224.3M
Businesses – 5,488
Exports – \$303.7M
Expected annual growth 2017-22 – 1.3%

Sources: Richard Campbell personal communication 2017, Johnson (2016b), Cloutman (2016b)

Success Factors:

- Economies of scale to reduce unit prices
- Access to seed (plant breeding right issues)
- Access to suitable soils
- Access to refrigerated transport is expanding growing areas away from major urban centres
- Access to supplementary labour during harvest periods
- Establishment of export markets
- Downstream ownership links
- Output is sold under contract - incorporate long-term sales contracts
- Appropriate physical growing condition

Major Australian Players:

- **Mitolo Group** – Vic, SA, <2% market share (potatoes)

Finding: Potato production in Walcha would probably be limited to producing seed potatoes and perhaps processing potatoes as the supply of whole potatoes is dominated by large growers, requires rich red soils, and seed supply is difficult to obtain.

However, assuming suitable land/soils can be found, it appears to be a more intensive use of irrigation water with higher returns than other extensive options. It will require identifying markets for seed potatoes such as those with growers in the Atherton area of Qld or Hillston area of NSW. Transport costs will require consideration.

5.3.13 Medicinal Cannabis

A recent report (Deloitte 2016) revealed an Australian market for medicinal cannabis in the order of 11 tonnes of flower heads per annum. This could be grown under several conditions including outdoors, in a glasshouse or in an indoor warehouse situation. The yields and costs of these options vary significantly and for this study, the figures from a glasshouse situation have been adopted. Cloughton (2017) reports that for security reasons, most Australian companies trialling the crop have been using glasshouses.

Just recently (February 2017), it was announced the Australian legislation will be changed to facilitate the importation of medicinal cannabis to increase Australian supply. This follows changes to Federal legislation last year which legalised the use of medicinal cannabis, with state legislation governing the cultivation of the crop (Anderson 2017).

Supplies are currently imported from overseas (Canada and Israel are key sources), with a few Australian firms now conducting trials. The global cannabis market is worth \$250B (Herbert 2016) and the Australian market is estimated at \$100M per year (Cloughton 2017).

Water use in cannabis varies greatly from 1.8ML/ha for outdoor crops, up to around 25ML/ha for indoor hydroponic crops. A figure of 14ML/ha (same as for glasshouse tomatoes) has been used in the calculations for this study (Chaitanya 2015, O'Hare *et. al.* 2013).

Key production and cost parameters for the crop (under glasshouse conditions) are provided in Table 3.

Table 3. Medicinal Cannabis - Glasshouse, Key Figures

Parameter	Value
Australian market size	11 tonnes
Yield (glasshouse conditions)	180g/m ² /cut (=1.8t/ha)
Cuts per year	4
Area needed to supply Australian market	1.52 ha
Water use	14ML/ha
Price (farm gate)	\$4.58M/t
Price (retail, manufactured product)	\$7.5M/t
Variable costs	\$11.1M/ha

Medicinal cannabis provides the largest return per ML of water applied of all the enterprises examined at \$2.3M/ML gross revenue and \$1.56M/ML gross margin. However, the Australian market is small in terms of the area needed to supply (only 1.52 ha of glasshouse) and this could easily be met by a small number of growers, or even a single grower.

Figure 43. Key Features of the Medicinal Cannabis Industry

Critical features:

- Recent changes in legislation to legalise cannabis for medicinal use – but it is still highly regulated
- Changes in legislation pending to boost imports for supply
- Doctors must apply to be Authorised Prescribers or apply through the Special Access Scheme to be allowed to prescribe to patients
- Large-scale production overseas (Canada, US, Israel)
- First Australian harvest has already occurred in Victoria to treat epilepsy sufferers.
- Clinical trials on efficacy still being conducted and may impact wider demand
- Will crop cultivation and manufacturing of final product occur in the same location?
- Governments prefer non-metropolitan locations for cultivation for security purposes
- Currently, doctors must get approval through the Therapeutic Goods Association to prescribe cannabis
- New legislation will mean easier importation in bulk and local storage
- Long-term effects of the drug are unknown

Economic Drivers:

- Demand from patients
- Regulatory hurdles
- Ease of prescription by medicos
- Trade-weighted index
- Import competition
- Ease of patient application process
- Retail price and inclusion on the Pharmaceutical Benefits Scheme



Industry Performance:

Revenue – \$100M
Profit – \$66M?
Businesses – none in Australia yet
Exports – n/a
Expected annual growth – unknown

Success Factors:

- Capacity to meet strict safety, quality and security standards
- Capacity to secure a production licence
- Yields and costs
- What happens to import rules once a domestic industry is established?
- Access laws to medical cannabis vary by state/territory
- Outcomes of future research into efficacy and side-effects
- Currently only 23 authorised prescribing doctors in Australia – 3 in Qld, 20 in NSW
- Potential inclusion on the Pharmaceutical Benefits Scheme

Major Australian Players:

- **None** – some production commencing in Victoria, some companies conducting trials. A WA company has produced its first crop in Chile.

Sources: Anderson (2017), Herbert (2016), Deloittes (2016), Collett (2017), Scarr (2017)

Finding: Medicinal cannabis is the most profitable use of water for Walcha in terms of both gross revenue and gross margin per ML of water used. However, the Australia market is very small (11t/pa) which could be met from a very small area of either indoor or outdoor production. The industry is also heavily regulated with security being a key issue.

Now that legislation around the use, importation and cultivation of medicinal cannabis is starting to be developed and relaxed, this is expected to become a highly competitive space. Several Australian firms already have a head-start in Vic and WA with cultivation/manufacturing trials.

The ultimate economic feasibility of the venture will also be closely tied to medical research findings into the efficacy and safety of the drug.

5.3.14 Tourism – Trout Fishing

Using the community proposed dam size of 25GL, a dam of this size would generate significant opportunities for recreational fishing tourism in the Walcha region. This would complement existing trout and bass fishing streams in the area. Trout would likely be the most suitable recreational fish species for a new dam due to the cold winter temperatures, though bass may be possible.

The dam as proposed would be around 5.5km long and up to 1km wide which would give ample space for both shore-based and watercraft-based angling.

Unlike the other enterprises where water is being consumed/recycled within the activity and it is possible to estimate a return per ML used, the fishing impacts have been based upon a 25GL dam water covering an area of approximately 285ha (or 88ML/ha).

A study of the economics of recreational fishing in NSW (McIlgorm and Pepperell 2013) revealed the following impacts from recreational fishing in inland NSW:

- Average days fished per year – 14.6;
- 11.6 million fishing days in NSW in 2012;
- Travel expenditure per freshwater trip \$138 (\$149 inflated by CPI);
- Equipment expenditure per freshwater trip \$215 (\$232 inflated by CPI);

- Total annual expenditure in NSW inland recreational fisheries \$131M (\$141M inflated by CPI - \$81M on travel, \$33M on fishing equipment, \$27M on boating);
- Every \$1M of fishing expenditure generated \$1.4M of output;
- Every \$1M of fishing expenditure generated \$0.59M of value-added;
- Every \$1M of fishing expenditure generated 6.1 jobs.

In 2014, total tourist visitation to the Walcha LGA was 110,000 (Destination NSW 2014). For the purposes of estimating the potential fishing tourism impacts to the region, it has been assumed this could be increased by a further 5% (i.e. 5,500 more visitors), each spending \$149 on travel in the Walcha region, and 10% or \$23 of their equipment expenditure in the region.

This is a total additional expenditure of \$946,000. It would generate for the Walcha economy:

- \$1.32M of additional output;
- \$0.56M of additional value-added;
- 5.8 additional jobs.

Figure 44. Key Features of Recreational Fishing Tourism

Critical features:

- Recreational fishing is gaining in popularity
- Fishing equipment prices are falling
- Regions must get a reputation as fishing destinations to attract large numbers of fishing tourists (e.g. NZ South Island, Wanaka, Queenstown, Gore)
- Important to have activities/facilities for other family members to maximise visitation
- Lack of nearby fishing tackle store and expertise (e.g. fishing guides) is an issue
- Will motorised watercraft be allowed on the dam? This will have a big impact on fishing visitation.
- How will the level of dam draw-down impact on fishing opportunities.
- Will private-property access need to be negotiated with local landholders?
- Future cost of fishing licences

Economic Drivers:

- Disposable income
- Expenditure per visitor
- Capacity to attract a wider cohort of visitors
- Exchange rate (international anglers)
- Capacity of local businesses to cater for extra visitors



Industry Performance (NSW):

Revenue – \$141M (inland NSW), \$1.75B (all of NSW)
Profit – ?
Businesses – ?
Exports – n/a
Expected annual growth – ?%

Success Factors:

- Number of visitors
- Access to local support services (accommodation etc.)
- Success of the fishery (fish numbers, size)
- Activities and facilities for non-anglers
- Reputation as a fishing destination
- Level of customer service
- Access rights to the dam/river
- Regulatory factors (biosecurity)

Major Australian Players:

- **Snowy Mountains Area**
- **Tasmania**
- These two areas are the most renowned for trout fishing tourism in Australia. The New England area (Armidale, Guyra, Ebor, Walcha, Glen Innes) is also a popular destination though the quality of the fishing is not regarded as being as good

Source: McIlgorm and Pepperell 2018

Finding: Recreational fishing which attracts an additional 5,500 visitors to the Walcha LGA each year would have a minor economic impact, less than irrigating existing grazing activities.

However, if a dam of sufficient size is built, it is a relatively low-cost exercise for NSW Fisheries to stock it with trout or bass, and the extra visitation this could bring would be welcome expenditure in the town.

It would require considerably more effort and investment to build the supporting infrastructure (accommodation, other attractions etc.) which could entice anglers' family and friends to the region.

The reason why destinations such as Queenstown in NZ and Jindabyne in the Snowy Mountains are such renowned fishing locations is because of the range of other activities also available there.

5.3.15 Dairy Cattle

Walcha already has a dairy which operates utilising perennial ryegrass pastures, but with limited irrigation. The published figures for the dairy (Herbert 2013) indicate relatively high returns of \$2,547/ML gross revenue and \$1,424/ML gross margin. These appear to be double the figures for other dairies in northern NSW, Vic and Tas (Kempton 2016, Waterman 2016, Griffiths 2013).

Irrigation of perennial pastures is likely to increase dry-matter production from 10 t/ha to 15t/ha, a 50% increase (Damien Timbs, personal communication 2017).

The industry is regarded as mature, with domestic revenue growth being supported by the development of speciality milks such as organic and A2. Consolidation means the number of dairy farms has halved in the past 20 years. Efficiency improvements has increased the average milk yield per cow (Tonkin 2017d).

Figure 45 and Figure 46 show major product and product buyer segments. Milk cannot be sold directly to consumers as it requires some degree of processing first. Almost all fresh drinking milk is consumed domestically, though trials of fresh milk sales to China look like expanding that market.

Figure 45. Major Dairy Product Segments

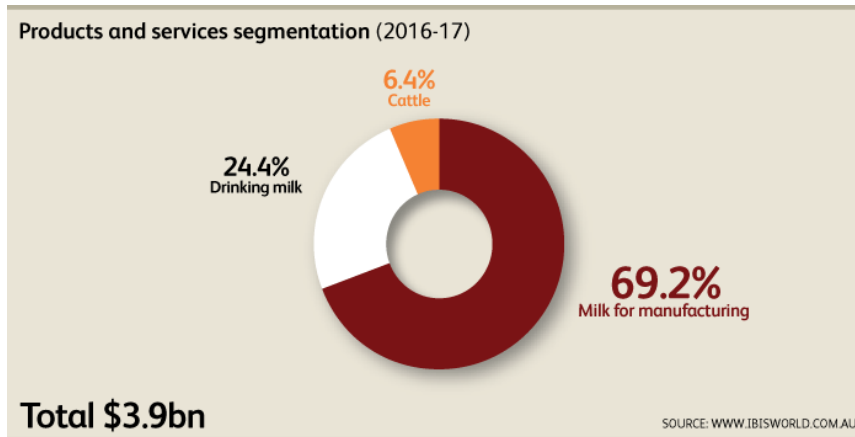
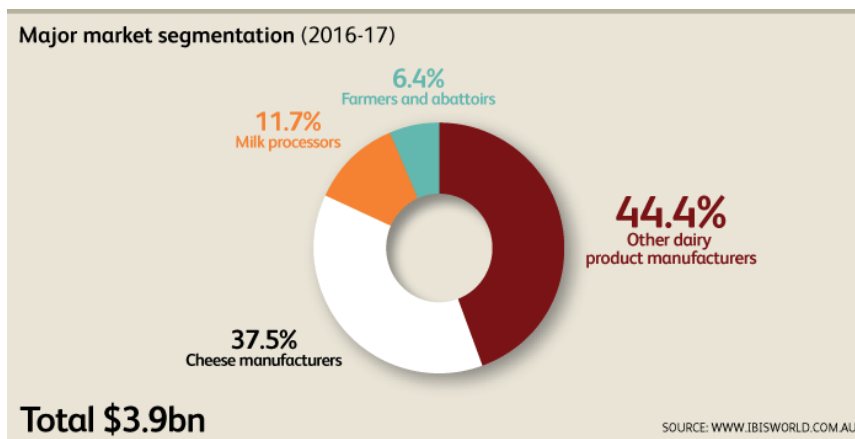


Figure 46. Major Dairy Markets



Dairy farmers are exposed to domestic and international competitive market forces. Competitive pressures have increased since 2000, when the industry was deregulated and state government marketing arrangements were removed.

Industry operators are fragmented and compete for supply contracts with large processors. Dairy co-ops (which are owned and operated by dairy farmers) have limited this competition, as farmers do not compete within co-ops. However, these co-ops have increased competition for farmers that are not a part of a co-op and lack economies of scale. Co-ops that are not vertically integrated face competition from those that are, such as Murray Goulburn, which has associated brands and sets highly competitive milk prices (Tonkin 2017d).



Figure 47. Key Features of Dairy Cattle

Critical features:

- Very volatile industry over past 5 years
- Large demand fluctuations and changes to farm gate prices
- Global dairy prices fell rapidly
- Major processors reduced the milk price paid to farmers as global prices fell
- Supermarket price war led to rapid declines in farm gate prices
- Rising overseas income and demand expected to improve the future situation
- Safety of dairy products in Asia has been a major concern, which benefits bio-secure Australian producers
- Average seasonal milk pricing arrangements by manufacturers mean farmers can be over or underpaid at various times of the year
- Highly concentrated industry with only a few major processors such as Murray Goulburn and Fonterra collecting raw milk
- Processors have strong price-setting power
- Prices can fall below the cost of production
- Fresh milk exports to China being trialled due to changed quarantine regulations
- A potential growth constraint for the Dairy Cattle Farming industry is increased competition from low-cost competitors such as Argentina, Brazil and Uruguay
- A large number of small family-run businesses

Economic Drivers:

- Domestic price of milk often driven by global trends
- Milk production
- Level of annual rainfall
- Milk consumption
- Domestic price of coarse grains
- Electricity service price



Industry Performance:

Revenue – \$3.9B
Profit – \$121.4M
Businesses – 6,007
Exports – \$1.2B
Expected annual growth 2017-22 – 1.8%

Success Factors:

- Economies of scale
- Superior financial management and debt management to deal with high revenue volatility
- Ability to secure long-term sales contracts
- Developments in farming and milking technologies to provide comparative advantage
- Cost of coarse grains can have a big impact on profitability
- Electricity prices also important due to use of electric milking machines
- Exports to Asia, North Africa and the Middle East may drive growth
- Rainfall and irrigation for good pasture growth to support milk productivity
- Increased automation means high capital intensity

Major Australian Players:

- **None** – dominated by a large number of small family-run farms

Sources: Tonkin (2017d), ABARES (2016)

Finding: There appears to be some potential for expanded dairy production in the Walcha area, and the sowing/fertilisation of high-performing pastures appears to be critical for success. The capacity to add irrigation to the production mix would further boost the economic performance of this enterprise.

Dairy produces significantly higher economic returns than the other extensive grazing activities in the region, though it has been noted even further productivity and profit could be gained by housing cows indoors as they do in Europe.

The economic figures for Walcha dairy production require further scrutiny as they are significantly higher than other dairy areas.

5.4 The Cost of Irrigation Water

5.4.1 Regulatory Costs of Water Delivery

Access to irrigation water involves several regulatory costs. These include:

1. The **cost of purchasing a water entitlement** (a water licence) which entitles the owner to a share of the water in a dam/river/creek or groundwater system. These licences can be traded on a temporary or permanent basis. Purchasing a permanent licence essentially amounts to a capital investment (similar to buying land). However, for dam/river/creek licences, that licence does not guarantee the owner access to a set amount of water each year. Depending on the amount of water in the dam and/or river system, the NSW Government will make regular water determinations which specify what percentage of their entitlement allocation licence owners can access (it may vary from 0 to 100%). There are also provisions for carrying-forward and banking (up to a limit) unused entitlement for future years;
2. **Fixed charges** are a fixed annual charge levied by the NSW government regardless of whether a licence holder uses their water or not. On **regulated rivers**, these are charged twice by two separate NSW government agencies – NSW DPI and NSW Water – and each has a different charge. On **unregulated rivers**, only the NSW DPI charge applies.
3. **Usage charges** which are charged per ML of water actually used by a licence holder. Again, on **regulated rivers** these are charged twice by two separate NSW government entities – NSW DPI and NSW Water – and each has a different charge. On **unregulated rivers**, only the NSW DPI charge applies.

Table 4 outlines the regulatory charges which may apply to General Security users on the Apsley River were a dam to be built. Comparative figures for some other systems are also shown.

General security users mostly include extensive agriculture irrigators (usually crop growers, but also perhaps irrigated pasture users). There are also High Security licences which receive preferential access to available water before General Security licence holders. These users conduct more intensive agricultural activities (e.g. horticulture, such as the pecan nut farm at Moree) where access to water is more critical to avoid catastrophic losses of a long-term crop.

At this stage, it is unclear if such a development would be classified as a regulated or unregulated system, so charges for both are shown. Note that the NSW Government is moving toward full cost

recovery of operating costs for these systems, so prices are likely to rise in the future (as they have in other systems).

Table 4. Regulatory Charges General Security Licences, North Coast NSW 2016-17 (\$/ML)

River/Valley	WaterNSW Charges Fixed (regulated system)	WaterNSW Charges Usage (regulated system)	DPI Water Charges Fixed (unregulated system)	DPI Water Charges Usage (unregulated system)
Apsley (North Coast)	\$7.25	\$45.04	\$3.76	\$5.80
Peel (Tamworth)	\$3.88	\$58.26	\$2.29	\$4.06
Namoi	\$8.25	\$20.26	\$2.59	\$1.74
Gwydir	\$3.47	\$12.13	\$1.41	\$1.22
Murrumbidgee	\$1.27	\$3.54	\$1.24	\$0.82

Source: DPI Water (2016)

It is highly likely that should the dam be built, licence holders would be operating under a regulated river reach system, hence the higher charges would apply.

5.4.2 Water Licence Capital Costs

In addition to the charges shown in Table 4, the water user must initially purchase a licence entitling them to use water in a regulated (or unregulated) water system.

Table 5 shows sale prices for permanent and temporary (use for one water year) sales in several river systems with different size dams. There are far more water trades in systems with large dams.

Table 5. Recent Water Licence Sale Prices

River/Dam	Recent Temporary Trades (\$/ML)	Recent Permanent Trades (\$/ML)
Apsley River	None	None
Apsley Gorge	None	None
Bega River/Brogo Dam (8,900ML)	None	400
Richmond River/Toonambar Dam (11,000ML)	None	None
Peel River /Chaffey Dam (100,500ML)	100	1,200
Belubula River/Carcoar Dam (35,800ML)	100	400
Paterson River/Lostock Dam (20,200ML)	30	None
Namoi River/Keepit Dam (425,510)	200	2,090
Gwydir River/Copeton Dam (1,365,000ML)	300	2,200

Source: DPI Water (2016), WaterNSW (2017)

Discussions with water and industry experts (Sam Newson, Agripath Tamworth and Kerry Kempton NSW DPI, personal communication 2017) revealed that the move to full cost recovery by the NSW Government has created a problem whereby the costs are shared amongst a very small number of licenced users in regulated systems with small dams. Hence their fixed and usage charges are high relative to large dam systems. Consequently, licence holders are not using their allocations, and very little trading occurs. This could be an issue for an Apsley Dam if the dam results in the river becoming a regulated system. Were this to happen, unless the returns from water use were sufficiently high, the water would not be used. If the Apsley system becomes an unregulated water source, these charges are much lower (Table 4).

5.4.3 Irrigation Infrastructure and Running Costs

There is also the cost of the physical infrastructure (pumps, pipes, irrigation equipment) and fuel needed to deliver the licenced water to a farm or premises.

For extensive pasture irrigation uses (beef, dairy, lambs, crops), these costs can be quite high. Indicative costs are provided in Table 6.

Table 6. Irrigation Capital and Fuel Costs

Irrigation System	Capital cost \$/ha	Irrigation efficiency (%)	Pumping Cost (\$/ML)	
			Electricity @35c/kWh	Diesel @ \$1.50/L
Furrow with head ditch & siphons	2500-3000	50-80	15.83	18.96
Flood Furrow (bore)	2500-3000	50-81	71.25	85.32
Border check laser- guided automatic	3000-5000	55-80	15.83	18.96
Lateral move, gravity fed channel, 1.5x LM run in length	2500-5000	80	47.5	56.88
Centre pivot w pump, motor, main, 1.5x CP length	2500-5000	80	95	113.76
Drip/jet spray	6000-9000	85	79.17	94.8
Spray (river)	2000-3000	80	87.09	104.28
Spray (bore)	2500-3500	80	134.59	161.16
Traveller river medium pressure	2000-2500	70	110.84	132.72
Traveller bore medium pressure	1800-2800	70	158.34	189.6
Traveller high pressure	1800-2500	70	158.34	189.6

Source: Smith, P. (2012)

A Tamworth lucerne grower paying 31c/kWh has estimated his electricity costs for pumping 8ML/ha are \$96/ML. So, for a Walcha grower using half that amount of water, the cost would be \$48/ML. However, it has been suggested irrigators below the proposed dam may require minimal pumping if a gravity-feed pipeline can be installed. This would significantly reduce irrigation costs.

Research in New Zealand has indicated that even for dairy farms, the additional stocking rate and milk sales which can be achieved with a \$NZ387,000 centre pivot irrigating 120ha of pasture are not warranted by the extra costs of the system unless high production levels can be achieved. At average irrigated production levels, the economic result can't be justified (McCarthy 2011).

In summary, even after the capital cost of an irrigation system has been met, the licencing and operating costs can be quite substantial in terms of \$/ha.

At Walcha, it is likely the NSW government regulatory costs plus the energy costs of pumping water would be a minimum of \$100/ha (though it could be closer to \$50/ML if a gravity-fed system, were in operation).

Applying 3.5-4ML/ha to pasture or lucerne means an additional \$350-400/ha of variable costs, excluding pump maintenance and other irrigation operating costs.

It is more likely that intensive activities which may use larger volumes of water per hectare, but smaller volumes in total, and which have higher returns per hectare will be the best economic use of any additional water from a dam on the Apsley River.

If these intensive activities are located long way from the Apsley, the pumping and infrastructure costs may be prohibitive. In that case, the most economic option may be to source water from the town supply, rather than directly from the dam. If that is the case, the need to augment the town water supply will become even more critical.

6. Regional Economic Impacts

6.1 Total Impacts of the Walcha Economy

Using the REMPLAN software which captures the structure of the Walcha economy, the value of the additional gross revenue generated by applying irrigation water was used to calculate the broader effects on the local economy. These effects include:

- The direct effect (i.e. additional production will mean more local expenditure on inputs);
- Production-induced effect – more purchases of local inputs mean the input businesses (e.g. the fertiliser sales business) will spend more on their inputs;
- Consumption-induced effect – more local expenditure equals more local wages/business profits meaning more non-input consumption (e.g. more sales at the local supermarket).

To estimate the impacts per ML of water, it was necessary to assume the new activities had sufficient scale to get an accurate calculation from the software, especially for extensive industries which had much lower gross output per hectare.

The following area assumptions were made to estimate the extra revenue, and hence calculate the total economic impacts per ML of additional water:

- Extensive farming activities – 1,000ha;
- Tomatoes, blueberries – 20ha;
- Pigs – 200ha;
- Fish Farm – 5ha;
- Softwood mill – 10ha;
- Large beef abattoir – 143ha;
- Small beef abattoir – 50ha;
- Medicinal cannabis – 1.53ha;
- Trout fishing – 285ha dam.

Also, because some industries are not/have not been present at large scale in Walcha, the REMPLAN database lacks information on their links to the rest of the local economy. Consequently, the Guyra economy was used as an estimate for some enterprises (tomatoes, blueberries, silage, hay, lucerne, potatoes, abattoirs) while the Tamworth economy had to be used for fish farming.

The additional employment in the Walcha LGA per ML of water used in different enterprises is shown in Figure 48. As expected, the intensive activities which produce large amounts of gross

revenue per hectare and per ML of water have larger job impacts than extensive activities with lower gross revenues. This is for two reasons:

1. These activities are industrial-type operations which usually require many employees (e.g. abattoirs, sawmills);
2. Because they are large operations, they produce a lot of revenue from a relatively small parcel of land, and from a small total volume of water. A proportion of this revenue is spent locally which generates increased economic output and hence jobs in other local businesses.

Figure 48. Employment Impacts of Additional Water

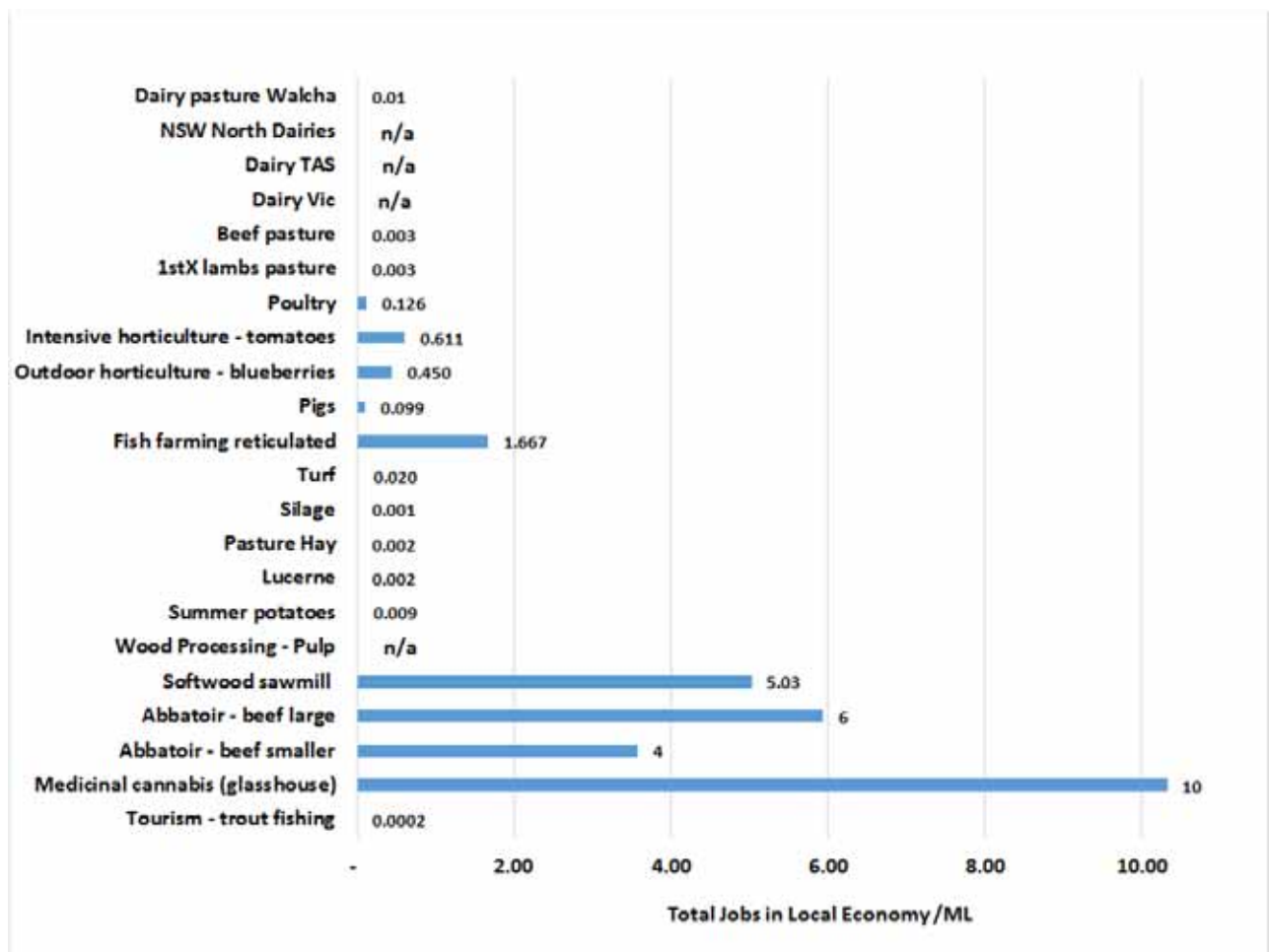
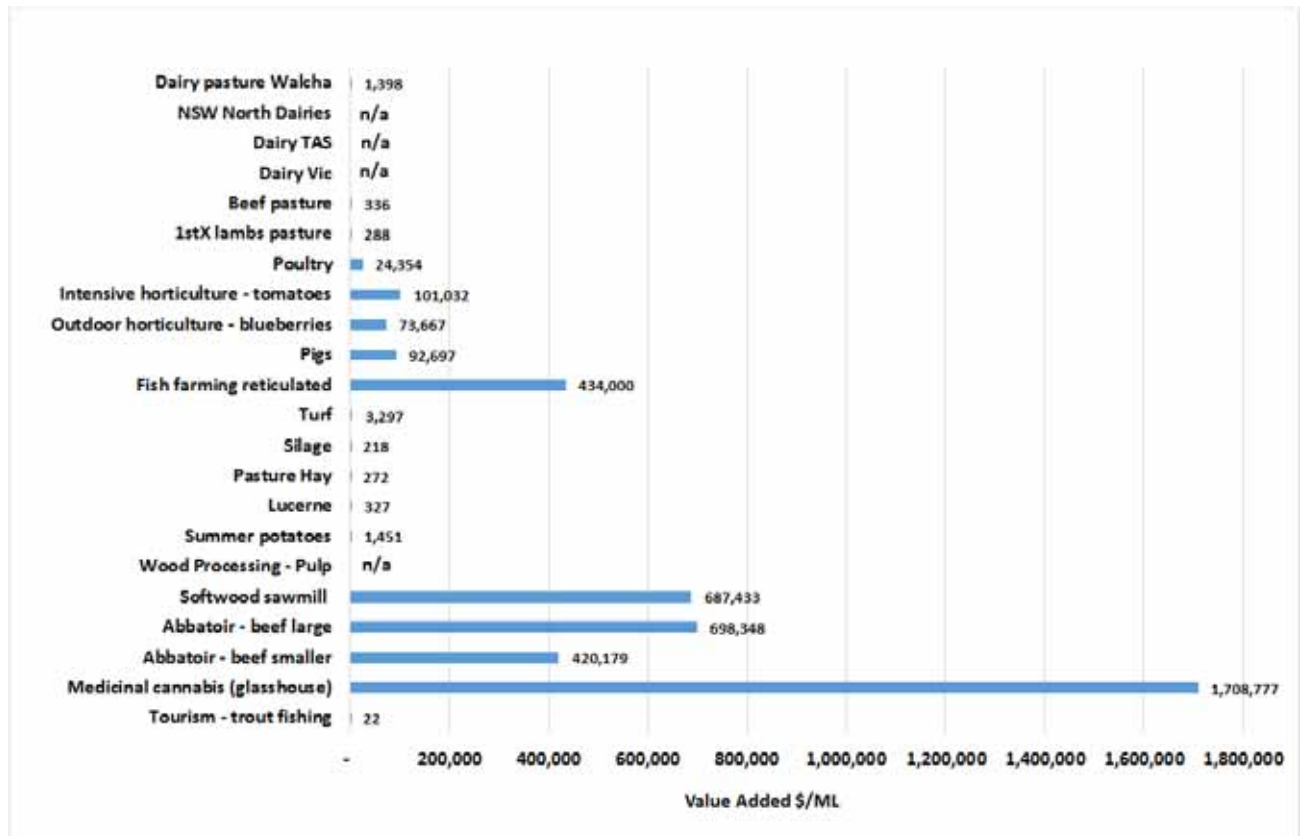


Figure 49 shows the amount of value-added per ML of additional water. Value-added is an important economic measure as it is similar to Gross Domestic Product and Gross Regional Product. It shows the additional value-added from the production process once the value of the intermediate inputs is removed, hence provides an insight into the relative returns to labour, capital, and land.

Again, it is the larger industrial-type activities which produce the most value-added, but several intensive agricultural operations (poultry, horticulture, pigs, fish-farming) also do well compared to traditional extensive agricultural industries.

Figure 49. Value-Added Impacts of Additional Water



6.2 The Economic Impact from Existing Grazing Enterprises

Regarding extensive grazing enterprises (beef and sheep production), the point has been made that more intensive pasture management (perennial pastures, with more fertiliser plus irrigation) would increase the spend in the local economy.

In REMPLAN, this shows up as an impact in the sector called 'Agriculture, Forestry and Fishing Support Services'. For every \$1M of extra output revenue from grazing, an extra \$0.123M is generated in this sector. However, this assumes a linear trend, and it has been suggested (Damien Timbs, personal communication 2017) that in fact the expenditure on inputs would

increase by a factor of 12 (from around \$80/ha spent on fertilizer and pasture maintenance to \$1,000/ha).

If this were the case, output revenue in the Agriculture, Forestry and Fishing Support Services sector would increase from \$0.123M to \$1.476M, thus raising the total impact on the local economy from \$2.971M to \$4.324M (a 45% increase).

This would increase the gross revenue per ML of water used in grazing across the entire Walcha economy from \$849/ML to \$1,234/ML – a substantial increase but still much lower than intensive activities such as poultry (\$44,293/ML), protected horticulture (\$94,432/ML), turf growing (\$6,163/ha) and a small beef abattoir (\$1.2M/ML).

However, the point must be made that only a very small number of these intensive activities will likely locate in the region, and in total they will only use a small proportion of the potential 25GL of water available from a new dam as proposed by the community:

- Abattoir – 89ML/pa;
- Softwood mill – 60ML/pa;
- 20ha tomato glasshouse – 280ML/pa;
- 200ha of piggeries – 958ML/pa;
- 1,000ha of turf – 11,000ML/ha

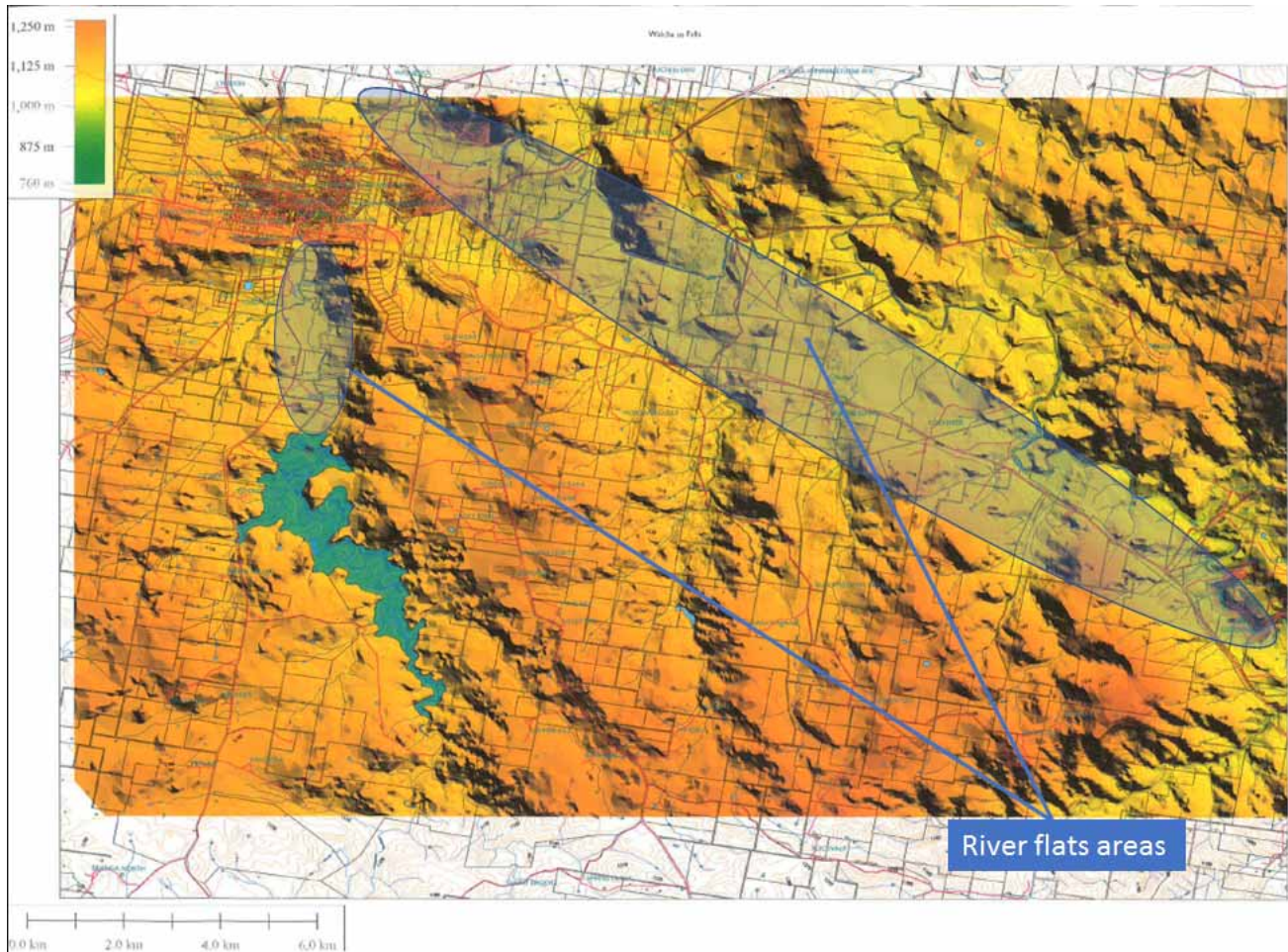
This leaves a lot of water still to be utilised, and using it to increase the output from existing grazing activities is a feasible option, though it would require a commitment to good pasture management and fertiliser regimes to reap the economic benefits.

The other point to be aware of is the pumping distances and hence costs from the Apsley River downstream of the proposed dam.

At present, there is only 21,408ha of total property area adjacent to the Apsley River. And only a proportion of these properties would be feasible to irrigate. If 25% of the area could be feasibly irrigated, this is 5,352ha. This would use up much of the water in a 25GL dam (18.7GL at 3.5ML/ha).

Figure 50 shows the location of the potential dam, with the Apsley River flat areas that may be suitable for irrigation to the east of the dam site, downstream of the dam wall.

Figure 50. Potential Irrigation Flats Along the Apsley River



The additional economic impact of irrigating this area for high-input grazing activities is presented in Table 7.

Table 7. Economic Impact from 5,352ha of Irrigated High Input Grazing Enterprises

	Beef grazing	1 st X Lamb Grazing	Dairy
Additional Gross Revenue	\$2.55M	\$2.19M	\$13.6M
Additional Gross Margin	\$1.04M	\$1.57M	\$7.6M
Additional Value Added	\$1.4M	\$1.2M	\$7.5M
Additional Total Jobs	10.7	10.7	53

Irrigated dairy production would provide the largest return to the Walcha economy if any additional water remaining after intensive enterprise use were to be used on grazing enterprises.

6.3 A 25GL Dam Case Study

To illustrate the potential economic impacts on the Walcha economy, a case study has been calculated using the community proposal of a 25GL dam. It was assumed this would attract a 20ha tomato glasshouse to the region, with the remaining water two-thirds of the water being available for boosting beef cattle production, dairy, turf and summer potatoes. Trout fishing tourism also increases, and the size of the aged care sector doubles. Results are shown in Table 8.

Table 8. Walcha Economic Impact of 25GL Dam Scenario

Enterprise	Area (ha)	Extra Water use (ML/pa)	Additional gross output (\$M)	Additional gross regional product (\$M) ¹	Additional jobs
Tomato glasshouse	20	280	26.4	14.1	85
Beef cattle	2,000	9,000	5.9	2.3	18
Dairy	900	4,068	3.2	1.2	9
Turf	200	2,200	1.2	0.65	4
Potatoes	300	900	0.81	0.43	3
Fishing tourism ²	285	n/a	1.3	0.56	6
Double aged care ³	n/a	5	4.4	3.4	31
TOTAL	3,420	16,453	43.2	22.5	156

1. Value-added from REMPLAN has been used as a proxy for GRP.
2. Results in an extra 5,500 visitor days.
3. Current gross output is \$5.8M for residential care and social assistance. Assumed this increases another \$3M in gross revenue.
4. Assumed that the additional profit margins for irrigated beef and dairy warrant its uptake at these levels.

A 25GL dam where two-thirds of the dam volume were available for production uses could significantly boost Walcha's GRP by 22.5M (an 11% increase) and employment by 156 jobs (a 12% increase).

7. Conclusion

There appear to be three main issues to consider regarding a dam on the Apsley River:

1. Securing the town water supply, as the current supply from the Macdonald is inadequate. The secure yield of 0.108GL/pa means the town water supply 5/10/10 rule is breached.
2. Climate change has agricultural producers concerned about their future ability to maintain current production levels and profitability. Access to adequate volumes irrigation water for pastures and fodder could alleviate these concerns.
3. More available water would provide the opportunity to diversify the Walcha economy by attracting new industries and expanding existing industries.

Securing the town water supply is a key priority, and one which DPI Water appear most likely to support. A less ambitious proposal (e.g. putting a weir across a 2nd order creek/gully) is likely to be a much easier task to take through the regulatory process than a dam on a 3rd or 4th order stream (e.g. the Apsley River). DPI Water have indicated a new dam could take 10 years for approval, unlike a smaller storage on a smaller stream.

The second issue – supporting production on local grazing farms – is problematic from several angles:

- There are likely only a small number of producers and a small total land area (less than 21,408ha) in the LGA which may benefit from access to irrigation water unless water can cheaply be piped large distance;
- Even if only 25% of this area were irrigated, at 3.5ML/ha it would use up most of the water (19GL) in a 25GL dam. It is unlikely DPI Water would allow this much water to be used.
- The economic impact of any resulting extra production is relatively small compared to some intensive water-use enterprises which use less water in total;
- The economics of irrigating pasture is doubtful given the likely costs of the water and the irrigation operating/capital expenditure;
- Regardless, if a dam were built, it is likely most the available water *would* be used to irrigate pasture or fodder crops, as realistically only one or two alternative intensive enterprises are likely to be attracted to the region, and they alone would only use a small proportion of the 25GL. As shown in Table 8, this situation could still provide a significant economic boost to the Walcha LGA.

Regarding the third issue, this is where most of the potential economic benefit lies. There are certainly more intensive uses of the dam water which would provide a much larger boost to the

Walcha economy than watering pasture or fodder crops. However, it will require a significant effort by the council and community to attract such a business or cluster of businesses to the region.

In Table 1, the attractiveness of those alternative enterprises has been rated based on their economic return per ML of water used and a range of other industry factors. Intensive glasshouse production of vegetables and/or fruits appears to be one of the most feasible options, but the specifics require further investigation with companies who work in that industry. As one of these companies has already invested in the region (Costa's at Guyra) and others are examining options in the Gwydir Shire, this improves the chance of success.

While medicinal cannabis production provides the largest economic return per ML of water, the limited market and other hurdles mean it is a long-shot, and more likely to be located near where existing Australian companies are cultivating/manufacturing the product (in Victoria and WA).

The most productive strategy would be to pursue an option which secures the town water supply, while leaving sufficient water to boost existing business expansion, or attract a significant new enterprise to the area. If a larger water supply can be developed, that water can be used on more traditional extensive agricultural activities to further increase local economic activity.

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