CHAPTER 14

ECONOMIC ANALYSIS

Nullinga Dam and Other Options Preliminary Business Case

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14 ECONOMIC ANALYSIS

CHAPTER SUMMARY AND CONCLUSIONS

- Agriculture is the main economic activity in the Atherton Tablelands, providing more than 2,200 direct and 5,600 indirect jobs.
- Recent land use changes in the area have seen a rapid expansion in the establishment of high value tree crops (e.g. avocados and bananas) and the 580,000 hectares of agricultural land produced approximately $470 million worth of production in 2015. This represents an increase of over 30 per cent from 2010-11.
- Productive land in the MDWSS produces the majority of regional agricultural production value due to supplemented irrigation. The MDWSS is close to the major regional centre of Cairns, two major ports and well-developed transport infrastructure, providing access to national and international markets.
- Water in the MDWSS is fully allocated. Low rainfall in recent years has created scarcity and increased the price of water and limited production capability. Late in 2016, water was trading at $2,800 per ML of medium priority water allocation, which is a historical high for the region.
- Areas of land suitable for the expansion of irrigated agriculture exist within the MDWSS and surrounding areas. Adjacent to the Walsh River (Area 10) is 9,900 hectares of currently unirrigated cropping land which is suitable for irrigated agriculture. Water, rather than suitable land, is therefore considered the limiting factor in increasing agricultural production in the region.
- However, 'brownfield' expansion of existing irrigation areas is expected to occur before 'greenfield' expansion in, and around, the MDWSS. Generally, 'brownfield' expansion is more profitable due to lower on-farm establishment costs and it can be achieved in a shorter time frame as the watering infrastructure and crops are already established. 'Brownfield' growth results in almost immediate financial benefits being realised by the farmer, with less on-farm investment required.
- 'Brownfield' expansion could result in increased hectares of crops under irrigation. It could also result in additional water allocations being applied to achieve higher yields from the same crops by increasing the volume or rate of water applied (e.g. from 5 to 10 megalitres (ML) per hectare), or using additional water allocations to replace existing production with higher value crops. Both result in increased values of production and yield net economic benefits to the region.

Option 1: Do minimum (base case) and sensitivity analysis

- The historic base case is considered as a continuation of the current patterns of production within the designated study area and the absence of any policy or infrastructure interventions. All quantified benefits and costs in the Cost Benefit Analysis (CBA) are incremental changes against Option 1 Do minimum (Base Case).
- The sensitivity analysis showed significant changes in the economic net present value (NPV) and benefit cost ratio (BCR) depending on the different parameters used in the economic modelling, in particular, the use of a shorter or longer timeframe for the projected take-up of new water allocations by irrigators. Given the preliminary nature of the economic analysis in the PBC stage, close consideration should be given to the range of results reported in the outputs to the economic model.

Option 2: Improve MDWSS rules and operation

- Once fully implemented, Option 2 could generate an additional $1.0 million per annum of value added to the economy due to increased agricultural production.
- Impacts on overall MDWSS employment are expected to be an additional 18 jobs annually comprised of 5 full time equivalent (FTE) direct and 13 FTE indirect jobs once the full benefits are realised.
- The medium scenario is an economic NPV of $31 million with a BCR of 11.4.
- The upper bound (worst case) of the sensitivity analysis is an economic NPV of positive $4 million with a BCR of 1.8.

Option 3: Modernise MDWSS and convert losses

- Once fully implemented, Option 3 could generate an additional $10 million per annum of value added to the economy due to increased agricultural production.
- Impacts on overall MDWSS employment are expected to be an additional 234 jobs annually comprised of 67 FTE direct and 168 FTE indirect jobs once the full benefits are realised.
- The medium scenario is an economic NPV of $73 million with a BCR of 2.8.
- The upper bound (worst case) of the sensitivity analysis is an economic NPV of negative $9 million with a BCR of 0.8.

Option 4: Nullinga Dam for agricultural use

- Once fully implemented, Option 4 could generate an additional $34 million per annum of value added to the economy due to increased agricultural production.
- Impacts on overall MDWSS employment are expected to be an additional 616 jobs annually comprised of 176 FTE direct and 441 FTE indirect jobs once the full benefits are realised.
- The medium scenario is an economic NPV of $6 million with a BCR of 1.0.
- The upper bound (worst case) of the sensitivity analysis is an economic NPV of negative $163 million with a BCR of 0.4.

14.1 Purpose

The purpose of this chapter is to assess the economic impact on society of the shortlisted options. The economic costs and benefits are assessed as impacts on the Atherton Tablelands and the regional economy. When assessing benefits, as an input to the BCRs, however, 'society' is considered as Australia.

The key benefit is assessed as being Industry Value Added (IVA), less the opportunity cost of replaced crops. Defining economic benefits as being those that accrue to Australia (rather than a global 'society') is consistent with the PBC being funded by the NWIDF, which will compare such projects nationally.

The key costs are assessed as being the upfront capital expenditure (capex) (and one-off operating expenditure (opex) for Option 2) associated with the three shortlisted options (project costs) and the up-front on-farm capital investment needed to unlock the economic benefits. The on-farm investment costs are comprised of the cost of irrigation equipment (i.e. a mixture of overhead centre-pivot and drip (or T-tape) irrigation equipment and the cost of crop establishment (ranging from $1,000 per hectare for planting

sugarcane to over $100,000 per hectare for blueberry crops). The data has been sourced from DAF, MSF Sugar and other key stakeholders as part of consultation on this PBC.

The ongoing project costs and on-farm opex are also included as costs in the economic CBA.

Direct and indirect jobs arising from construction expenditure, are excluded from the economic CBA and BCRs, but are included in the economic impact discussion.

This chapter presents preliminary findings in relation to the economic impacts arising from each of the shortlisted options.

Option 1: Do minimum (base case) reflects the regional economic agricultural baseline profile that is initially presented to establish the operating context for each of the shortlisted options. Following this, the potential incremental economic impacts of each shortlisted option are described and estimated in a manner consistent with the summarised method above.

14.2 Establishing the Economic Base Case (Economic Baseline)

The shortlisted options pertain predominantly to the Atherton Tablelands agricultural area, which is defined by the boundaries of the Mareeba Shire Council (MSC) and Tablelands Regional Council (TRC) (DAF, 2016).

14.1.1 Option 1: Do Minimum (Base Case)

The historic base case is considered as a continuation of the current patterns of production within the designated study area (outlined in the economic baseline) and the absence of any policy or infrastructure interventions.

Analysis conducted as part of the development of this PBC indicates that the service need is predicated on an opportunity to increase agricultural production in the study area, rather than to solve a problem (urban water supply to Cairns).

Given the historic reliability of the current irrigation scheme that is now fully allocated there is considered to be no base case in which the agricultural sector will run out of water supply catastrophically. However, when faced with scarcity in dry years, irrigators will reduce application of water on the lowest value crops. Irrigators also will not expand (plant new crops) if the current supply situation indicates there is a reasonable prospect of losing those crops and the associated capital investment.

The analysis undertaken for the PBC has included the following key findings:

- The majority of irrigators in the MDWSS have adopted on-farm efficiency measures (i.e. drip and T-Tape irrigation systems) to maintain or improve crop yield per ML of water applied, and will continue to do so where it creates efficiencies for their business operations. Improvements in water efficiency can free up water allocations to support additional production.
- The MDWSS is moving towards an efficient market for water, with temporary and permanent trading of water promoting 'highest and best' use. Permanent trades of water entitlements that are currently not used could facilitate industry growth and can activate sleepers (i.e. water allocation holders who use none of their allocation) and dozers (i.e. water allocation holders who use little of their allocation).
- Recent dry conditions have increased water trading activity to address scarcity. However, the water utilisation rates have remained below 100 per cent as safety buffer.

As noted in the water trading data presented below, the market will allocate new water allocations and both high value crops and sugarcane will be in the mix where demand is concerned. However, under Option 1, where no extra water is made available, the sugar industry in the MDWSS has the potential to, in the long-

term, contract (or at least reduce its share of water use) relative to higher value crops as water allocations continue to move to higher value crops through water trading.

14.2.1 Employment

Table 1 indicates that the agriculture sector employs the most people in the region being responsible for approximately 13 per cent of all jobs in the region (ABS 2011). It is expected that this share may have grown with the increase of labour intensive tree and horticultural crops in recent years.

Table 1 Employment by Industry—Tablelands Agricultural Region and Queensland 2011

INDUSTRY	TABLELANDS REGION	TABLELANDS REGION	QUEENSLAND
	FTEs	PORTION OF JOBS	PORTION OF JOBS
Agriculture, forestry and fishing	2,257	13.0%	2.7%
Retail trade	2,044	11.8%	10.7%
Health care and social assistance	1,953	11.3%	11.9%
Construction	1558	9.0%	9.0%
Education and training	1,480	8.6%	7.9%
Public administration and safety	1,230	7.1%	6.7%
Accommodation and food services	1,097	6.3%	7.0%
Manufacturing	1,030	6.0%	8.4%
Transport, postal and warehousing	721	4.2%	5.3%
Professional, scientific and technical services	696	4.0%	6.5%
Mining	677	3.9%	2.6%
Wholesale trade	471	2.7%	3.6%
Administrative and support services	463	2.7%	3.2%
Rental, hiring and real-estate services	224	1.3%	1.8%
Arts and recreation services	234	1.4%	1.4%
Electricity, gas, water and waste	230	1.3%	1.2%
Financial and insurance services	195	1.1%	2.7%
Information, media and telecommunications	116	0.7%	1.2%
Other services	626	3.6%	3.9%
Total	**17,302**	**100%**	**100%**

Source: Australian Bureau of Statistics 2011

Standard employment multipliers devised for Far North Queensland by Horticulture Australia indicate that every direct position of employment in the agricultural sector creates an additional indirect 2.51 positions in

other sectors (Horticulture Australia 2013)[1]. Applied to 2011 estimates of total full time equivalent (FTE) jobs, this indicates that an additional 5,665 FTE jobs are indirectly supported inside and outside of the region by the agricultural industry as follows (see Table 2).

Table 2 Employment for Agriculture, Forestry and Fishing Industry—Tablelands Agricultural Region

SECTOR	DIRECT JOBS (FTE)	MULTIPLIER	INDIRECT JOBS (FTE)
Agriculture, forestry and fishing	2,257	2.51	5,665

Source: Australian Bureau of Statistics (2011) Census of Population and Housing, ABS, Canberra

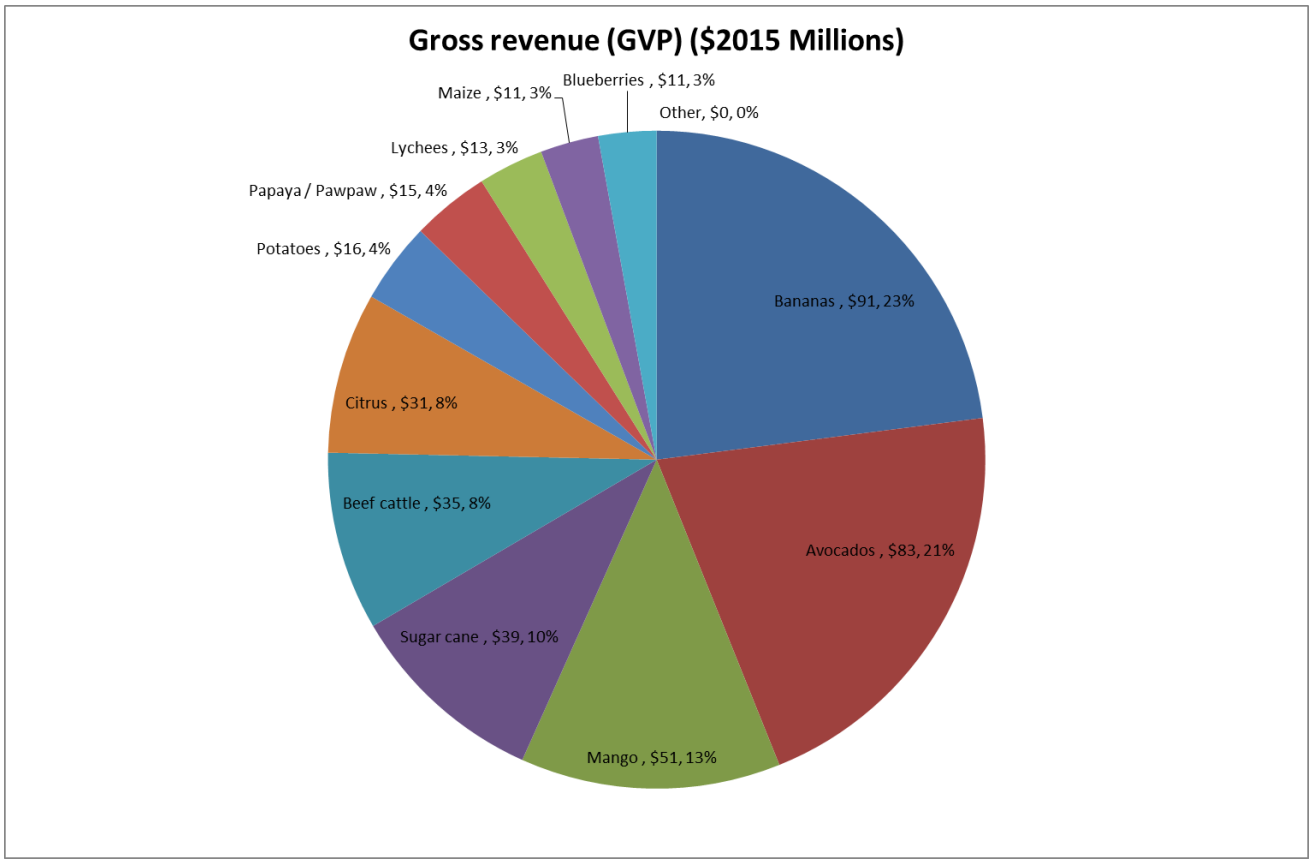
It is expected that the number of direct and indirect jobs may have grown since 2011, in line with the increase of labour intensive tree and horticultural crops in recent years (DAF 2016).

14.2.2 Profile of Agricultural Production

In terms of land use, grazing for beef production is the dominant land use across the region using 550,000 hectares or 92.6 per cent of land currently used by agriculture. However, in terms of Gross Value Product (GVP) it is relatively minor in comparison to the irrigated crops grown in the region, which covered 31,362 ha in 2015. The total area under agricultural production was 581,362 hectares with an overall GVP of $471 million in 2015.

[1] The Horticulture Australia estimate is considered appropriate as it is based on a recent analysis carried out specifically in the North Queensland Region. There is significant congruence between this value and that of the Australian Bureau of Statistics that found an employment multiplier of 2.576 for agriculture overall in 2001. ABARE in 2006 found an employment multiplier of 2.5 for Dairy Australia.

Figure 1 GVP Tablelands Agricultural Region $ (DAF 2015)



Source: DAF (2015) Profile of Tablelands Agricultural Region

14.2.3 Area and Value of Crops (per Hectare) in the Tablelands

The comparatively high value per hectare of production from irrigated agriculture crops is shown in Table 3. The crops have been listed according to the value of total gross revenue to the region.

Table 3 Total Area, Gross Revenue and Revenue per Hectare by Commodity 2014-15

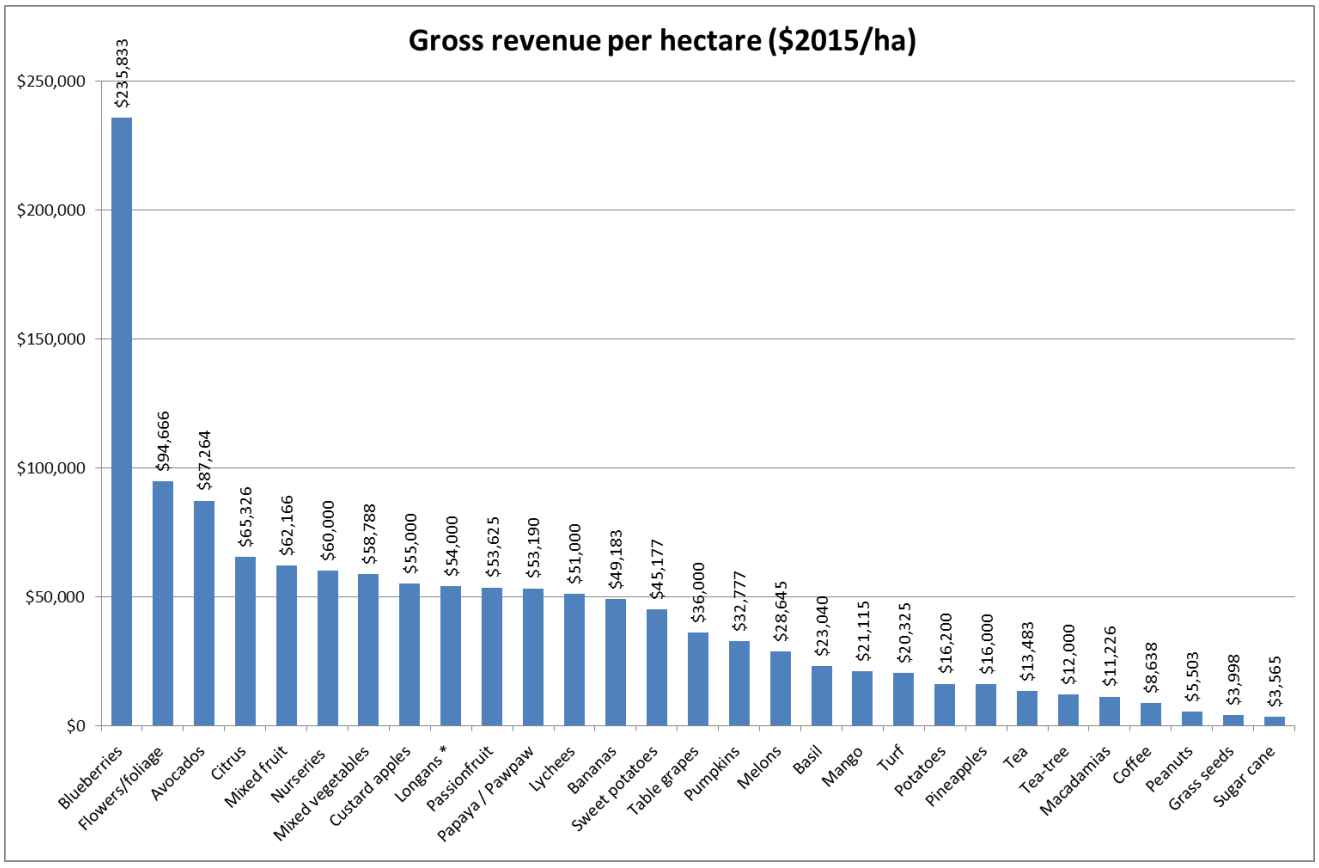
COMMODITY	AREA 2015 (HA)	GROSS REVENUE ($2015 MILLIONS)	SHARE OF TOTAL GVP	GVP/HA ($2015/HA)
Bananas	1,850	91.0	19.3%	49,183
Avocados	950	82.9	17.6%	87,264
Mango	2,400	50.7	10.8%	21,115
Sugarcane	10,956	39.1	8.3%	3,565
Beef cattle	550,000	34.7	7.4%	63
Citrus	480	31.4	6.7%	65,326
Potatoes	972	15.7	3.3%	16,200
Papaya/Pawpaw	285	15.2	3.2%	53,190
Lychees	250	12.8	2.7%	51,000
Maize	4,719	11.3	2.4%	2,400
Blueberries	48	11.3	2.4%	235,833

COMMODITY	AREA 2015 (HA)	GROSS REVENUE ($2015 MILLIONS)	SHARE OF TOTAL GVP	GVP/HA ($2015/HA)
Pumpkins	270	8.9	1.9%	32,777
Longans* (like lychees)	125	6.8	1.4%	54,000
Nurseries	100	6.0	1.3%	60,000
Tea	445	6.0	1.3%	13,483
Sweet potatoes	123	5.6	1.2%	45,177
Peanuts	874	4.8	1.0%	5,503
Grass seeds	1,195	4.8	1.0%	3,998
Hay	3,020	3.7	0.8%	1,240
Flowers/foliage	36	3.4	0.7%	94,666
Coffee	369	3.2	0.7%	8,638
Table grapes	87	3.1	0.7%	36,000
Legume seeds	968	3.0	0.6%	3,114
Mixed vegetables	51	3.0	0.6%	58,788
Pineapples	150	2.4	0.5%	16,000
Passionfruit	40	2.1	0.5%	53,625
Tea-tree	150	1.8	0.4%	12,000
Custard apples	30	1.7	0.4%	55,000
Mixed fruit	24	1.5	0.3%	62,166
Melons	42	1.2	0.3%	28,645
Basil	45	1.0	0.2%	23,040
Macadamias	48	0.5	0.1%	11,226
Turf	20	0.4	0.1%	20,325
Cashews	240	0.2	0.0%	791
Total	**581,362**	**471**	**100%**	**810**

Source: DAF (2015) Profile of Tablelands Agricultural Region.

Figure 2 shows the crops which have the highest value per hectare from highest to lowest.

Figure 2 Gross Value of Crop Production per Hectare in the Tablelands (DAF 2015)



Source: DAF (2015) Profile of Tablelands Agricultural Region. Note: * Longans are similar to lychees.

Figure 2 shows that blueberries return the highest GVP and that, on average, sugarcane is a relatively low value crop. Anecdotal evidence suggests that the returns on sugar are higher if value added processing is included. This advice has not been analysed as part of the PBC, and would need to be considered in further analysis of Option 3 and Option 4.

Details of GVP per hectare (including production systems with less revenue per hectare than sugarcane) are shown in Table 4.

Table 4 GVP or Gross Revenue per Hectare by Commodity 2014–15

COMMODITY	GROSS REVENUE PER HECTARE ($2015/HA)
Blueberries	235,833
Flowers/foliage	94,666
Avocados	87,264
Citrus	65,326
Mixed fruit	62,166
Nurseries	60,000
Mixed vegetables	58,788
Custard apples	55,000

COMMODITY	GROSS REVENUE PER HECTARE ($2015/HA)
Longans*	54,000
Passionfruit	53,625
Papaya/Pawpaw	53,190
Lychees	51,000
Bananas	49,183
Sweet potatoes	45,177
Table grapes	36,000
Pumpkins	32,777
Melons	28,645
Basil	23,040
Mango	21,115
Turf	20,325
Potatoes	16,200
Pineapples	16,000
Tea	13,483
Tea-tree	12,000
Macadamias	11,226
Coffee	8,638
Peanuts	5,503
Grass seeds	3,998
Sugarcane	3,565
Legume seeds	3,114
Maize	2,400
Hay	1,240
Cashews	791
Beef cattle	63

Source: DAF (2015) Profile of Tablelands Agricultural Region. Note: *Longans are similar to lychees.

Analysis of the average gross value of production per hectare for different groups of commodities is presented in Table 5. The CBA assumes that the IVA is 66.7 per cent of the GVP figures.

Table 5 Different Commodities Relating to GVP per Hectare for Tablelands and MDWSS Agriculture 2015

COMMODITY	AREA (HECTARES) IN 2014-15	GROSS REVENUE (GVP) ($2015)	GROSS REVENUE PER HECTARE ($2015/HA)	VALUE ADDED PER HECTARE ($2015/HA)
Tablelands Region (excl. beef cattle but including all crops $ per ha)	31,362	436,388,913	13,915	9,282
MDWSS (incl. sugar but excl. beef and lower value production crops than cane – not traditionally irrigated - and outliers) ^	26,179	424,848,913	16,229	10,826
Tablelands Region (incl. sugar but excl. beef and all lower value production crops than cane) ^ – using water use for weighting	22,415	418,111,313	18,653	12,444
MDWSS (excl. sugar, beef cattle and low value crops $ per ha)	15,223	385,781,883	25,342	16,906

Note: ^ New water supplies are likely to be applied to sugarcane and higher value crops (perhaps new allocations will not be purchased by crops with a lower per hectare production value than sugarcane).

Of these four per hectare values, it is considered that the MDWSS area is most pertinent to this PBC and that new water would most likely be purchased by a blend of crops reflecting the inclusion of sugarcane and other higher value crops (but not beef and lower value crops). Specifically, Table 5 shows results for SunWater's MDIA as follows:

1. Including sugarcane (excl. beef, crops with lower returns than sugarcane and crops not traditionally irrigated and outliers), the 26,179 hectare average GVP is $16,229 per hectare and IVA is $10,826 per hectare
2. Excluding sugarcane, beef cattle and lower value crops (with a GVP per ha lower than sugarcane) the 15,223 hectare average GVP of $25,342 per hectare and IVA of $16,906 per hectare.

For the purposes of the CBA, the best assessment of benefit for new water would be an average IVA of **$10,826 per hectare**, including sugarcane (but excluding beef and crops with lower returns than sugarcane, which are not traditionally irrigated).

This contrasts with average returns on sugarcane of $3,565 per ha (DAF 2015) or assumed IVA of $2,378 per hectare based on ABS's 'other agriculture', which are significantly lower. The CBA assumes IVA for sugar of $2,378 per hectare, which further analysis for Option 3 or 4 should test further.

The implications of the above analysis are included in the assessment of economic benefits further below.

14.2.4 Changes in Regional Agricultural Production 2011–2015

From 2011 to 2015, Table 6 indicates that significant changes have occurred in crop types:

- Increases have occurred in the area of production devoted to the higher value crops (top of Table 6)
- Decreases have occurred in the area of production dedicated to certain crops (bottom of Table 6).

Table 6 Changes in Hectares of Agricultural Production 2011 to 2015

COMMODITY	AREA IN 2015 (HA)	CHANGE SINCE 2011 (HA)	CHANGE IN AREA	GROSS REVENUE PER HA IN 2015
Passionfruit	40	25	63%	$53,625
Pineapples	150	90	60%	$16,000
Tea-tree	150	80	53%	$12,000
Coffee	369	154	42%	$8,638
Bananas	1,850	578	31%	$49,183
Turf	20	7	30%	$20,325
Papaya / Pawpaw	285	85	30%	$53,191
Mixed fruit	24	7	29%	$62,167
Sugarcane	10,956	3,015	28%	$3,566
Custard apples	30	8	27%	$55,000
Macadamias	48	10	21%	$11,227
Poultry (eggs)	12	2	17%	$408,582
Basil	45	7	16%	$23,040
Legume seeds	968	115	12%	$3,115
Flowers/foliage	36	4	11%	$94,667
Avocados	950	100	11%	$87,265
Longans	125	10	8%	$54,000
Hay	3,020	148	5%	$1,241
Mango	2,400	-100	-4%	$21,116
Pumpkins	270	-20	-7%	$32,778
Lychees	250	-30	-12%	$51,000
Potatoes	972	-228	-23%	$16,200
Melons	42	-10	-24%	$28,646
Maize	4,719	-1,303	-28%	$2,400
Table grapes	87	-33	-38%	$36,000
Mixed vegetables	51	-20	-39%	$58,788
Tea	445	-305	-69%	$13,483
Grass seeds	1,195	-866	-73%	$3,998
Peanuts	874	-846	-97%	$5,503

Source: MJA (2017) Demand Assessment for the Nullinga Dam

This illustrates the ability of the area to transition crop mixes to maximise opportunities in external markets. Sugarcane has expanded 28 per cent and higher-value crops (e.g. turf, various fruits, and coffee and tea trees) have increased 30 to 60 per cent in terms of land area used. In absolute terms (i.e. total hectares), sugar, bananas and coffee expanded the most from 2011 to 2015.

14.2.5 Mareeba Dimbulah Water Supply Scheme (MDWSS)

Options 2, 3 and 4 meet the opportunity to increase agricultural production value either within or close to the MDWSS irrigation area in which the majority of irrigated agricultural production occurs on the Atherton Tablelands.

Plantations of mango, banana, pawpaw, avocado, lychee, macadamia, citrus and other nuts and fruits have been established in the MDWSS. Sugarcane is a major crop throughout the MDWSS, with production centred on the Arriga flats and areas surrounding the Tableland Mill. The area has significant access to good-quality soils and reasonably flat, arable land for cropping. There are also small areas of irrigation (supplemented from the scheme) in the Clohesy River and Davies Creek area, between Mareeba and Kuranda. These are used predominantly for horticulture.

The scheme has 26,200 hectares of irrigation, which in 2015 produced $424 million worth of produce (DAF 2015). The highest gross revenue crops in 2015 were avocados, bananas, mango, citrus and sugarcane.

There are extensive networks of roads, good access to labour and other important infrastructure to support agricultural development. The local community has established on-site accommodation to support labour (DAF 2013 Queensland Agricultural Land Audit).

According to the Queensland Agricultural Land Audit, the MDWSS has significant capacity for agricultural value expansion with areas previously used for irrigated tobacco production currently being used for lower values uses such as sugarcane and grazing. The total area with suitable soils for agriculture within and around the MDWSS area is approximately 43,600 ha. The Queensland Agricultural Audit found that there were between 7,000 and 9,000 ha of land in the scheme area that could be further developed. The majority of the area identified for expansion is in the South Walsh area of the scheme (DAF 2013).

These parts of the region have good transport networks and access to coastal markets. Population centres are within easy access to the growing areas and there is support for long-term labour and services.

The region has historically had a very reliable water supply. Announced allocations are determined at the start of the water year (in July) and may be revised throughout the year, depending on storage inflows. Due to the large capacity and favourable hydrology of Tinaroo Falls Dam, the announced allocation in the scheme has been met in most years, with allocations of less than 100 per cent uncommon since the completion of the scheme in the late 1960s.

However, announced allocations of less than 100 per cent have become more common in recent years. The annual level of water use in the scheme is inversely related to the amount of rainfall. Historically, the level of utilisation (water use as a percentage of entitlements) is 60-70 per cent. However, the recent dry conditions have persisted since 2012-13 and as a result the level of utilisation in 2015-16 was about 86 per cent (MJA 2017).

The Queensland Agricultural Land Audit found that the allocation of water supplies from the MDWSS is currently maximised. The only way new land can be developed for irrigated cropping is by the transfer of existing unused allocation or by the development of crops that can access currently unused allocations. Further supply could be gained by improving the efficiency of irrigation and the supply scheme distribution. (DAF 2013 Queensland Agricultural Land Audit).

DAF states that to fully use the area of suitable cropping land, a new irrigation supply will have to be developed (DAF 2013 Queensland Agricultural Land Audit).

14.2.6 Future Water Demand—MJA 2017

The MJA Demand Assessment found that there are three key demand drivers underlying the current and future level of water use in the MDWSS:

- Dry conditions – persistent low rainfall since 2012-13 has resulted in higher than average level of water utilisation and emerging water security concerns by irrigators.
- Crop profile – change in crop profile to higher value permanent plantings, for example avocados and bananas, which require high water security and increasing amounts of water, especially as plantings mature.
- Industry growth – MSF Sugar, an integrated grower, processor, marketer and exporter of raw sugar, has large-scale expansion plans in the region.

According to MJA's discussions with stakeholders, water utilisation has recently increased and water security is a key concern given the recent persistent dry conditions. Irrigators in the region identified that change in the crop profile and industry growth as drivers for the recent increase in water utilisation. Stakeholders advised that there is a switch to permanent plantings of high value crops such as avocados and bananas in the MDWSS.

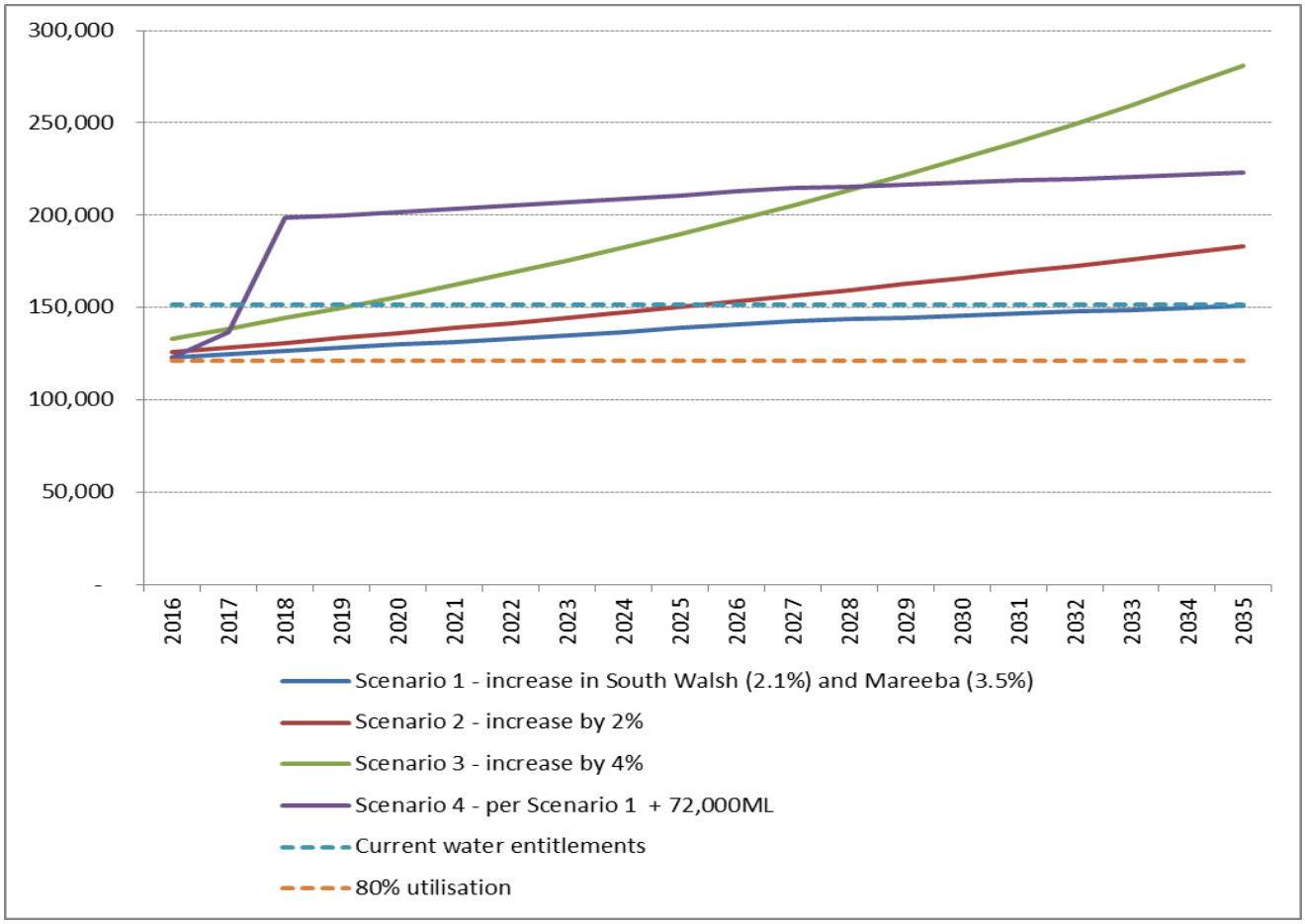
MJA concluded that MSF Sugar will be the major driver behind any significant future growth in demand for additional water. Consultation with industry in the region indicated a conservative estimate of 72,000 ML of additional water demand may be required within the next 30 years, subject to a number of factors including access to additional land, supply chain constraints, investment in 'value-add' facilities and broader market factors.

MJA modelled four demand scenarios:

- Scenario 1: based on historical growth rates at an operational system level. Modelled annual growth rates of 3.5 per cent for Mareeba and 2.1 per cent for South Walsh for 10 years and then 0.7 per cent annual growth rate thereafter. For the rest of the operational systems 0.7 per cent annual growth rate.
- Scenario 2: 2.0 per cent annual growth rate for the whole system, based on the high scenario from the Queensland Treasury Corporation's (QTC) analysis.
- Scenario 3: 4.0 per cent annual growth rate for the whole system as expressed by some stakeholders.
- Scenario 4: growth rates as per Scenario 1 plus a conservative estimate for industry expansion of water demand of 72,000 ML by 2018, for illustrative purposes.
-

Scenario 1 produced the most conservative forecast, whilst Scenarios 3 and 4 represent high growth scenarios as shown in Figure 3.

Figure 3 Gross Demand Forecast Scenarios (MJA 2017)



Source: Marsden Jacob and Associates 2017

The upper dotted line in the figure above shows the level of water that would be available if current entitlements received 100 per cent announced allocation, and the lower dotted line represents 80 per cent water utilisation. The 80 per cent utilisation line represents a buffer level, taking into account water security concerns raised by stakeholders. The 100 per cent availability of supply is exceeded in Scenario 3 and 4 by 2019.

14.2.7 Barriers to Agricultural Expansion

The Queensland Agricultural Land Audit (2013) identified the following selected weaknesses in the region that may act as a barrier to future agricultural production. The weaknesses include the following:

- Current supplies from Tinaroo Falls Dam are fully allocated and opportunities for the expansion of existing irrigation or the development of new irrigation areas are limited.
- The Tablelands area has an average wet season rainfall of 1157 mm and an average dry season rainfall of 534 mm. However, the climate of this area is highly variable. The Atherton–Evelyn tablelands have average annual rainfall ranging from 4,376 mm at Topaz to 1,295 mm at both Kairi and Tinaroo Falls Dam. The drier MDWSS area ranges from 1,032 mm at Walkamin to 780 mm at Dimbulah.
- Baseload power is sourced from Central Queensland and can be significantly interrupted by extreme weather. There is very limited regional generation of power (from sugar mills and hydropower).

- Salinity hazard areas exist in the Arriga area of the Tablelands. This is a small part of the MDWSS, about halfway between Mareeba and Mutchilba. Irrigated sugarcane is the predominant crop in the area. Currently between 700 and 1,000 hectares is at high to extreme risk from rising and highly saline groundwater. Almost double that is at moderate risk. A small portion of land has already been taken out of production.

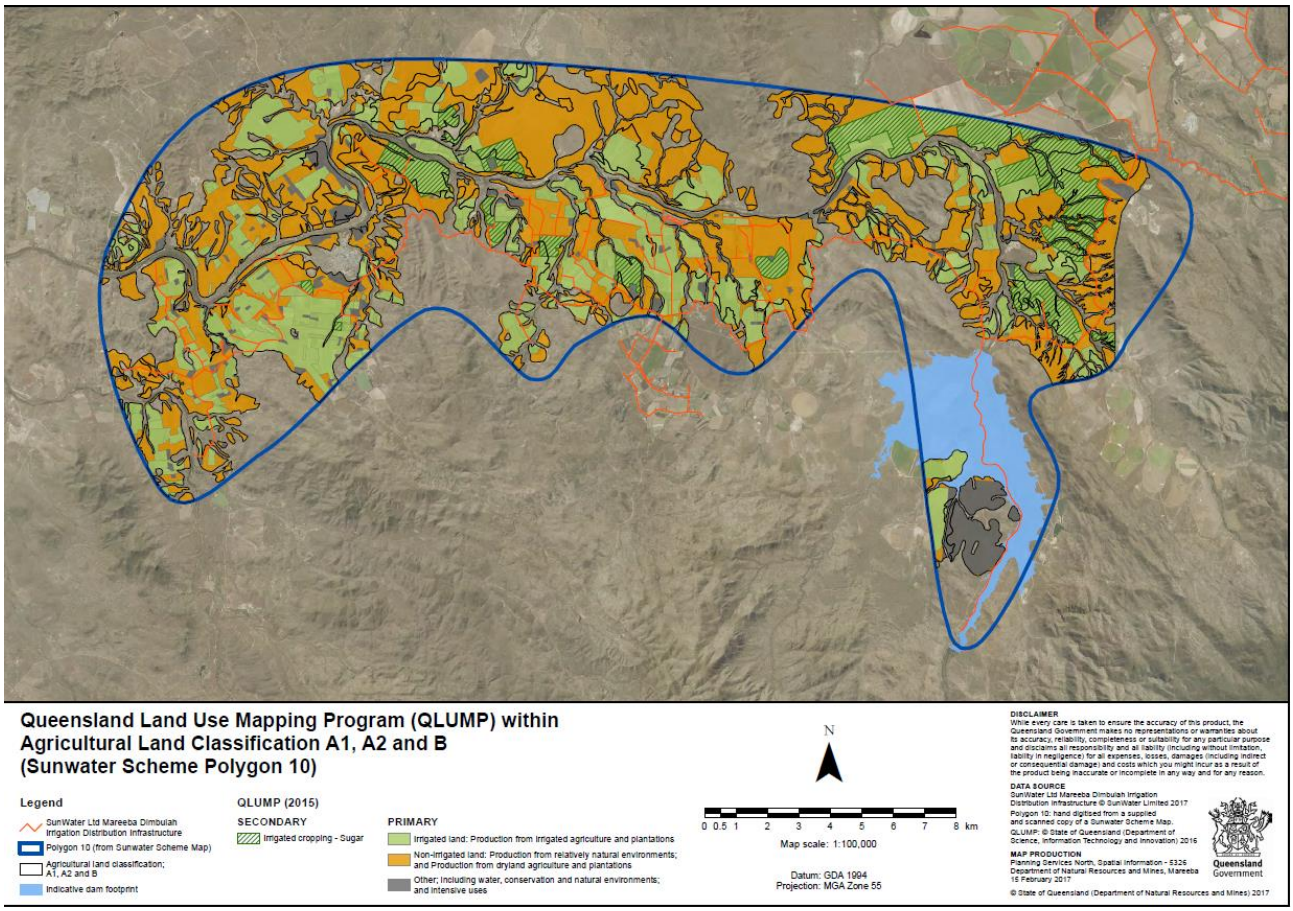
The first two bullet points (above) suggest that a new water supply (Options 3 and 4) and other related measures (Option 2) would address some of the barriers to agricultural production in Northern Queensland.

14.3 Demand for Water Based on Unirrigated Cropping Land

DNRM (2017) mapped cropping land (Cropping suitable categories A1, A2 and B) within the SunWater management Area 10, which is the section of the MDWSS irrigation area which DNRM consider could readily be supplied by Nullinga Dam as it is near the dam and the banks of the Walsh River. DNRM used the Queensland Land Use Mapping Program (QLUMP) data from 2015 to estimate what land is under irrigation.

In the map of Area 10 in Figure 4 irrigated areas are in green and sugar has an additional green hatch. Suitable cropping land not under irrigation is denoted as orange.

Figure 4 Queensland Land Use Mapping of SunWater Management Area 10



Source: DNRM 2017

DNRM excluded land from the totals where:

- Land was within the proposed dam footprint (440 m Australian Height Datum option)
- Where it had a land use defined as water, conservation, natural environments or intensive use.

The results for Area 10 only (within the MDWSS) are summarised in Table 7.

Table 7 Areas of Cropping Land in Area 10 (Section of MDWSS near Nullinga Dam)

CLASS OF CROPPING LAND IN AREA 10 (NULLINGA DAM ACCESSIBLE SUBSET OF MDWSS)	AREAS (HA)	PORTION OF TOTAL LAND
Non-irrigated Class A1	6,889	38%
Non-irrigated Class A2	21	0%
Non-irrigated Class B	3,003	16%
Non-irrigated cropping land (Total)	**9,913**	**54%**
Irrigated cropping land (agriculture and plantations)	7,301	40%
Other intensive uses	613	3%
Water, conservation, natural environments	513	3%
Total	**18,340**	**100%**

Source: DNRM 2017

According to DNRM's data, 7,300 hectares are presently under irrigation in Area 10, of which some areas may require additional supply (i.e. sugarcane growers increasing application rates from e.g. 5 to 10 ML per hectare).

In 2015, there were 1,902 hectares of irrigated sugarcane within Area 10. DRNM expect that this area has increased since, due to the recent improved price of sugarcane and incentives currently being offered by the Tableland Mill for sugarcane production.

Based on its assessment, DNRM estimate that there are about 9,900 hectares of cropping land which were not irrigated in 2015 and could be irrigated, based on the existing bounds of soil mapping in Area 10. The suitability for cropping of the 9,900 hectares has been assessed and confirmed by DNRM. At various assumed water use rates of 6 ML per hectare to 10 ML per hectare, the potential demand arising from this area is outlined in the table below. However, the realisation of such demand is dependent on a number of factors, of which water allocations are just one.

Table 8 Areas of Unirrigated Cropping Land in Area 10 and Potential Demand for Water

CLASS OF CROPPING LAND	AREAS (HA)	TOP-UP DEMAND (6ML/HA) (ML)	LOW DEMAND (8ML/HA) (ML)	MEDIUM DEMAND (10ML/HA) (ML)
Non-irrigated Class A1	6,889	41,332	55,110	68,887
Non-irrigated Class A2	21	126	168	210
Non-irrigated Class B	3,003	18,018	24,024	30,030
Non-irrigated cropping land (potential new demand)	9,913	59,477	79,302	99,128

DNRM (2017) noted that delivery of any supplemented water from Nullinga Dam along the Walsh River could also potentially service additional (to the 9,900 hectares) land outside Area 10 (e.g. the Arriga area within MDWSS, which is a major sugarcane production area in which the Tableland Mill is located). The Arriga area could increase the potential land area base demand for additional water because although it is currently irrigated, sugarcane growers in the area have expressed interest in increasing the megalitres applied per hectare.

The Arriga area is also somewhat constrained by existing distribution infrastructure capacity. A potential solution to service this area could be a fit for purpose pipeline run from the Walsh River (using Nullinga Dam water allocations) to deliver increased supply to the area.

DNRM also noted that a substantial additional area of the land adjacent to the proposed dam would likely be suited to irrigation (i.e. in addition to the identified 9,900 hectares).

14.4 Economic Benefits—Method and Assumptions

Benefit to Australia's economy has been estimated using the incremental increase in agricultural IVA derived from gross production values or GVP less the opportunity cost of foregone agricultural production. The incremental benefits (and costs) inform the economic CBA.

The assessed economic benefits represented by the net GVP include:

- Benefits to farm owners (i.e. return on farm capital)
- Benefits to farm labourers (i.e. wages)

The assessed economic benefits exclude the following from the net GVP estimates:

- Estimated value of foregone agricultural production (e.g. for greenfield this may be beef and for brownfield a combination of beef, crops of lower value than sugarcane and sugarcane)
- An estimated 34.29 per cent adjustment to GVP to account for intermediate inputs to 'other agriculture'. This excludes benefits to local agricultural support industries i.e. profits and wages for support industries, such as local fertiliser producers and local manufacturing industries.

Key metrics and assumptions underpinning this analysis are drawn from a number of data sources and use actual 2015 production values within the existing irrigation scheme and regional area as the baseline.

14.4.1 Industry Value Added per Hectare—Underpinning Benefit Assessment

The IVA per hectare of irrigated land is based on 2015 production values reported in the Tablelands Agricultural Profile (DAF 2015) as these are the most recent available. The data is then converted to IVA using ABS data (outlined below).

The categories of cropping expansion suggested in regional consultation are:

- sugarcane only
- mixture of sugarcane and other higher value crops
- tree and other irrigated crops (e.g. avocado, mango, citrus, and bananas – excluding sugarcane).

14.1.1.1 Conversion of GVP to IVA using Input-Output Tables for Other Agriculture

The categories of agriculture in the ABS (2014) Input-Output Tables are:

- Sheep, Grains, Beef and Dairy Cattle

- Poultry and Other Livestock
- Other Agriculture
- Aquaculture
- Forestry and Logging
- Fishing, hunting and trapping
- Agriculture, Forestry and Fishing Support Services.

Of these 'Other Agriculture' best reflects the cropping mix in the Tablelands, as it is described as including:

- Vegetable Growing
- Fruit Growing
- Other Livestock Farming
- Other Crop Growing

All of the above reflect key cropping types in the MDWSS and Atherton Tablelands.

On this basis the ABS Input-Output tables identify the following intermediate inputs to the three main agricultural categories and the resulting IVA (second bottom row). The far right column was adopted to reflect the benefits in the study area, i.e. intermediate inputs of 34 per cent were excluded resulting in an IVA that is 66 per cent of gross value of production.

Table 9 IVA—Three Main Agricultural Categories in the Atherton Tablelands

AGRICULTURAL SECTOR	SHEEP, GRAINS, BEEF AND DAIRY CATTLE	POULTRY AND OTHER LIVESTOCK	OTHER AGRICULTURE
Total Intermediate Use - Inputs from other sectors	**55**	**38**	**34**
Compensation of employees	7	9	12
Gross operating surplus & mixed income	30	48	48
Taxes less subsidies on products	1	0	1
Other taxes less subsidies on production	1	1	1
Complementary imports	-	-	-
Competing imports	6	3	4
IVA	**45**	**62**	**66**
Australian Production	**100**	**100**	**100**

14.1.1.2 Comparison with Australian Agriculture

Generally, the IVA arising from agriculture on average across Australia is considered to be lower than 66 per cent. Table 9 shows that for:

- Sheep, Grains, Beef and Dairy Cattle the IVA is 45 per cent
- Poultry and Other Livestock the IVA is 62 per cent.

It was considered that the 66 per cent IVA for other agriculture was the most appropriate for the PBC. However, any further assessment should consider a more refined measure of IVA (e.g. explicitly looking at the IVA of sugarcane and the specific crop mix in the region). The following benefits are indicative only.

14.1.1.3 Options 2 and 3—Industry Value-added Benefit

Under Options 2 and 3, where the benefits are likely to be predominantly from 'brownfield' expansion of agricultural production – for modest volumes of new water (e.g. 12,900 ML under Option 3) – Table 10 presents the low, medium and high benefit assumptions for gross revenue.

Table 10 Comparison of GVP per Hectare in MDWSS—Options 2 and 3

BENEFIT	IVA PER HECTARE ($ /HA)	DESCRIPTION
Low	2,378	Sugarcane only
Medium	10,825	Mixture of crops including sugarcane making up approximately 50% irrigated area (excluding beef and other lower value production)
High	16,903	Higher value crops than sugarcane (excluding beef cattle, sugarcane and lower value crops than sugar)

14.1.1.4 Option 4—Gross Benefit

For Option 4, where the benefits may arise in mix of greenfield and brownfield production – for relatively large volumes of new water (e.g. 55,000 ML) – Table 11 presents the low, medium and high benefit assumptions for gross revenue.

Table 11 Comparison of GVP per Hectare in MDWSS—Option 4

BENEFIT	IVA PER HECTARE ($ /HA)	DESCRIPTION
Low	2,378	Sugarcane only (100% of cropping area)
Medium	6,601	Midpoint returns reflecting approximately 75% sugarcane as a portion of irrigated cropping area
High	10,825	Mixture of crops including sugarcane making up approximately 50% irrigated area (excluding beef and other lower value production)

Under Option 4, the assumed per hectare benefits are lower in the medium and high benefit scenarios than under Options 2 and 3, because it is assumed that a sizeable portion of demand for new water allocations from Nullinga Dam would arise from sugarcane producers – MSF Sugar's expansion plans in particular.

14.4.2 Area of Potential Production

Hectares of potential additional production calculations are based on the availability of irrigation water.

A range of application rates is considered in the analysis between 6 ML and 10 ML per hectare per year. This range was derived through analysis of various crop requirements and via discussions with irrigators and representative groups who indicated 10 ML per hectare per year as an accepted baseline dependent on a variety of climate, soil and crop variables.

Consequently, the assessment of economic benefits assumes 10 ML of water use per hectare for greenfield and an increase from 5 to 10 ML for brownfield.

Specifically:

- Options 2 and 3 generally assume brownfield expansion of agricultural production
- Option 4 assumes various combinations of greenfield and brownfield expansion.

The analysis of each option below generates an estimate of benefit, however, in summary the hectares of expanded production (assuming greenfield for simplicity) are as follows:

1. Option 2 – 3 per cent[2] increased use of 144,000 ML of allocations in the MDWSS = 4,330 ML divided by 10 ML per hectare = 433 hectares of incremental expanded production
2. Option 3 – 12,900 ML divided by 10 ML per hectare = 1,290 hectares of incremental expanded production.
3. Option 4 – 55,000 ML divided by 10ML per hectare = 5,500 hectares of incremental expanded production.

For brownfield, assuming 5 ML per hectare results in twice as many hectares at half the increase in GVP per hectare. For simplicity, using 10 ML for greenfield and brownfield results in an equivalent benefit.

14.4.3 Opportunity Costs—Foregone or Displaced Agricultural Production

The estimated value of foregone agricultural production (e.g. for greenfield this may be beef and for brownfield a combination of beef, crops of lower value than sugarcane and sugarcane) was excluded from the estimated incremental benefit, as the new production will replace the value of existing production.

The following tables present the PBC's assumptions and methods. The method established scenarios where replaced agricultural production was described for each option and then that lost GVP was based on 2014-15 GVP values and weightings. The rest of GVP figures (which are expressed in 2015 dollars) have not been escalated to 2017 dollars as commodity prices are not subject to price escalation as may be the case for input costs. That is, prices may rise or fall from year to year, so 2015 dollars have been maintained.

Once foregone GVP was subtracted from the additional GVP, the net GVP was converted to IVA using the assumed 66 per cent IVA as a portion of net GVP.

14.1.1.5 Options 2 and 3—Opportunity Cost

Table 12 Opportunity Cost—Option 2 and 3

BENEFIT	GVP PER HECTARE ($ /HA) ^	DESCRIPTION	FORGONE PRODUCTION ASSUMPTIONS	GVP VALUE OF OPPORTUNITY COST ($ /HA) ^
Low	3,565	Sugarcane only	100% Beef	63
Medium	16,229	Mixture of crops including sugarcane making up approximately 50% irrigated area (excluding beef and other lower value production)	50% Beef 50% Sugar	1,814
High	25,342	Higher value crops than sugarcane (excluding beef cattle, sugarcane and lower value crops than sugar)	25% Beef 75% Sugar	2,690

Note: ^ Once foregone GVP was subtracted from the additional GVP, the net GVP was converted to IVA using the assumed 66 per cent IVA as a portion of net GVP.

[2] The 3 per cent increase is based on historical precedent of similar water supply schemes (i.e. Emerald Water Supply Scheme).

14.1.1.6 Option 4—Opportunity Cost

Table 13 Opportunity Cost—Option 4

BENEFIT	GVP PER HECTARE ($ /HA) ^	DESCRIPTION	FORGONE PRODUCTION ASSUMPTIONS	GVP VALUE OF OPPORTUNITY COST ($ /HA) ^
Low	3,565	Sugarcane only (100% of cropping area)	100% Beef	63
Medium	9,897	Midpoint returns reflecting approximately 75% sugarcane as a portion of irrigated cropping area	75% Beef 25% Sugar	939
High	16,229	Mixture of crops including sugarcane making up approximately 50% irrigated area (excluding beef and other lower value production)	50% Beef 50% Sugar	1,814

Note: ^ Once foregone GVP was subtracted from the additional GVP, the net GVP was converted to IVA using the assumed 66 per cent IVA as a portion of net GVP.

14.5 Economic Costs

The economic costs include those required to realise the economic benefit, that is:

- One-off costs (e.g. capex) associated with the establishment of Options 2 to 4 (project costs)
- Ongoing opex associated with Options 2 to 4
- One-off on-farm investment costs
- Ongoing on-farm opex.

The costs included above were incremental changes in economic costs against a base case. For example, in Option 3 the changes in opex accounted for savings in the base case cost of operating MDWSS, and were net increases in opex only.

14.5.1 Capex and One-off Opex to Establish Options 1 to 3 (Project Costs)

The economic costs needed to realise the economic benefit, that is, one-off capital costs, one-off opex and ongoing project opex associated with establishing Options 2 to 4 are presented in the analysis of each option further below.

14.5.2 On-Farm Investment

The economic costs include on-farm investment needed to realise the economic includes comprised of:

- Cost of irrigation infrastructure (e.g. conversion to overhead centre-pivot or drip irrigation)
- Cost of establishing new crops (e.g. conversion from beef to sugarcane or sugarcane to tree crops).

Each is addressed below. The ongoing opex was considered equivalent to annual water charges, the balance of ongoing on-farm opex is captured in the intermediate inputs which has been removed from the benefit using the IVA method.

14.5.2.1 Cost of Irrigation Infrastructure

Irrigation engineers estimated that a value of:

- Up to $5,000 per hectare could be assumed for the capex needed to establish irrigation for sugarcane and other crops using overhead centre-pivot irrigation systems

- Approximately $10,000 per hectare could be assumed for the capex needed to establish irrigation for tree (i.e. banana and avocados) and other irrigated non-sugarcane crops to install drip (T-tape) irrigation technologies.

Consultation with irrigators in the Tablelands region revealed similar but more precise one-off costs of irrigation equipment as follows:

- Flood irrigation $0 per hectare (already established in most cases or included in soil preparation)
- Centre-pivot $3,750 per hectare
- Drip irrigation $10,000 per hectare.

Based on these input costs and the weightings below, the following values have been included in the economic CBA and BCRs as part of on-farm investment costs.

Options 2 and 3—On-Farm Irrigation Equipment Cost

Table 14 Irrigation Equipment Cost—Option 2 and 3

BENEFIT	IVA PER HECTARE ($ /HA PA)	DESCRIPTION	IRRIGATION COST ASSUMPTIONS	VALUE OF INVESTMENT ($ /HA PA)
Low	2,378	Sugarcane only	80% Flood (nil cost) 20% Centre Pivot	750
Medium	10,825	Mixture of crops including approx. 50% sugarcane by area (excl. beef and other lower value production)	50% Flood (nil cost) 40% Centre Pivot 10% Drip	2,500
High	16,903	Higher value crops than sugarcane (excluding beef cattle, sugarcane and lower value crops than sugar)	20% Flood (nil cost) 60% Centre Pivot 20% Drip	4,250

Option 4—On-Farm Irrigation Equipment Cost

Table 15 Irrigation Equipment Cost—Option 4

BENEFIT	IVA PER HECTARE ($ /HA PA)	DESCRIPTION	IRRIGATION COST ASSUMPTIONS	VALUE OF INVESTMENT ($ /HA PA)
Low	2,378	Sugarcane only	80% Flood (nil cost) 20% Centre Pivot	750
Medium	6,601	Midpoint—approx. 75% sugarcane by area	65% Flood (nil cost) 30% Centre Pivot 5% Drip	1,625
High	10,825	Mixture of crops including approx. 50% sugarcane by area (excl. beef and other lower value production)	50% Flood (nil cost) 40% Centre Pivot 10% Drip	2,500

The costs above are applied to the area in hectares assumed for the corresponding option.

14.5.2.2 Cost of Establishing New Crops

The cost of establishing new crops required some assumptions that are set out for the shortlisted options below. There are many variables so the analysis is indicative, but suitable for a PBC.

The costs included in the economic CBA and BCRs for this item depends on the mix of on-farm investment required including soil preparation and planting costs, which depends on the assumed benefit scenario.

Specific assumptions are made for each of the low, medium and high benefit scenarios, depending on the scenario envisaged in terms of crop mix – this is impacted by the brownfield and/or greenfield assumptions as set out in the following tables. The approach taken is also consistent with the assumed irrigation equipment costs (see table above).

Options 2 and 3—On-Farm Cost of Establishing Crops

Table 16 On-Farm Crop Establishment Costs—Option 2 and 3

BENEFIT	IVA /HA ($ /HA PA)	GVP /HA ($ /HA)	DESCRIPTION	CROP ESTABLISHMENT ASSUMPTIONS	VALUE OF INVESTMENT ($ /HA PA)
Low	2,378	3,565	Sugarcane only	100% sugarcane	1,007
Medium	10,825	16,229	Mixture of crops (incl. 50% sugarcane by area and excl. beef and other lower value production)	50% sugarcane 50% weighted average of other higher value crops	4,447
High	16,903	25,342	Higher value crops than sugarcane (excl. beef cattle, sugarcane and lower value crops than sugar)	100% weighted average of irrigated Tablelands crops (excl. sugarcane)	7,887

Option 4—On-Farm Cost of Establishing Crops

Table 17 On-Farm Crop Establishment Costs—Option 4

BENEFIT	IVA /HA ($ /HA PA)	GVP /HA ($ /HA)	DESCRIPTION	CROP ESTABLISHMENT ASSUMPTIONS	VALUE OF INVESTMENT ($ /HA PA)
Low	2,378	3,565	Sugarcane only	100% sugar	1,007
Medium	6,601	9,897	Midpoint – approx. 75% sugarcane by area	75% sugar 25% weighted average of other higher value crops	2,727
High	10,825	16,229	Mixture of crops (incl. 50% sugarcane by area and excl. beef and other lower value production)	50% sugar 50% weighted average of other higher value crops	4,447

The costs above are applied to the area in hectares assumed for the corresponding option.

14.6 Timing of Economic Costs and Benefits—Assumptions

This section outlines the assumed timing of the economic costs and benefits in the model, which inform the economic CBA, NPVs and BCRs as follows.

Table 18 Timing of Economic Costs and Benefits in Economic Model—Option 4

YEAR	1	2	3	4	5	6	7	8	9	10
Indicative FY	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Incremental share of project costs (e.g. capex for Option 4)	5%	5%	35%	35%	20%					
Incremental share of on-farm costs					25%	50%	25%			
Cumulative Benefits – Sugarcane						50%	100%			
Cumulative Benefits – Higher value crops other than sugarcane						20%	40%	60%	80%	100%

The above applies for Option 4, and with minor appropriate modifications, generally to Options 2 and 3. In summary, the reasons for the above are (by row):

- Incremental share of project costs (e.g. capex for Option 4) – two years of approvals and procurement, three year construction weighted more heavily to the first two years as it is likely a 2.5 year build, this means that water may be available for the second half of Year 5 (2022).
- Incremental share of on-farm costs – experience in other jurisdictions has demonstrated that farmers commence on-farm investment in the final year of dam construction (e.g. buying irrigation equipment) so that they can realise the financial benefits as soon as practical once water is available (this is driven in part by the upfront cost of new water allocations and the need for a return) (25 per cent); most investment will then take place in the year after construction is available (50 per cent); however, some farmers will continue irrigation equipment and crop establishment (25 per cent) in the second year of water availability.
- Cumulative Benefits – Sugarcane is quick to yield returns and it is assumed that 50 per cent of the economic benefits occur in the first full year in which water is available and 100 per cent in the second year of water availability.
- Cumulative Benefits – Crops with higher GVPs ($ per ha) than sugarcane yield benefits in one to two years, three to five years and three to seven years in some cases. The assumption of 20 per cent per annum over five years is a mid-point that is considered reasonable. Data in Table 18 informed this decision and supports the adopted approach.

Table 19 Timing of Water Uptake and Indicative Cumulative Economic Benefit

YEAR	1	2	3	4	5	YEARS TO FULL PRODUCTION
Fodder	100%					1
Melons	50%	100%				2
Peanuts	50%	100%				2
Sugarcane	50%	100%				2
Bananas	33%	67%	100%			3
Avocados	20%	40%	60%	80%	100%	5
Citrus	20%	40%	60%	80%	100%	5 *
Legumes	20%	40%	60%	80%	100%	5
Mangos	20%	40%	60%	80%	100%	5

Source: Qld DAF 2017. Note: *Citrus may take up to seven years to deliver full benefits and may not deliver revenue for three years.

Table 19 shows that some crops take up water and therefore may deliver economic benefits in:

- One to three years (e.g. fodder, melons, peanuts, sugarcane and bananas)
- Five years (e.g. avocados, citrus, legumes and mangos).

Accordingly, the adopted economic model assumption of crops other than sugarcane, delivering economic benefits over five years, is somewhat conservative as it potentially understates the rate at which economic benefits will be realised for fodder, melons, peanuts and bananas. This is balanced by the fact that certain tree crops (e.g. avocados and citrus) may not provide material revenue for three years even if they need water. On balance, assuming the realisation of economic benefits over five years is considered reasonable.

14.6.1 Employment

The employment potential of increased agricultural production is estimated using the most recent regional figures for agricultural GVP and employment by category reported by the ABS. Under this calculation, the value of regional agricultural production ($552 million) divided by the number of people employed in the agricultural sector (2,257 FTEs) gives the equivalent of one direct FTE per $0.24 million of GVP.

For indirect jobs, a standard multiplier of 2.5 FTE indirect jobs per one direct FTE identified by Horticulture Australia is also used. Table 20 summarises this and the low, medium and high scenarios based on alternative (lower) values for agricultural production.

Table 20 Direct and Indirect Jobs from Agriculture in the Tablelands

ITEM	LOW ^	MED	HIGH *
Value of agricultural production ($2016 million)	471	512	552
Number of FTE jobs	2,257	2,257	2,257
Production value that creates one direct FTE	208,741	226,716	244,690
Multiplier applied to direct jobs to create indirect FTEs	2.5	2.5	2.5
Number of indirect jobs created	5,665	5,665	5,665

Source: ^ DAF 2015* ABS 2016

The above describes the base case jobs arising from agriculture. Further below these assumptions are applied to each option, as part of economic impact assessment, to estimate the incremental jobs arising from the short-listed options, based on the net economic benefit (i.e. GVP, less GVP opportunity cost, less overseas leakage of benefits). Indirect jobs are excluded from the economic CBA.

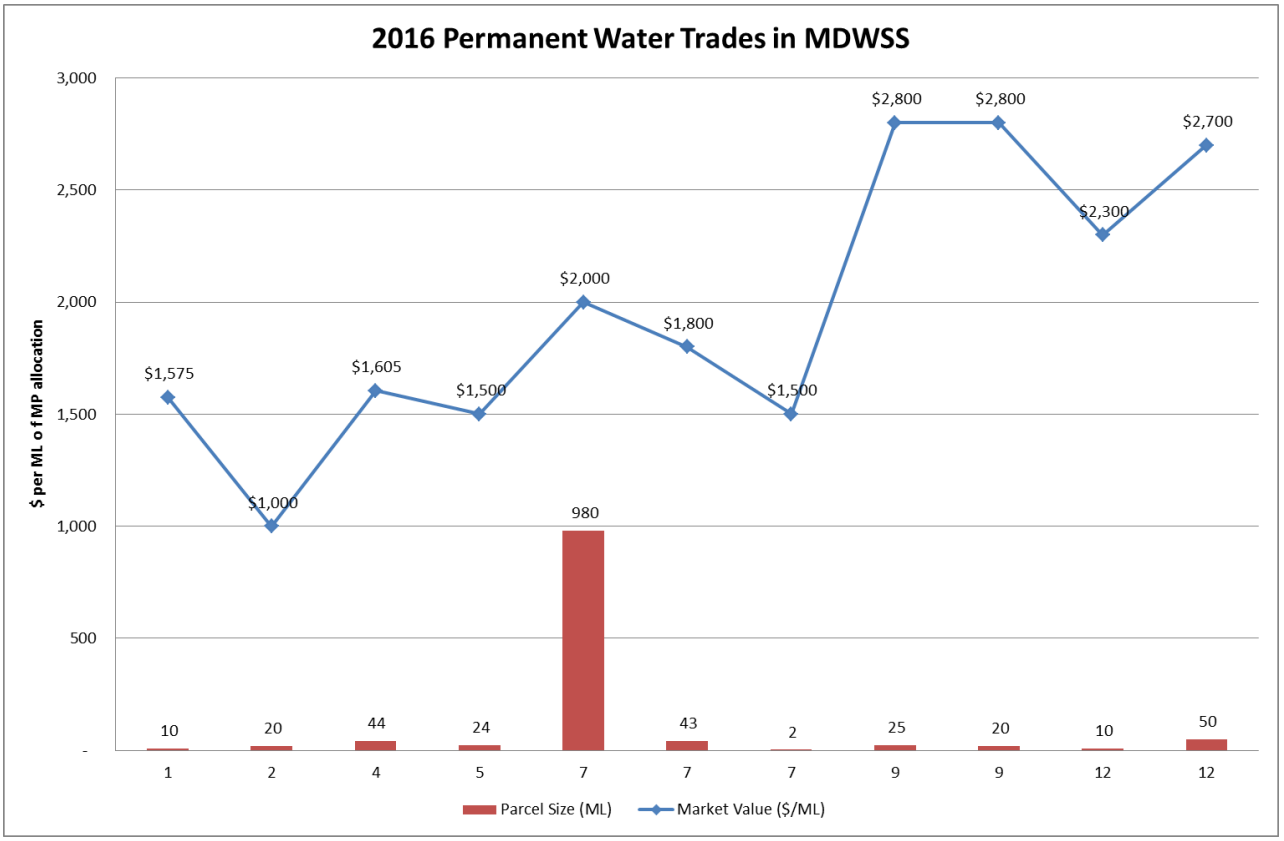
14.6.2 Value of Irrigation Water

A range of low, medium and high values for irrigation water are used in the economic and financial analysis for additional irrigation water. The range of prices between $2,000 and $4,000 per ML were established through the MJA Demand Report and further consultation with irrigators by Jacobs as part of the development of the PBC.

In the MDWSS, existing industry in the region indicated that the price for additional permanent MP water allocations ranges between $2,000 to $3,000 per ML, with the current price between $2,500 and $2,700 per ML.

The latest DNRM water trading data was analysed – where water trades are identifiable as separate from land values – which corroborate irrigators' views and as follows.

Figure 5 2016 Permanent Water Trades in the MDWSS



Source: DNRM (2016)

The figure above shows that in late 2016, from September to December, water was trading in the range $2,300 to $2,800 per ML. The data is incomplete as a number of other trades took place bundled with land parcels, making it impractical to identify the market value assigned to the water allocations. Trading data from January to March 2017 was not available from DNRM.

In line with the data above, irrigators indicated there exists a willingness to pay for permanent MP water allocations in the range $2,000 to $3,000 per ML. Willingness to pay is dependent in part on the annual water charges, soil and crop type, capacity constraints in the distribution system and on-farm investment costs.

The stated prices above generally assume the current level of annual charges that apply in the MDWSS (not new higher annual charges, for example, that may apply to Nullinga Dam water).

14.6.3 Summary of One-off Prices for Water Allocations – Model Assumptions

The economic modelling medium scenario assumes a price for MP water allocations of $2,500 per ML.

- For Option 3 this is conservative
- For Option 4 the medium price $2,500 is conservative for higher value crops, with a medium willingness to pay of $2,200 per ML (assuming annual charges of $200 per ML) for most sugarcane farmers.

On balance, $2,500 per ML reflects a forward-looking view, supported widely by key stakeholders and market data. The model assumes a low of $2,000 per ML and a high of $3,000 per ML.

14.6.4 Availability of Soils

The economic assessment of the shortlisted options is based on the assumption that sufficient additional good quality soils are available for expansion of the scheme in key areas. Water is considered the limiting factor rather than land in the majority of the scheme area. This assumption is based on irrigator consultation, findings of the Queensland Agriculture Audit and consultation with government agencies. Details of the advice from DNRM on the suitability of soils in the region is provided in section 15.3.

14.7 Option 2: Improve MDWSS Rules and Operation

14.7.1 Economic Issues Associated with Option 2

The intended outcome of Option 2 is to increase the overall productivity of the scheme through increasing the percentage of allocated water used. Consultation with growers indicated that Option 2 reforms would improve confidence and the ability to take up more of their allocated allowance.

Modelling and accurately predicting the change in irrigators' behaviour and water use is beyond the scope of this PBC and as such a proxy measure of percentage increases in utilisation is used to determine the predicted economic benefits and costs of Option 2. Stakeholder consultation indicated that a conservative estimate of production increases would be 3 per cent annually. This has been adopted for the PBC.

14.7.2 Key Assumptions

- Changes to the existing irrigation scheme will increase production by between 3 per cent over five years.
- Benefits take up to seven years to be fully realised.
- Current land use patterns will remain the same.
- No additional water allocations will be created under this option.

14.7.2.1 Area of Production

Implementation of Option 2 alone will not increase the hectares under production within the existing scheme as most of the increased utilisation is expected to increase rates of water application on brownfield irrigation areas (i.e. existing irrigation farms within MDWSS).

14.7.3 Economic Costs and Benefits of Option 2

Table 21 shows the impacts on overall scheme productivity under each increase scenario presented as part of Option 2. One-off project costs (opex) totalling $1 million are incurred in 2017 and 2018 (i.e. $500,000 per annum for two years of government wages and external consultancies).

Table 21 Option 2 Increase Utilisation, On-Farm Investment and Benefit Estimation

$2017	INPUT ($ PER HA)	2019	2020	2021	2022	2023	2024	2025
Increased utilisation		1.0%	1.5%	2.0%	2.5%	3.0%	3.0%	3.0%
Increased use of existing MP (ML)	4,329	4,329	4,329	4,329	4,329	4,329	4,329	4,329
Value of benefit ($ pa) – new GVP	3,503		252,735	631,837	884,572	1,137,307	1,390,042	1,516,409
Intermediate inputs	34%	-	-86,663	-216,657	-303,320	-389,983	-476,645	-519,977
Net value of benefit ($ pa) - Net IVA	66%	-	166,072	415,180	581,252	747,324	913,396	996,432
Total benefits		**-**	**166,072**	**415,180**	**581,252**	**747,324**	**913,396**	**996,432**
Total on-farm costs	1,757	63,380	158,449	158,449	126,759	126,759	95,070	31,690
Total costs	**1,757**	**63,380**	**158,449**	**158,449**	**126,759**	**126,759**	**95,070**	**31,690**
Net economic benefit		**-63,380**	**7,623**	**256,731**	**454,493**	**620,565**	**818,327**	**964,743**

14.7.4 Employment Impacts of Option 2

Table 22 shows the impacts on overall scheme employment under each increase scenario presented as part of Option 2, which are excluded from the CBA.

Table 22 Additional Employment Associated with Option 2 Productivity Scenarios

ADDITIONAL FTE EQUIVALENT EMPLOYMENT	FTES
Direct	5
Indirect	13
Total	18

14.7.5 Cost Benefit Analysis Results and Sensitivity Analysis—Option 2

The economic CBA results for Option 2 are as follows including sensitivities for each of the stipulated discount rates and low, medium and high benefit and cost scenarios.

Table 23 Economic Net Present Value—Sensitivity Analysis

ECONOMIC NPV OF OPTION	LOW ON-FARM BENEFITS & COSTS	MEDIUM ON-FARM BENEFITS & COSTS	HIGH ON-FARM BENEFITS & COSTS
NPV (4% discount rate)	11,234,902	49,255,071	77,581,043
NPV (7% discount rate)	6,796,232	**30,867,641**	48,662,921
NPV (10% discount rate)	4,196,986	20,058,447	31,655,581

Table 24 Economic Benefit Cost Ratios—Sensitivity Analysis

ECONOMIC BENEFIT COST RATIOS	LOW ON-FARM BENEFITS & COSTS	MEDIUM ON-FARM BENEFITS & COSTS	HIGH ON-FARM BENEFITS & COSTS
Benefit cost ratio (net) - 4% discount rate	8.7	17.4	18.1
Benefit cost ratio (net) - 7% discount rate	5.8	**11.4**	11.8
Benefit cost ratio (net) - 10% discount rate	4.0	7.8	8.1

Table 25 Economic Net Present Value—Sensitivity Analysis

ECONOMIC NPV - SENSITIVITY ANALYSIS	LOW ON-FARM BENEFITS	MEDIUM ON-FARM BENEFITS	HIGH ON-FARM BENEFITS
Low on-farm costs	6,796,232	32,408,429	51,744,497
Medium on-farm costs	5,255,444	**30,867,641**	50,203,709
High on-farm costs	3,714,656	29,326,854	48,662,921

Table 26 Economic Benefit Cost Ratios—Sensitivity Analysis

ECONOMIC BCR - SENSITIVITY ANALYSIS	LOW ON-FARM BENEFITS	MEDIUM ON-FARM BENEFITS	HIGH ON-FARM BENEFITS
Low on-farm costs	5.8	23.7	37.3
Medium on-farm costs	2.8	**11.4**	17.9
High on-farm costs	1.8	7.5	11.8

Table 27 New Water Created by Option 2

NEW WATER USE CREATED BY OPTION	LOW	MED	HIGH
Predominantly MP water use (ML)	4,329	4,329	4,329

14.1.2 Conclusions

- Once fully implemented, Option 2 could generate an additional $1.0 million per annum of value added to the economy due to increased agricultural production.
- Impacts on overall MDWSS employment are expected to be an additional 18 jobs annually comprised of 5 FTE direct and 13 FTE indirect jobs once the full benefits are realised.
- The medium scenario is an economic NPV of $31 million with a BCR of 11.4.
- The upper bound of the sensitivity analysis is an economic NPV of positive $4 million with a BCR of 1.8.

14.2 Option 3: Modernise MDWSS and Convert Losses

14.7.6 Key Economic Issues Associated with Option 3

Consultation with irrigators and other stakeholders indicates that demand for additional water is strong within the scheme (but sensitive to price) and that generally the targeted, partial modernisation of the scheme would be well received. The medium scenario assumes 12,900 ML of new water allocations, but this requires further analysis.

Stakeholder concerns will be to avoid materially driving scheme costs upwards, resulting in higher annual water charges for all customers of the distribution system. Other concerns will relate to capacity constraints (e.g. peak flows in ML per day) and customers will seek to ensure that adding say 12,900 ML of new allocations to the scheme does not compromise:

- peak flow entitlements of existing customers
- water security in Tinaroo Falls Dam
- SunWater's ability to fill the channels and deliver existing allocations via the distribution system if loss allocations are reduced.

There is also likely to be concerns about reducing flows in the supplemented streams which currently benefit riparian users and the environment (e.g. Jabiru (Mareeba) wetlands, which may have tourism and the associated economic impacts). Social and environmental impacts are considered in the relevant chapters.

14.7.7 Key Assumptions

- The predicted water savings in the scheme can be achieved and loss allocations converted to saleable allocations. Of the approximately 20,000 ML of predicted savings under the scheme, 12,900 ML will be made available for sale to irrigators (permanently, seasonally or via leases).
- All additional allocations can be sold for between $2,000 and $3,000 per ML.
- Irrigation applications range between 8 ML per hectare and 12 ML per hectare annually dependent on a range of variables but a 10 ML per hectare total use is the medium scenario.
- The current land use mix remains the same although the analysis includes a low, medium and high benefit and low, medium and high cost scenario.
- Additional water allocations will be used to develop or increase irrigation intensity on currently underutilised land within the existing scheme boundaries – so the benefits are largely brownfield or a mixture of brown and greenfield agricultural expansion.

14.7.7.1 Hectares of Production

Implementation of Option 3 is expected to increase the area under irrigated production within the existing scheme. Table 28 shows the hectares of additional production provided under a range of irrigation application regimes per hectare. Based on consultation with irrigators the mid-range of 10 ML is considered the most likely scenario.

Table 28 Additional Hectares of Production—Option 3

	8ML PER HECTARE	10ML PER HECTARE	12ML PER HECTARE
Total Additional hectares of Production Area	1,613	1,290	1,075

14.7.8 Economic Costs and Benefits of Option 3

Capex, on-farm investment and benefit calculation and key assumptions are shown in Table 29.

Table 29 Option 3 Capex, On-Farm Investment and Benefit Estimation—Medium Scenario

$2017	PV 2017-2046 ($, 7% discount rate)	2019	2020	2021	2022	2023	2024
Value of benefit ($ pa) – GVP	154,123,133	-	1,653,027	4,959,080	8,814,323	13,218,755	16,519,349
Intermediate inputs	52,848,822	-484,980	-1,454,940	-2,586,026	-3,878,238	-4,846,596	-5,329,974
Net value of benefit ($ pa) – Net IVA	101,274,310	929,368	2,788,104	4,955,606	7,431,875	9,287,542	10,213,841
Opex related water revenue	8,671,508	487,615	627,290	767,286	745,024	747,770	750,491
Residual value	238,589	-	-	-	-	-	-
Total benefits	**110,184,407**	**1,416,983**	**3,415,394**	**5,722,893**	**8,176,899**	**10,035,312**	**10,964,332**
Capex	33,589,052	9,916,433	9,916,433	9,916,433	9,916,433	-	-
Water related opex	8,671,508	487,615	627,290	767,286	745,024	747,770	750,491
Total on-farm costs	6,476,609	1,532,687	2,043,583	2,043,583	1,532,687	510,896	-
Total costs	**48,737,169**	**11,936,735**	**12,587,305**	**12,727,302**	**2,277,711**	**1,258,666**	**750,491**
Net economic benefit	**61,447,238**	**-10,519,752**	**-9,171,911**	**-7,004,409**	**5,899,188**	**8,776,646**	**10,213,841**

By 2026, the model assumes full realisation of economic benefits has occurred. This value is the basis of the following employment impacts.

14.7.9 Economic Impacts of Option 3

Table 30 shows the impacts on overall scheme employment presented as part of Option 3. It represents the amount of additional employment generated through additional agricultural activity. The mid-range value of 10 ML per hectare, 12,900 ML of additional water allocation and the current land use mix is the basis of this analysis. These FTEs are excluded from the economic CBA.

Table 30 Additional Employment Associated with Option 3 Productivity Scenarios

ADDITIONAL FTE EQUIVALENT EMPLOYMENT	FTES
Direct	67
Indirect	168
Total	234

14.7.10 Cost Benefit Analysis Results and Sensitivity Analysis—Option 3

The economic CBA results for Option 3 are as follows including sensitivities for each of the stipulated discount rates and low, medium and high benefit and cost scenarios.

Table 31 Economic Net Present Value—Sensitivity Analysis

ECONOMIC NPV OF OPTION	LOW ON-FARM BENEFITS & COSTS	MEDIUM ON-FARM BENEFITS & COSTS	HIGH ON-FARM BENEFITS & COSTS
NPV (4% discount rate)	14,917,560	125,485,352	199,695,972
NPV (7% discount rate)	827,030	**73,256,330**	119,792,457
NPV (10% discount rate)	-6,959,738	42,673,462	72,944,644

Table 32 Economic Benefit Cost Ratios—Sensitivity Analysis

ECONOMIC BENEFIT COST RATIOS	LOW ON-FARM BENEFITS & COSTS	MEDIUM ON-FARM BENEFITS & COSTS	HIGH ON-FARM BENEFITS & COSTS
Benefit cost ratio (net) (4% discount rate)	1.4	3.9	5.1
Benefit cost ratio (net) (7% discount rate)	1.0	2.8	3.6
Benefit cost ratio (net) (7% discount rate)	0.8	2.1	2.7

Table 33 Economic Net Present Value—Sensitivity Analysis

ECONOMIC NPV - SENSITIVITY ANALYSIS	LOW ON-FARM BENEFITS	MEDIUM ON-FARM BENEFITS	HIGH ON-FARM BENEFITS
Low on-farm costs	827,030	78,270,012	129,819,823
Medium on-farm costs	-4,186,653	**73,256,330**	124,806,140
High on-farm costs	-9,200,335	68,242,647	119,792,457

Table 34 Economic Benefit Cost Ratios—Sensitivity Analysis

ECONOMIC BCR - SENSITIVITY ANALYSIS	LOW ON-FARM BENEFITS	MEDIUM ON-FARM BENEFITS	HIGH ON-FARM BENEFITS
Low on-farm costs	1.0	3.2	4.7
Medium on-farm costs	0.9	**2.8**	4.1
High on-farm costs	0.8	2.5	3.6

Table 35 New Water Use Created by Option 3

NEW WATER USE CREATED BY OPTION	LOW	MEDIUM	HIGH
Predominantly MP water use (ML) ^	12,872	12,872	12,872

14.7.10.1 Conclusions

- Once fully implemented, Option 3 could generate an additional $10 million per annum of value added to the economy due to increased agricultural production.
- Impacts on overall MDWSS employment are expected to be an additional 234 jobs annually comprised of 67 FTE direct and 168 FTE indirect jobs once the full benefits are realised.
- The medium scenario is an economic NPV of $73 million with a BCR of 2.8.
- The upper bound of the sensitivity analysis is an economic NPV of negative $9 million with a BCR of 0.8.

14.8 Option 4: Nullinga Dam for Agricultural Use

14.8.1 Economic Issues and Assumptions Associated with Option 4

The intended outcome for Option 4 is to develop an additional bulk water source for expansion of irrigated agriculture in the region. Key assumptions associated with Option 4 are:

- Additional water allocations will be used to develop currently underutilised and undeveloped land within Walsh River area between the dam wall and Dimbulah, though if required there may be the opportunity to use further greenfield sites downstream toward Chillagoe.
- The dam and associated infrastructure is capable of receiving the required water planning, environmental and other development approvals and can be built with the range of costs estimated.
- Approximately 55,398 ML of additional water allocations will be available for sale to irrigators.
- Sufficient areas of suitable soil for additional irrigation are available in the existing scheme boundaries or further downstream, noting that DNRM has identified 9,900 of unirrigated but suitable cropping land in Area 10, a western area of the MDWSS adjacent to the proposed Nullinga Dam and the Walsh River upstream of Dimbulah.
- All additional allocations can be sold for between $2,000 and $3,000 per ML. The PBC adopts the medium scenario of $2,500 per ML.
- Irrigation applications range between eight ML per hectare and 12 ML per hectare annually dependent on a range of variables; however, water use of 10 ML per hectare is the medium use scenario adopted.
- The current land use mix remains the same as within the existing scheme although the analysis includes the low, medium and high benefit scenarios respectively assuming 100 per cent, 75 per cent and 50 per cent sugarcane use of the water. The balance of water use assumed higher value crops making up 0 per

cent, 25 per cent and 50 per cent respectively, including tree crops and other higher value then sugarcane cropping, as identified in consultation with stakeholders (MJA 2017).

- For the purposes of the PBC, the benefits analysis has assumed the scheme reaching full production over five years, after water becomes available, with the IVA based 2014-15 GVP values provided by DAF (2016).

14.8.1.1 Area of Production

Implementation of Option 4 is expected to increase the hectares under production. Table 36 shows the hectares of additional production under a range of irrigation application regimes per hectare.

Table 36 Additional Hectares of Production—Option 4

	8 ML PER HECTARE	10 ML PER HECTARE	12 ML PER HECTARE
Total additional hectares of Production Area based on 55,398 ML additional allocation	6,924 ha	5,539 ha	4,616 ha

DNRM estimated that in Area 10 (Walsh River area) there is up to 9,900 hectares of unirrigated cropping land that could be developed using Nullinga Dam water allocations. The areas above are derived by dividing the dam yield of 55,398 ML by 8-12 ML per hectare. The area of available unirrigated cropping land is larger than the area required for this demand (DNRM 2017).

14.8.2 Economic Costs and Benefits of Option 4

Timing assumptions for capex, on-farm investment and benefit realisation are shown in Table 37.

Table 37 Option 4 Capex, On-Farm Investment and Benefit Realisation Schedule ($2017)

YEAR	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Incremental share of project costs (Nullinga Dam design, approvals and construction capex)	5%	5%	35%	35%	20%					
Incremental share of on-farm investment costs					25%	50%	25%			
Incremental Benefits - Sugarcane						50%	50%			
Incremental Benefits - Higher value than sugarcane						20%	20%	20%	20%	20%

The Option 4 project risk adjusted capex profile is shown in Table 38 in 2017 dollars.

Table 38 Option 4 Capex Profile ($2017)

YEAR	2018	2019	2020	2021	2022
Capex ($2017)	16,451,293	16,780,843	119,818,963	122,219,160	71,238,535

On-farm investment and benefit calculation and other inputs are shown in Table 39 in dollars.

Table 39 Option 4 On-Farm Investment and Benefit Estimation – Medium Scenario

$2017	PV 2017-2046 (7% discount rate)	2023	2024	2025	2026	2027	2028
Benefit (ML of new MP water)		52,663	52,663	52,663	52,663	52,663	52,663
Extra cropping (ha)		5,266	5,266	5,266	5,266	5,266	5,266
Incremental GVP	394,990,897	21,514,600	43,029,199	46,060,064	49,090,928	52,121,793	52,121,793
Adjustment for intermediate inputs	135,442,379	7,377,356	14,754,712	15,793,996	16,833,279	17,872,563	17,872,563
Net value of additional benefit - Net IVA	259,548,519	14,137,243	28,274,487	30,266,068	32,257,649	34,249,230	34,249,230
Opex related water revenue	47,270,861	5,536,473	5,567,065	5,597,408	5,627,503	5,657,352	5,686,956
Residual value	11,224,555	-	-	-	-	-	-
Total benefits	**318,043,934**	**19,673,716**	**33,841,552**	**35,863,476**	**37,885,152**	**39,906,582**	**39,936,186**
Water capex	253,443,841	-	-	-	-	-	-
Water opex	47,270,861	5,536,473	5,567,065	5,597,408	5,627,503	5,657,352	5,686,956
On-farm irrigation costs	1,625	4,278,877	2,139,438	-	-	-	-
On-farm establishment costs	2,727	7,180,206	3,590,103	-	-	-	-
Total on-farm costs	4,352	11,459,083	5,729,542	-	-	-	-
Total costs	**311,918,443**	**16,995,556**	**11,296,607**	**5,597,408**	**5,627,503**	**5,657,352**	**5,686,956**
Net economic benefit	**6,125,491**	**2,678,160**	**22,544,945**	**30,266,068**	**32,257,649**	**34,249,230**	**34,249,230**

By 2027, the model assumes full realisation of economic benefits has occurred. This value is the basis of the employment impacts presented below, which are excluded from the economic CBA.

14.8.3 Economic Impacts of Option 4

Table 40 shows the impacts on overall scheme employment presented as part of Option 4. It represents the amount of additional employment generated through additional agricultural activity. The mid-range value of 10 ML per hectare, approximately 55,000 ML of additional water allocation and the current land use mix is the basis of this analysis.

Table 40 Additional Employment Associated with Option 4 Productivity Scenarios

ADDITIONAL FTE EQUIVALENT EMPLOYMENT	FTES
Direct	176
Indirect	441
Total	616

14.8.4 Cost Benefit Analysis (CBA) Results and Sensitivity Analysis—Option 4

The economic CBA results for Option 4 are as follows including sensitivities for each of the stipulated discount rates and low, medium and high benefit and cost scenarios.

Table 41 Economic Net Present Values—Sensitivity Analysis

ECONOMIC NPV OF OPTION	LOW ON-FARM BENEFITS & COSTS	MEDIUM ON-FARM BENEFITS & COSTS	HIGH ON-FARM BENEFITS & COSTS
NPV (4% discount rate)	-110,362,444	136,343,056	368,704,861
NPV (7% discount rate)	-149,947,713	**6,125,491**	150,539,357
NPV (10% discount rate)	-163,387,868	-60,406,368	33,036,868

Table 42 Economic Benefit Cost Ratios—Discount Rates Sensitivity Analysis

ECONOMIC BENEFIT COST RATIOS	LOW ON-FARM BENEFITS & COSTS	MEDIUM ON-FARM BENEFITS & COSTS	HIGH ON-FARM BENEFITS & COSTS
Benefit cost ratio (net) – 4% discount rate	0.7	1.4	2.0
Benefit cost ratio (net) – 7% discount rate	0.5	**1.0**	1.5
Benefit cost ratio (net) – 10% discount rate	0.4	0.8	1.1

Table 43 Economic Net Present Value—Sensitivity Analysis

ECONOMIC NPV - SENSITIVITY ANALYSIS	LOW ON-FARM BENEFITS	MEDIUM ON-FARM BENEFITS	HIGH ON-FARM BENEFITS
Low on-farm costs	-149,947,713	12,806,288	163,900,951
Medium on-farm costs	-156,628,510	**6,125,491**	157,220,154
High on-farm costs	-163,309,307	-555,306	150,539,357

Table 44 Economic Benefit Cost Ratios—On-farm Benefits Sensitivity Analysis

ECONOMIC BCR - SENSITIVITY ANALYSIS	LOW ON-FARM BENEFITS	MEDIUM ON-FARM BENEFITS	HIGH ON-FARM BENEFITS
Low on-farm costs	0.5	1.0	1.5
Medium on-farm costs	0.5	**1.0**	1.5
High on-farm costs	0.5	1.0	1.5

Table 45 New Water Use Created by Option 4

NEW WATER USE CREATED BY OPTION	LOW	MEDIUM	HIGH
Predominantly MP water use (ML) ^	49,893	52,663	55,433

14.8.4.1 Conclusions

- Once fully implemented, Option 4 could generate an additional $34 million per annum of value added to the economy due to increased agricultural production.
- Impacts on overall MDWSS employment are expected to be an additional 616 jobs annually comprised of 176 FTE direct and 441 FTE indirect jobs once the full benefits are realised.
- The medium scenario is an economic NPV of $6 million with a BCR of 1.0.
- The upper bound of the sensitivity analysis is an economic NPV of negative $163 million with a BCR of 0.4.