

NULLINGA DAM AND OTHER OPTIONS

PRELIMINARY BUSINESS CASE

ABOUT THIS DOCUMENT

Building Queensland finalised the Nullinga Dam and Other Options (the Project) Preliminary Business Case (PBC) in 2017. The core elements of the PBC are presented in this document.

The PBC is being released to inform stakeholders and community members of the analysis underpinning the outcomes. In making the PBC publicly available, commercial-in-confidence information has been removed to protect confidential information of project stakeholders, and the Queensland Government's commercial position during future project stages.

The key objective of the PBC stage under the Building Queensland Business Case Development Framework is to confirm the service need, undertake analysis of potential options that would address the service need, identify preferred option/s and confirm whether to invest in a detailed business case.

The PBC is supported by funding from the Australian Government's National Water Infrastructure Development Fund, and is an initiative of the Northern Australia and Agricultural Competitiveness white papers.

Note:

The findings and recommendations in this document reflect the position of the Project when the PBC was completed in 2017.

Since the completion of the PBC, parties interested in sourcing bulk water supply from the potential Nullinga Dam have provided further details of proposed future demand to Building Queensland. The Queensland Government determined that the new information addresses the triggers identified in the PBC to proceed to a detailed business case under Building Queensland's Business Case Development Framework with a focus on supply for agricultural use in the region.



CHAPTER INDEX

Executive Summary

1. Methodology
2. Proposal Background
3. Service Need
4. Options Generation
5. Options Filter
6. Options Shortlist
7. Strategic Considerations
8. Legal and Regulatory Considerations
9. Market Considerations
10. Public Interest Considerations
11. Sustainability Considerations
12. Social Impact Evaluation
13. Environmental Assessment
14. Economic Analysis
15. Financial and Commercial Analysis
16. Delivery Model Analysis
17. Affordability Analysis
18. Preferred Option for Further Development
19. Conclusions
20. Implementation Plan
21. Recommendations

Glossary



EXECUTIVE SUMMARY

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

EXECUTIVE SUMMARY	2
Overview and Recommendations	2
Proposal Background	5
Service Need	8
Options Analysis	12
Shortlisted Options	13
Strategic Considerations	15
Legal and Regulatory Considerations	15
Market Considerations	17
Social Impact Evaluation	18
Environmental Assessment	18
Economic Analysis	19
Financial and Commercial Analysis	21
Delivery Model Analysis	23
Affordability Analysis	23
Preferred Options for Further Development	24
Conclusion	24
Implementation Plan	25
Recommendations	27

TABLES

Table 1	Nullinga Dam Proposed Uses Over Time	7
Table 2	Options Analysis Outcomes.....	12
Table 3	Social Impact Evaluation—Key Impacts.....	18
Table 4	Economics Analysis—Key Outcomes	21
Table 5	Financial Analysis—Key Outcomes	22
Table 6	Option 2 and Option 3—Key Dependencies for Success and Risks	25

FIGURES

Figure 1	Barron Water Resource Plan area and location of Tinaroo Falls Dam and Nullinga Dam .	5
Figure 2	Tinaroo Falls Dam and proposed Nullinga Dam.....	6
Figure 3	Demand forecast for Cairns Regional Council (2016).....	9
Figure 4	Agricultural demand forecast scenarios (2016).....	10
Figure 5	Gross value of production Tablelands agricultural Area (2015).....	20



EXECUTIVE SUMMARY

Overview and Recommendations

Background

In 2015, the Queensland Treasurer made an election commitment to ‘submit an assessment of the proposed Nullinga Dam to Building Queensland for priority consideration in recognition of the need for additional water storage for urban and agricultural expansion in the tropical North’. Subsequently, the Australian Government made a commitment in the Developing Northern Australia White Paper to provide up to \$5 million from the National Water Infrastructure Development Fund (NWIDF) for a ‘detailed examination of the economic feasibility of Nullinga Dam’. As such, this preliminary business case (PBC) is supported by funding from the Australian Government’s NWIDF.

The proposed Nullinga Dam site is located in far north Queensland on the Walsh River, within the Mareeba Shire Council and Barron Water Plan areas. The Mareeba-Dimbulah Water Supply Scheme (MDWSS) is owned and operated by SunWater and comprised of Tinaroo Falls Dam, a number of weirs and an extensive distribution (channel) system.

The Queensland Government is currently investigating transitioning the MDWSS distribution system to Local Management Arrangements. If this proceeds, the MDWSS distribution infrastructure business, assets and liabilities will be transferred from SunWater to a new local management entity, and SunWater will retain responsibility for Tinaroo Falls Dam as the bulk water supply to the MDWSS. The MDWSS Local Management Arrangements Investigation Board is due to lodge its final business proposal to the Queensland Government in November 2017.

Nullinga Dam Proposed Use

The proposed use for Nullinga Dam at the commencement of the PBC was two-fold:

- To create a new bulk water supply for future urban water demand in Cairns. This proposal was made when the proposed Aquis Resort at the Great Barrier Reef had a planned capital investment of \$8 billion and included a large entertainment and hotel complex, including a casino. The Aquis Resort proposal has since been reduced to an anticipated capital investment of approximately \$2 billion without a casino.
- To stimulate irrigated agriculture in the region, as the MDWSS is currently fully allocated. Alternative options, such as reform, better use of existing infrastructure or new infrastructure, would therefore need to be progressed to allow for the potential expansion of irrigated agriculture.

Preliminary Business Case Objectives

The proposed Nullinga Dam has not been through any formal stages of the Queensland Government Project Assurance Framework. Building Queensland has undertaken a staged approach to the assessment of the Nullinga Dam proposal. This PBC is the first stage. The PBC objectives agreed with the Project Owner—the Department of Energy and Water Supply (DEWS) and the Australian Government are:

- Identify and clearly describe the water supply problems and opportunities within the region.
- Present the Nullinga Dam option along with other options as potential solutions to the identified problems and opportunities.
- Undertake a preliminary analysis of the shortlisted options.
- Provide recommendations for a Stage 2 Detailed Business Case.



Key Findings—Nullinga Dam and Service Need

- The proposed Nullinga Dam is less effective than the existing Tinaroo Falls Dam due to yield and hydrology inefficiency. Tinaroo Falls Dam has a full storage capacity of 438,900 megalitres (ML) and a yield of 211,834 ML per year. In comparison, the ‘large size’ proposed Nullinga Dam has a full storage capacity of 491,000 ML and a yield of between 65,000 and 90,000 ML per year (depending on the hydrological model used). This inefficiency is expected as the original decision was to build Tinaroo Falls Dam because of its more favourable features.
- The Nullinga Dam site suffers from inefficiency issues for irrigation purposes as it can only deliver water to a limited number of existing farms via current delivery infrastructure.
- It is not possible for Cairns to efficiently receive water from the proposed Nullinga Dam. Cairns would need to receive water from Tinaroo Falls Dam via additional releases down the Barron River. This would require MDWSS irrigation water allocation holders to ‘swap’ existing Tinaroo Falls Dam water allocations to Nullinga Dam water allocations. Irrigators may have concerns with this—water from the proposed Nullinga Dam may have different price, quality and reliability characteristics.
- There is no current Cairns urban water supply problem to be addressed. Under current population and demand forecasts, Cairns Regional Council has an implementation plan of council owned and operated demand and supply measures recognised within existing water resource planning frameworks to meet future demand for at least the next 30 years. Cairns Regional Council does not have an identified need for water from a regional source (such as Nullinga Dam) until the very long-term.
- There are three key agricultural demand drivers in the region: dry conditions and water security; changes in crop profile to higher value permanent plantings; and industry growth. There is therefore an opportunity to expand agricultural production on the Atherton Tablelands and surrounding region by increasing the availability of supplemented water.

Key Findings—Shortlisted Options

- Option 1: Do minimum (base case)—continuation of water trading and on-farm efficiency measures in the MDWSS.
- Option 2: Improve MDWSS rules and operation to increase operational performance and reduce current constraints.
- Option 3: Modernise the MDWSS distribution system via infrastructure works to reduce system losses and convert certain loss allocations into new water allocations for sale.
- Option 4: Design and build Nullinga Dam for agricultural use—initially for delivery of water to Walsh River customers within and downstream of the Mareeba-Dimbulah Irrigation Area, but with flexibility for commercial distribution systems to evolve. Distribution infrastructure for the delivery of water from Nullinga Dam to the MDWSS channel system or other locations is not included in this option due to the need for further demand assessment of the volume and location of credible demand.

Conclusion and Recommendations

Option 1: Do minimum (base case) is a viable option as it represents business as usual.

This option provides for incremental expansion of agricultural production via existing mechanisms. However, assessment has identified water security concerns among irrigators in MDWSS, with utilisation at 80 per cent in the current dry conditions. Assessment has also identified crop changes which have the potential to impact on the future operations of sugarcane producers and the operation of the Tableland Mill as water



moves to higher value crops. In comparison, other options provide for additional water availability and have a greater capacity to meet the identified service need.

Option 2: Improve MDWSS rules and operation is recommended to progress to further evaluation.

This option primarily involves changes to bulk storage rules and operation. It is low cost, has stakeholder support and projected economic benefits. A key focus of further evaluation will be modelling to ensure that the proposed rule and operational changes will make a difference to water availability for irrigators. Given its potential to impact on MDWSS operations overall, its recommended implementation involves ongoing consultation with the existing local management entity.

Option 3: Modernise MDWSS distribution infrastructure and convert losses is recommended to progress to further evaluation.

This option improves existing infrastructure, will produce new water allocations for irrigation use, is scalable and can be implemented in stages. A key focus of further evaluation will be:

- the capital cost of works and potential yield of new water allocations. Depending on the outcomes of these assessments, this option may be cost-effective to address irrigators' water security concerns.
- the potential implications of the transition of the MDWSS distribution infrastructure business, assets and liabilities to a new local management entity.

Option 4: Nullinga Dam is not recommended to progress to a detailed business case at this time.

Nullinga Dam (via a 'swap' arrangement of existing water allocations from Tinaroo Falls Dam) is not needed for Cairns urban water supply for at least the next 30 years and assessment has revealed limited certainty of information in relation to Nullinga Dam for agricultural use.

Established industry in the region has identified an immediate requirement for up to 14,000 ML to meet current land holding and production plans. In addition, wider industry consultation has identified a conservative estimate of potential demand of 72,000 ML of water within the next 30 years. This future expansion is considered uncertain and is dependent on a number of factors, including access to additional land, supply chain constraints, investment in associated production or 'value-add' facilities and broader market factors.

The trigger for any further consideration of Option 4: Nullinga Dam for agricultural use is recommended to be a satisfactory level of certainty about the demand for new water allocations at a nominated volume and a nominated price (e.g. a significantly large proportion of the dam yield at an appropriate price). This certainty may be developed via an approach from industry to government, or via government commissioning a detailed demand assessment for new water allocations in the region. In addition, it is recommended:

- any further assessment of Option 4 Nullinga Dam for agricultural use include the following key considerations:
 - development of a robust agricultural economic profile for the sale and use of new water allocations (e.g. crop types and take-up by irrigators)
 - development of the size of the dam, and the location of any distribution infrastructure, to meet market needs
 - the potential to use a pre-commitment process for the sale of water allocations to water users prior to any procurement or construction activities being undertaken.
- that given the complexities associated with the use of Nullinga Dam as a water supply for Cairns due to the requirement for a 'swap' of existing water allocations from Tinaroo Falls Dam, any further assessment

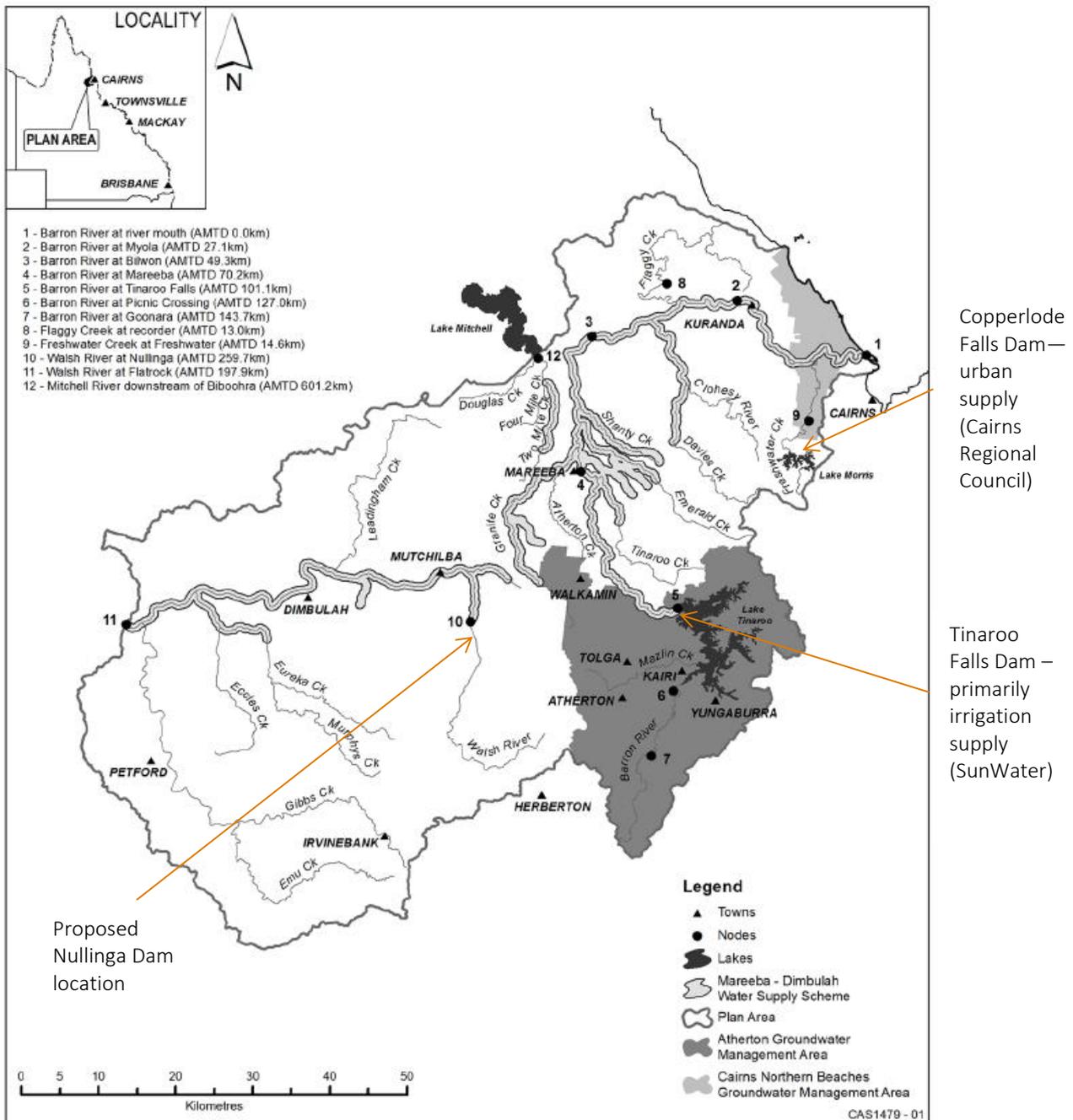


of Nullinga Dam for Cairns urban water supply include development of a better understanding of the options for the delivery of water from a bulk water supply in the Atherton Tablelands region to Cairns.

Proposal Background

The proposed Nullinga Dam site is located on the Walsh River, approximately 55 kilometres south-west of Cairns and 24 kilometres south-south-west of Mareeba. It is situated within the Mareeba Shire Council area and sub-catchments E and F of the Barron Water Plan (See Figure 1).

Figure 1 Barron Water Resource Plan Area and Location of Tinaroo Falls Dam and Nullinga Dam



Source: DNRM

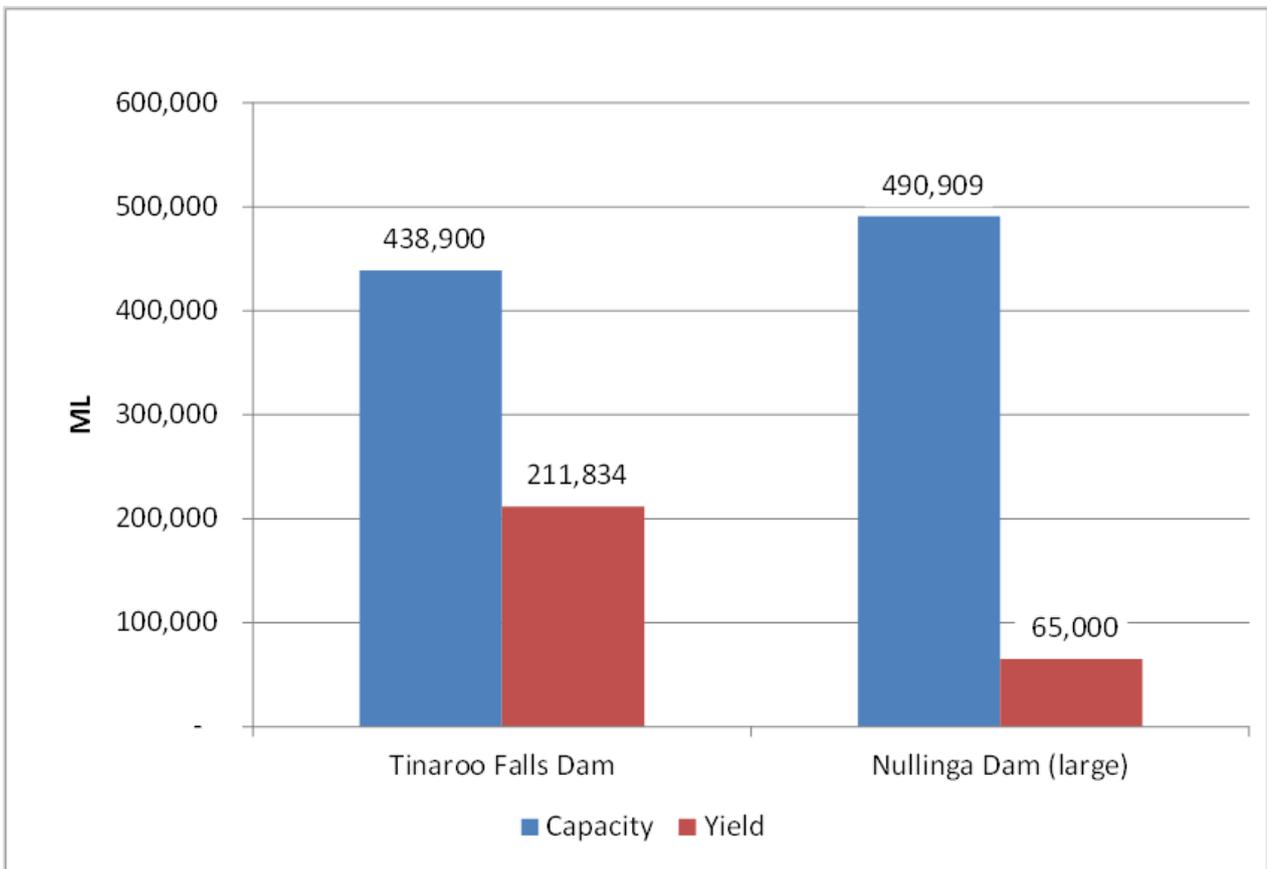


Nullinga Dam was first proposed in the 1950s as part of the original investigations for the development of the Mareeba-Dimbulah Irrigation Area to support tobacco production. However, a decision was made to build Tinaroo Falls Dam instead of Nullinga Dam, as it could supply significantly more water to a greater area.

Tinaroo Falls Dam was completed in 1958 and is the current bulk water supply for the MDWSS, which is owned and operated by SunWater and comprises Tinaroo Falls Dam, a number of weirs and 375 kilometres of delivery channels. At full supply Tinaroo Falls Dam has a storage capacity of 438,900 ML and a yield of 211,834 ML per year.

In comparison, Nullinga Dam is less effective than Tinaroo Falls Dam due to yield and hydrology efficiency. Figure 2 highlights that for a comparable size dam (i.e. a Nullinga Dam the size of Tinaroo Falls Dam), the medium priority yield from Nullinga Dam is about 35 per cent of Tinaroo Falls Dam. This inefficiency is expected as the original decision to build Tinaroo Falls Dam was based on its more favourable features.

Figure 2 Tinaroo Falls Dam and Proposed Nullinga Dam



Source: Queensland Hydrology Unit, Queensland Treasury Corporation, Marsden Jacob Associates



This PBC has considered the various proposals for Nullinga Dam water supply uses over time, as outlined in Table 1, and sought to understand the relevance of these historical assessments to the current demand for additional water supply in the region.

Table 1 Nullinga Dam Proposed Uses Over Time

YEAR	PURPOSE
1950	Tobacco production in the Mareeba-Dimbulah Irrigation Area (no specified volume)
2008	30,000 ML high priority for urban water supply to Cairns
2010	Cairns urban water supply and agricultural water supply (no specified volume)
2015	Urban and agricultural expansion in the Tropical North (no specified volume)
2015	Long-term option for Cairns urban water supply (no specified volume)
2015	12,500 ML of high priority water for Cairns urban water supply, via substitution of Barron sub-catchment E water entitlements back into the Barron River from Tinaroo Falls Dam. Remaining yield of medium priority water for supply to the Walsh River section of the MDWSS (estimated between 36,000 to 69,500 ML depending on the size of the dam)

Nullinga Dam as Supply for Cairns

It is not possible for Cairns to efficiently receive water from the proposed Nullinga Dam due to the location of the dam site relative to Cairns. The existing Tinaroo Falls Dam located on the Barron River and Nullinga Dam located on the Walsh River, would need to operate together, with Cairns receiving water via additional releases from Tinaroo Falls Dam down the Barron River for extraction at Cairns.

Water allocations from Tinaroo Falls Dam are fully allocated. Irrigation is the predominant use of water in the MDWSS, with only a small amount of water servicing towns in the region. The process to supply Cairns would require Tinaroo Falls Dam irrigation water allocation holders to ‘swap’ their existing water allocations for Nullinga Dam water allocations. Irrigators are likely to have significant concerns with this as water from the proposed Nullinga Dam may have different price, quality and reliability characteristics. Cairns would also need to construct water treatment plants and other infrastructure to allow for the transmission of water into its reticulation network for urban use.

The potential for Nullinga Dam as bulk water supply option for Cairns urban use is therefore considered to have significant complexities.

Nullinga Dam as Supply for Irrigated Agriculture

The MDWSS is the major water resource development in the region and supplies irrigation water to approximately 25,000 hectares of irrigated agriculture. Water allocations in the MDWSS are currently fully allocated. Alternative options, such as efficiency gains or new infrastructure, would therefore need to be progressed to allow for the potential expansion of irrigated agriculture.

In terms of land area and water use, sugarcane is one of the major crops in the region, followed by perennial horticulture and broadacre cropping. Bananas, mangoes and avocados are the main perennial horticulture crops grown in the region. Horticulture dominates the region in terms of the dollar value of production. In recent years, there has been an increase in permanent plantings of high value crops. Such crops require more water as they mature so their demand for water allocations is expected to continue to grow.

The annual level of water use in the MDWSS is inversely related to the amount of rainfall. Historically, the level of utilisation (water use as a percentage of water allocation entitlements) is mostly around 60 per cent



to 70 per cent. However, recent dry conditions have persisted since 2012–13 and as a result the level of utilisation in 2015–16 was about 86 per cent.

The MDWSS is considered a highly developed irrigation area with sophisticated irrigators and a history of large scale agricultural production and innovation. Is it therefore considered there is potential for the proposed Nullinga Dam to service additional irrigated agriculture in the region, subject to market appetite.

Service Need

Urban Demand

In 2015, Cairns Regional Council released *Our Water Security: Cairns Regional Council Water Security Strategy* (Cairns Water Security Strategy). The Cairns Water Security Strategy set out a preferred strategy for implementing a series of short, medium and long-term initiatives to address the future demand for water in Cairns over the next 30 years. The long-term initiatives included the conversion of MDWSS water losses to new water allocations and Nullinga Dam, with conversion of losses preferred first.

At the time of the Cairns Water Security Strategy, the proposed Aquis Resort at the Great Barrier Reef, located north of Cairns at Yorkeys Knob, had a planned capital investment of \$8 billion and involved a large entertainment and hotel complex, including a casino. Water demand from the proposed Aquis Resort would be supplied by Cairns Regional Council from its water supply system. Cairns Regional Council modelled two demand forecasts for the Cairns Water Security Strategy, one which included the proposed Aquis Resort (with Aquis) and one which did not (without Aquis). Under the Cairns Water Security Strategy, Cairns would require longer-term water supply augmentation from external regional sources such as the proposed Nullinga Dam by 2035 if the proposed Aquis Resort was developed.

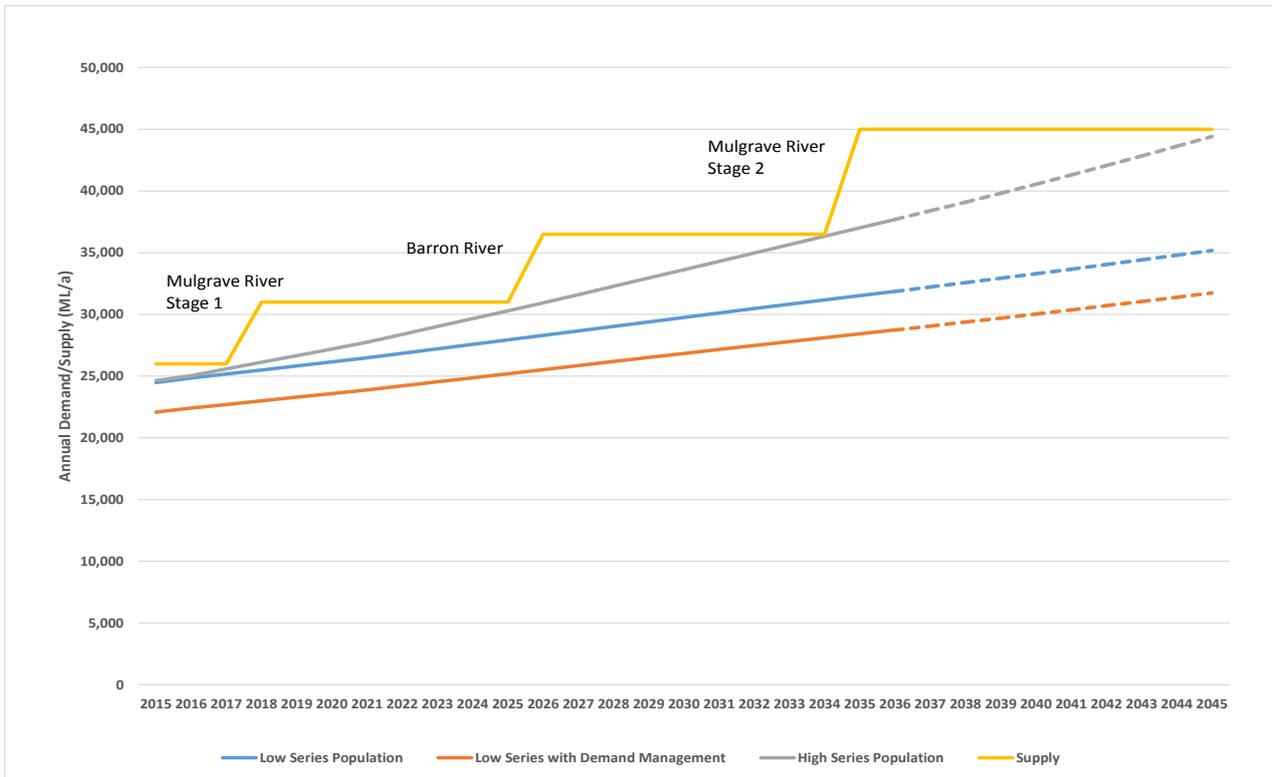
In 2016, Marsden Jacobs Associates (MJA) (engaged by Building Queensland) revised the water demand forecast for Cairns with input from Cairns Regional Council, updated population growth projections and revised assumptions regarding the proposed Aquis Resort. The revised water demand forecast is outlined in Figure 3 and shows a lower demand profile than the ‘without Aquis’ scenario presented in the Cairns Water Security Strategy, and well below the ‘with Aquis’ scenario. It is now considered that the proposed tourism and residential development is likely to be part of the planned growth captured in Cairns Regional Council and other agencies’ planning forecasts.

The revised demand forecast was peer reviewed by Jacobs and Synergies Economic Consulting. Both firms agreed that, on the information provided, Nullinga Dam would not be required to meet the urban water supply needs of Cairns over the next 30 years.

Building Queensland wrote to Cairns Regional Council to confirm the revised demand profile. Cairns Regional Council advised that MJA had developed the revised profile with input from the council, but that Cairns Regional Council would confirm its revised demand forecast in the second half of 2017. Cairns Regional Council also advised that it considers it has a portfolio of identified water supply measures recognised within existing water resource planning frameworks that could be implemented to meet future demand.



Figure 3 Demand Forecast for Cairns Regional Council (2016)



Source: Cairns Regional Council and Marsden Jacob Associates

Agricultural Demand

MJA was engaged by Building Queensland to conduct an agricultural demand assessment. This identified three key agricultural demand drivers in the region:

- **Dry conditions and water security:** Persistent low rainfall since 2012–13 has resulted in emerging water security concerns by irrigators. The recent dry conditions mean that current system utilisation exceeds 80 per cent, which is above the water security buffer generally desired by irrigators. Maintaining a percentage of entitlement holdings as a buffer against dry conditions is desirable by irrigators for crop longevity.
- **Changes in crop profile:** Sugarcane is the dominant crop in the region. However, in recent years there has been an increase in permanent plantings of high value crops such as avocados and bananas. Such crops require high water security and more water as they mature, so their demand for water allocations is expected to continue to grow.
- **Industry growth:** MSF Sugar is an integrated grower, processor, marketer and exporter of raw sugar and owns and operates the Tableland Mill within the MDWSS area. The Tableland Mill commenced operations in June 1998 and is the newest and most technologically advanced sugar mill in Australia. Since 2012, the Mill has been owned by Thai based Mitr Phol Group, a large global sugar milling company. MSF Sugar is currently milling about 800,000 tonnes per year at the Tableland Mill (the mill currently has capacity to mill 930,000 tonnes), of which 400,000 tonnes are under a tolling arrangement from Mossman Mill, owned by Mackay Sugar. In addition, MSF Sugar is the largest water holder in the MDWSS with around 16,350 ML of water entitlements.

Consultation with established industry in the region has indicated a conservative estimate of potential demand of 72,000 ML of additional water demand within the next 30 years. This future expansion is



considered uncertain and is subject to a number of factors, including access to additional land, supply chain constraints, investment in associated production or ‘value-add’ facilities and broader market factors.

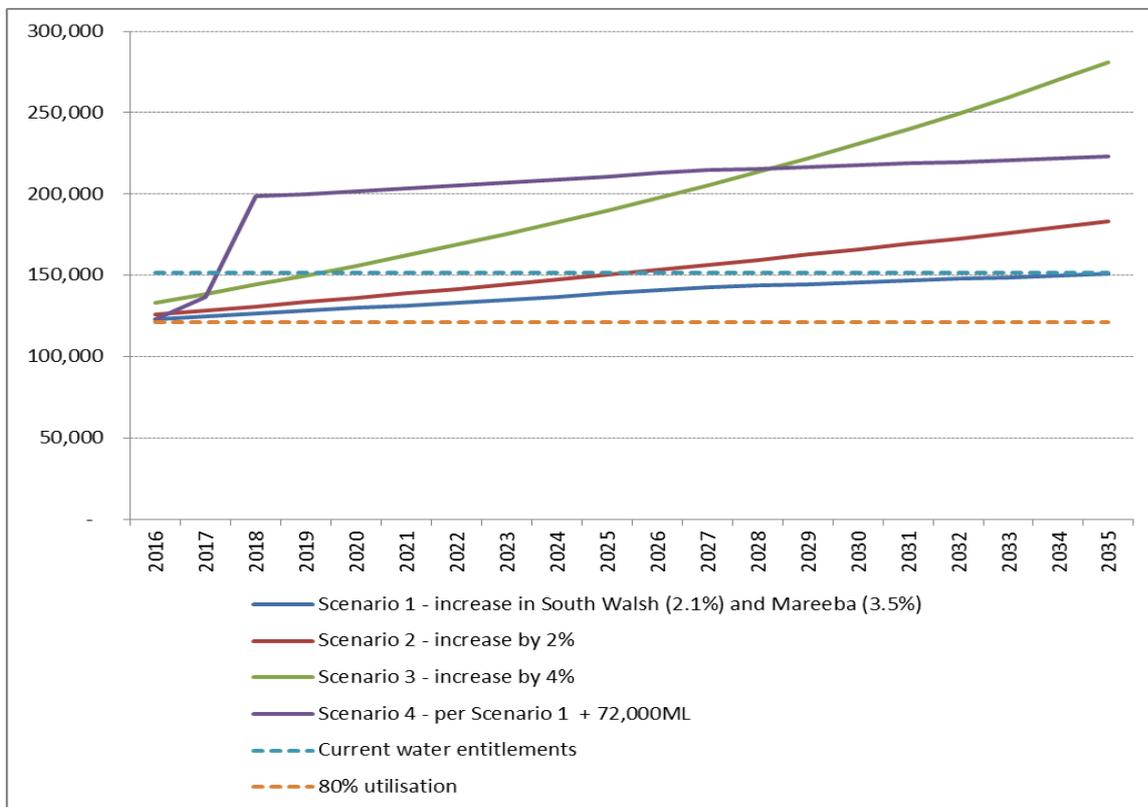
Four demand scenarios were modelled by MJA on the basis of the demand drivers (outlined in Figure 4):

- Scenario 1 based on historical growth rates at an operational system level: annual growth rates of 3.5 per cent for the Mareeba sub-system and 2.1 per cent for the South Walsh sub-system for 10 years and then 0.7 per cent annual growth rate thereafter. For the rest of the operational MDWSS systems, 0.7 per cent annual growth rate.
- Scenario 2: 2 per cent annual growth rate for the whole MDWSS.
- Scenario 3: 4 per cent annual growth rate for the whole MDWSS.
- Scenario 4: growth rates as per Scenario 1 plus a conservative estimate for industry expansion of 72,000 ML by 2018, for illustrative purposes.

These scenarios were modelled against the 2012–13 year, just prior to the recent low years of rainfall, to remove the impact of recent dry conditions. Scenario 1 produced the most conservative forecast, while Scenarios 3 and 4 represent high growth scenarios.

These scenarios should be compared with the annual average growth rate of water deliveries to the MDWSS (including losses) between 1981 and 2016 of 3.6 per cent per year,¹ and the Far North Queensland Regional Water Supply Strategy (2010) indication of an average annual growth rate of 1.0 per cent to 2.0 per cent in the MDWSS, up to the limit of existing supplies.

Figure 4 Agricultural Demand Forecast Scenarios (2016)



Source: Marsden Jacob Associates

¹ SunWater annual reports.



Scenario 1 is based on past irrigation demand and was considered by MJA to be the most likely scenario, in the absence of significant expansion from established industry. Based on Scenario 1, there would not be an immediate need for large-scale water supply augmentation. However, it would be prudent to undertake small scale water supply augmentation to address irrigators' water security concerns. Where the system is supply constrained it would necessarily constrain future expansion.

The MJA demand assessment was peer reviewed by Jacobs and Synergies Economic Consulting (Synergies). The results from the peer reviews are presented below.

Jacobs noted agricultural demand for new water supplies and willingness to pay has historically been extremely difficult to predict. However, while urban supply generally responds to predictable demand based on population growth, the inverse can be true for agricultural water supply where water and land availability drive demand—irrigators cannot expand in schemes that are fully allocated unless a step change in supply occurs. Rather, demand will only grow materially if a new supply is developed. Jacobs therefore considered that further testing of demand and willingness to pay should be incorporated into future investigations of Nullinga Dam.

Synergies agreed with MJA's conclusion that Scenario 1 represented the most likely scenario for future agricultural demand for water in the region. Synergies noted that in the absence of new, major bulk water customers, incremental additions to supply are generally preferable as they are less expensive and have greater scalability, and should be pursued prior to major supply augmentations being pursued.

Conclusion

There is no current Cairns urban water supply problem to be addressed.

Under current population and demand forecasts, Cairns Regional Council has an implementation plan of council owned and operated demand and supply measures recognised within existing water resource planning frameworks to meet its future water demand for at least the next 30 years. Cairns Regional Council does not have an identified need for water from a regional source (such as Nullinga Dam) until the very long-term. The measures include implementation of a demand management strategy and using currently held reserves in the Mulgrave and Barron Rivers through development of water supply and treatment infrastructure. Beneficial water trading opportunities have also been identified in the Mulgrave catchment.

However, Cairns Regional Council has indicated in the Cairns Water Security Strategy the conversion of MDWSS operational losses to new water allocations as a proposed long-term option to meet the future water needs of Cairns. If this option is pursued for agricultural use, there may be an impact on the Cairns Water Security Strategy. Key aspects of consideration of this issue include:

- water rights: This option has been identified by Cairns Regional Council through strategic planning and does not constitute an 'as of right' access to water from converted allocations. This may be compared with the council's existing strategic reserve from the Barron River of 4,000 ML in the Barron Water Plan.
- market: If new water allocations are created from the conversion of MDWSS operational losses, Cairns would be able to pursue purchase of these new water allocations for urban use, if it chooses to.



There is an opportunity to expand agricultural production on the Atherton Tablelands and surrounding region by increasing the availability of supplemented water.

In addressing this opportunity there are two key issues:

- Agricultural production and growth is constrained when irrigators exceed their preferred scarcity buffer (e.g. irrigation is constrained to 70 to 80 per cent water use as a portion of available water allocations to protect longevity of crops at dry times).
- Water cannot be moved to certain agricultural production areas within the Atherton Tablelands and surrounding region because of constraints in the distribution system (e.g. in parts of the east and west MDWSS) and a lack of infrastructure in greenfield areas.

Options Analysis

A long list of options was generated through consideration of the State Infrastructure Plan policy approach and categories for options assessment, analysis of previous assessments, work undertaken for the PBC and the outcomes of stakeholder consultation.

The long list of options was filtered against criteria under the Building Queensland Business Case Development Framework, as well as direct service need specific considerations. The outcomes of this assessment are outlined in Table 2.

The three highest scoring options were taken forward. A ‘do minimum’ option was also included, which combined water trading and on-farm water efficiency. The scope of the shortlisted options was then refined through consultation with SunWater, government agencies and commercial irrigators in the region prior to further analysis.

Table 2 Options Analysis Outcomes

LONG LIST OF OPTIONS	SHORTLISTED OPTION
Do nothing	No
Reform	
Improve MDWSS rules and operation	Yes—Option 2
Increase on farm water use efficiency	Yes—Option 1
Improve existing/better use	
Modernise MDWSS distribution infrastructure and convert losses to new water allocations for sale	Yes—Option 3
Improve water trading	Yes—Option 1
Utilise (private) Quaid Dam/Mitchell Dam and build a pipeline	No
Build New	
Build Nullinga Dam for agricultural use—bulk supply to Walsh River delivery only (no distribution infrastructure)	Yes—Option 4
Build Nullinga Dam for agricultural use—limited interaction with western MDWSS	No
Build Nullinga Dam for mixed use—Cairns urban and agricultural water supply	No



LONG LIST OF OPTIONS	SHORTLISTED OPTION
Build Nullinga Weir for agricultural use	No
Raise Tinaroo Falls Dam	No
Harvest water from the Johnstone River and build a pipeline	No

Shortlisted Options

Option 1: Do minimum (base case)

As the identified service need is an opportunity—rather than a problem—it is considered there is no base case in which any sector will run out of water supply catastrophically. However, when faced with scarcity during dry times, irrigators will reduce application of water on the lowest value crops. Irrigators will also not expand (i.e. 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 included the following key findings:

- The majority of irrigators in the MDWSS have adopted on-farm water efficiency measures 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 allocations, 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.

Option 1 is therefore considered a viable option as it provides for incremental expansion of agricultural production on the Atherton Tableland via existing mechanisms.

However, other options if progressed would provide for additional water availability and have a greater capacity to meet the identified service need. It should also be noted that the Queensland Government and Australian Government commitment to assess the feasibility of the proposed Nullinga Dam has raised expectations in the region for the possibility of new water supply options to increase agricultural expansion and provide regional economic development.

Option 2: Improve MDWSS Rules and Operation

Option 2 comprises a review of the MDWSS operating rules against the changed cropping and water use practices of the modern scheme to increase operational performance and reduce current constraints. These improvements are intended to increase water use within the MDWSS without undermining the current supply or reliability of supply, or creating new water allocations.

Key potential opportunities include reviewing the water year to match the current demand patterns, improving carryover provisions to enable greater flexibility and use of this water, improving water ordering to address underperformance, and increasing awareness of peak flow entitlements (ML per day) as the MDWSS moves to maximum use.

The success of Option 2 is considered to depend on a number of factors, including:



- modelling showing that the implementation of rule and operational changes will make a difference to water availability
- appetite of government and SunWater to implement improvements and reforms to scheme rules and operation
- change in water use practices by irrigators in response to the improvements, and associated increase in agricultural production
- considering potential changes in local management of the MDWSS distribution infrastructure that may affect the operation of the scheme.

Option 3: Modernise MDWSS and Convert Losses

It is estimated that current operational losses from the MDWSS are around 30,000 ML per year. Option 3 involves a targeted modernisation of the MDWSS distribution infrastructure to reduce operational losses and increase the amount of water allocations available in the MDWSS.

The key elements of Option 3 are:

- Modernise parts of the MDWSS distribution system via a range of infrastructure improvements. The scope of these works and the amount/yield of loss allocations potentially able to be converted would be determined as part of further detailed investigation and may be done in stages. In principle support for the conversion of loss allocations would also be sought from the Department of Natural Resources and Mines (DNRM) prior to works commencing.
- Following completion of the works, apply to the DNRM to convert a specified amount of distribution loss allocations² to new tradeable medium priority water allocations (created by the savings from infrastructure improvements).
- Sell the new medium priority water allocations on the market.

The success of Option 3 is dependent on a number of factors, including:

- deliverability and cost of the infrastructure improvements
- ability for SunWater to convert a suitable yield of loss allocations to new allocations for sale
- purchase of new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production
- limited negative impacts on the existing scheme and owners of existing allocations from the implementation of the option.

In March 2017, the Queensland Government and SunWater submitted an Expression of Interest application to the NWIDF seeking a capital contribution towards several of the sub-projects in option 3 to modernise the existing MDWSS distribution system. Any implementation of the Option 3 sub-projects resulting from the application will need to be considered in the context of further evaluation of Option 3 in the future.

Option 4: Nullinga Dam for Agricultural Use

Option 4 comprises the development of Nullinga Dam as a bulk water source for the expansion of irrigated agriculture in the region. The scope of inclusions and exclusions for Option 4 are:

² SunWater has estimated the amount of loss allocations able to be saved could be 8,000 to 15,000 ML, depending on the works conducted.



- Design and build a Nullinga Dam for primarily medium priority water allocations open to all customers and in particular for agricultural users. This would initially be for delivery of water to Walsh River customers within and potentially downstream of the MDWSS area, but with the flexibility for commercial distribution systems to evolve.
- No distribution infrastructure for delivery of water from the dam to the MDWSS or elsewhere is included. Future connection to the MDWSS would be subject to the result of a process that identifies clear cost effective opportunities for new or augmented distribution infrastructure.

A 'bulk only, river delivery' Nullinga Dam simplifies design, costing, water pricing, stakeholder engagement, water planning and scheme operation. It also supports the continued functioning of MDWSS by not interfering with the current irrigation scheme and distribution system.

DNRM and the Department of Agriculture and Fisheries have reported areas of suitable soils and provided details on the type of crops that may succeed in this region. Up to 9,900 hectares of suitable land for irrigated agriculture has been identified adjacent to the Walsh River within the existing MDWSS area, from the proposed Nullinga Dam wall to the end of the Dimbulah area.

Previous assessments of Nullinga Dam have provided for small, medium and large sizes. Option 4 has assessed Nullinga Dam on the basis of the small size used in previous assessments to allow for analysis against the other shortlisted options. It is recommended the size of Nullinga Dam in any future evaluation be determined by further demand assessment, and the dam be designed (and resized) to match the volume of credible demand.

The success of Option 4 is dependent on a number of factors, including:

- realisation of an economic profile for a new irrigation scheme and agricultural production along the Walsh River
- realisation of credible water demand for the dam yield
- affordability of Nullinga Dam for irrigators and government
- ability to secure approvals to progress Nullinga Dam (including amendments to the Barron Water Plan and environmental assessments)
- deliverability of Nullinga Dam within a suitable cost and risk profile
- purchase of new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production.

Strategic Considerations

The identified service need and the shortlisted options are considered to generally align with strategic objectives of various government plans, programs and policies, as follows:

- Queensland Government: State Infrastructure Plan, Far North Queensland Regional Water Supply Strategy, Cairns Regional Water Supply Security Assessment, Agricultural Land Audit and Advancing North Queensland
- Australian Government: National Water Infrastructure Development Fund and National Water Initiative
- Local government: Cairns Water Security Strategy.

Legal and Regulatory Considerations

The water planning regulatory context in Queensland is changing with the recent commencement of the:



- *Water Reform and Other Legislation Amendment Act 2014* which introduced a new water planning framework to provide a more streamlined and responsive approach to water planning, including transitioning content of Resource Operations Plans to a suite of new water instruments.
- *Water (Local Management Arrangements) Amendment Act 2017* which deals with local area ownership and management of SunWater channel irrigation schemes.

The Barron Water Plan will continue to operate until 2022. The MDWSS is the only water supply scheme included in the Barron Water Plan area and SunWater is the holder of the Resource Operations Licence for the MDWSS. There are no provisions in the statutory water instruments that provide for the development of Nullinga Dam. The current Queensland Competition Authority price path for SunWater's irrigation prices for the MDWSS and Mareeba-Dimbulah Distribution System will apply until 30 June 2019.

Option 1 will continue the status quo and no changes to legislative or regulatory frameworks are envisaged. Key legal and regulatory issues with shortlisted Options 2 to 4 are as follows.

Option 2: Improve MDWSS Rules and Operation

This option will primarily require changes to the Barron Resource Operations Plan (as transitioned to the new water instruments following the *Water Reform and Other Legislation Amendment Act 2014*) and Resource Operations Licence. Unless modification is made to existing bulk releases, no pricing issues are expected, as there are no capital costs and no new water allocations created. There are no approval issues, as only changes to rules and operation of the existing MDWSS will occur, rather than physical works.

Option 3: Modernise MDWSS and Convert Losses

This option will require changes to the Barron Water Plan, Barron Resource Operations Plan (as transitioned) and Resource Operations Licence.

SunWater may sell, lease or seasonally assign the converted water allocations. Prices will need to consider the National Water Initiative principles. A referral may be made to the Queensland Competition Authority in relation to pricing practices.

The potential transfer of the MDWSS distribution system business, assets and liabilities to new local management entity may occur prior to, during the course of, or following the implementation of Option 3.

Option 4: Nullinga Dam for Agricultural Use

The current statutory water instruments do not allow for Nullinga Dam. Water is not reserved to allow for construction of the dam and the environmental flow objectives for the relevant parts of the Walsh River where the dam would be built are set at 99 per cent. Changes will be required to the Barron Water Plan, Barron Resources Operations Plan (as transitioned) and Resource Operations Licence.

If suitable water reserves and changes to water instruments can be established, DNRM will have the flexibility to sell the water allocations by public auction, tender or fixed price sale. The terms of sale may be used to facilitate customer pre-commitments by allowing the sale of water allocations conditional upon sufficient water demand and/or the construction of Nullinga Dam. Pricing for new water allocations would need to comply with the National Water Initiative principles. A referral may be made to the Queensland Competition Authority in relation to pricing practices.

Environmental impacts, native title issues, land access and approvals would need to be considered further during detailed investigations of Nullinga Dam. Tenure would be required for the dam wall and inundation area and additional land may be required for construction purposes, requiring consultation with potentially affected landholders.



Market Considerations

Market feedback was sought on the interest in additional water allocations in the MDWSS and on the shortlisted options. Established industry indicated an immediate requirement of 14,000 ML, while a conservative estimate of an additional 72,000 ML of new water allocations may be sought in the longer-term, dependent on a range of factors.

The general stakeholder feedback on the shortlisted options was that there was a need to consider the interrelationship of components within the entire system rather than individual options in isolation. Views on individual options were as follows.

Option 1: Do minimum (base case)

Water trading is already happening and the majority of irrigators in the region have already adopted efficient water use methods. Savings to date have been taken up by production growth and increases in water intensive, high-value crops.

Option 2: Improve MDWSS rules and operation

Large commercial irrigators were supportive of Option 2, but considered proper modelling and the implications of each sub-option important, and that the crop mix should be considered. The potential for local management of the distribution infrastructure and the impacts of this should also be considered.

Option 3: Modernise MDWSS and convert losses

Option 3 had general support from all participants, but interest in new water allocations will be based on price—particularly for lower value crops compared with higher value crops. More needs to be done to ‘prove up’ the concept, works, options, price and marketing of the water (e.g. sale or leasing of allocations, pre-sold or auction processes, and the pay-back period for investment). There is likely to be progressive take-up of new water allocations as new allocations are placed on the market for sale. Option 3 is considered a cheaper option for new water allocations than the Nullinga Dam option.

Option 4: Nullinga Dam for Agricultural Use

Demand for water allocations from Nullinga Dam will depend on the water price, where water can be delivered to, the cost of developing land for irrigation, and the prevailing water and commodity market conditions at the time. Water quality is a concern as the Walsh River catchment is different to the Barron catchment. A ‘bulk only, river delivery’ dam without distribution infrastructure makes sense, but the design should consider future connection to MDWSS, as water will only be accessible to river frontage land unless private distribution infrastructure is developed. The efficiency of water delivery also needs to be considered, as the yield of the dam may be affected to account for losses in river delivery or over long distances.

In addition, Advance Cairns advised that the Nullinga Dam option in this form does not provide a long-term solution for Cairns urban water supply and that Cairns urban water supply should be considered in the Nullinga Dam option. As indicated, there are considerable complexities in Nullinga Dam providing an additional water supply for Cairns due to the need for a ‘swap’ of water allocations with Tinaroo Falls Dam. Furthermore, the progression of council owned and operated supply options in the Cairns Water Security Strategy is a matter for Cairns Regional Council, and not a matter for consideration in this PBC.



Social Impact Evaluation

Population growth in the Tablelands agricultural area³ is slower than Queensland average and the area has an ageing population and high percentage of Indigenous residents. Levels of education are lower than the average for Queensland and there is a high degree of socio-economic disadvantage in the region, with an unemployment rate of 10.2 per cent in the September quarter of 2016, compared to 6.1 per cent for Queensland.⁴

Agriculture is the largest employer in the region and is central to the region’s character and identity. Stakeholder consultation revealed strong support for agricultural growth projects and stakeholders noted additional water supply would enable future agricultural investment and other associated economic opportunities. Option 1 is expected to continue the status quo. Key beneficial and detrimental impacts for the shortlisted Options 2 to 4 are identified in Table 3.

Table 3 Social Impact Evaluation—Key Impacts

OPTION 2 – IMPROVE MDWSS OPERATION	OPTION 3 – MODERNISE MDWSS INFRASTRUCTURE	OPTION 4 – NULLINGA DAM
Key beneficial impacts		
Additional employment and regional growth	Additional employment and regional growth Enhanced confidence to invest in long term business operations	Additional employment and regional growth Enhanced confidence to invest in long term business operations
Key detrimental impacts		
Changes to existing business practices and processes	Competition for additional water supply Changes to existing flow regimes Impacts on the Mareeba wetlands and associated tourism and cultural values	Impacts on downstream communities from flow alterations Large-scale land use change Pressure on existing infrastructure Land acquisition Potential social impacts due to impacts on threatened species and community and cultural values associated with the Mitchell River and the Gulf of Carpentaria

Source: Jacobs

Environmental Assessment

The majority of the MDWSS area has been cleared for grazing and intensive agriculture. Surface water quality is moderate with elevated levels of nutrients and pesticides associated with irrigated agriculture. Areas of elevated groundwater and high salinity risk have been identified.

Areas within the Tablelands agricultural area and the existing MDWSS are identified as containing non-remnant vegetation. A number of threatened ecological communities and flora and fauna species are mapped as occurring within the study area and may be impacted by the shortlisted options. Option 1 is expected to continue the status quo. Anticipated environmental impacts from Options 2 to 4 are outlined below.

³ Boundaries of the Mareeba and Tablelands local government areas.

⁴ Queensland Government Statisticians Office 2017.



Option 2: Improve MDWSS Rules and Operation

The key environmental issues associated with Option 2 relate to the associated impacts of (marginal) expansion of land under irrigation:

- Changes to surface water and groundwater level and quality due to increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
- Clearing of vegetation to facilitate new irrigation areas. Land surrounding the existing irrigation area is mapped as regulated vegetation and has the potential to contain threatened ecological communities. Clearing in these areas could trigger relevant approvals.

Option 3: Modernise MDWSS and Convert Losses

The key environmental issues associated with Option 3 relate to the associated impacts of expansion of land under irrigation and are the same as those for Option 2, but on a larger scale.

Option 4: Nullinga Dam for Agricultural Use

The construction of Nullinga Dam would result in impoundment on the Walsh River and may involve development of a new irrigation area. However, much of the unirrigated cropping land adjacent to the Walsh River would fall within the existing MDWSS area (as far west as the end of the Dimbulah area).

To the extent that Option 4 results in increased irrigation within the existing irrigation area, key environmental issues are the same as Options 2 and 3, but again on a larger scale. Potential additional environmental issues associated with Option 4 (both the dam and associated increased irrigation) include:

- potential approval triggers at both state and Commonwealth levels, particularly related to threatened ecological communities and threatened species
- impacts on water quality and flows downstream of the dam with consequential impacts on species composition
- clearing of regulated vegetation for both the dam inundation area and any new irrigation development. Offsets for vegetation clearing under the *Environmental Offsets Act 2014* (Qld) may be required.
- change in land use both at the dam site and in the new and existing irrigation areas will result in a change in visual amenity
- Aboriginal cultural heritage has the potential to be disturbed and an approved Cultural Heritage Management Plan is likely to be required.

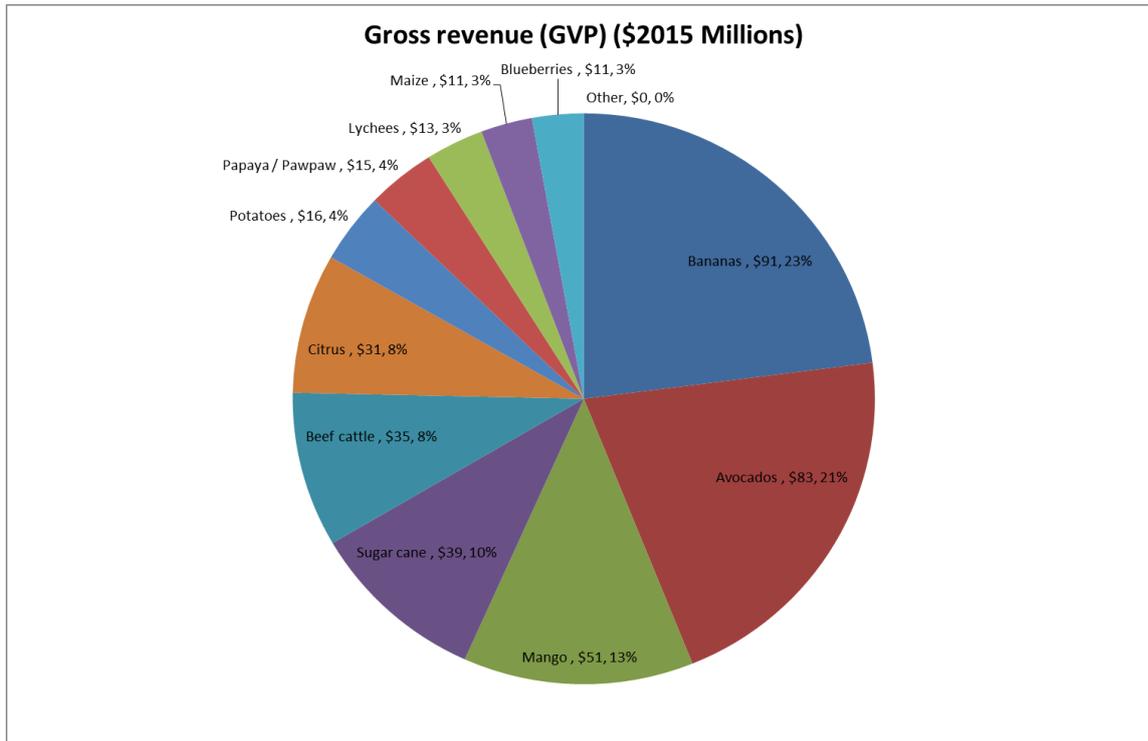
Economic Analysis

Agriculture is the main economic activity in the Tablelands agricultural area, 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). The 580,000 hectares of agricultural land produced approximately \$470 million of gross value of production in 2015, as illustrated below in Figure 5. This represents an increase of over 30 per cent from 2010–11.

The MDWSS produces the majority of regional 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.



Figure 5 Gross Value of Production Tablelands Agricultural Area (2015)



Source: Department of Agriculture and Fisheries

Low rainfall in recent years has created scarcity and increased the price of water, and has limited production capability. Late in 2016 water was trading at up to \$2,800 per ML for medium priority water allocations, 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 (SunWater 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 watering infrastructure and crops are already established.

‘Brownfield’ expansion could result in increased land under irrigation. It could also result in additional water 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 ML per hectare), or using additional water to replace existing production with higher value crops. Both possibilities result in increased production and yield net economic benefits to the region.

The key economic indicators from economic analysis of the shortlisted options are outlined in Table 4. Although there is an increase in the use of available water or an increase in the availability of new medium priority water allocations from progressing from Option 2 to 4, the analysis reveals there is a corresponding decrease in the benefit cost ratio and a fluctuation in the net present value.



Table 4 Economics Analysis—Key Outcomes

ITEM	OPTION 1 – DO MINIMUM (BASE CASE)	OPTION 2 – IMPROVE MDWSS RULES AND OPERATION	OPTION 3 – MODERNISE MDWSS AND CONVERT LOSSES	OPTION 4 – NULLINGA DAM FOR AGRICULTURE
Water availability				
Additional medium priority water available (ML)	-	4,330 (additional use)	12,900 ⁵ (new allocations)	55,400 (new allocations)
Central Case				
Economic net present value (\$M)	-	31	73	6
Benefit cost ratio	-	11.0	2.8	1.0
Upper Bound Sensitivity Analysis				
Economic net present value (\$M)	-	4	-9.0	-163
Benefit cost ratio	-	1.8	0.8	0.4

Source: Jacobs

The economic analysis was peer reviewed by Synergies. Synergies made a number of recommendations related to methodological issues about the estimation of economic benefits and costs, particularly related to Option 4. These recommendations have been incorporated into the final PBC.

Synergies noted there was a significant change in the economic net present value and benefit cost ratio depending on the different parameters used in the modelling. In particular, the use of a shorter or longer timeframe for the projected take-up of new water allocations by irrigators, with a shorter period creating a more positive result. The upper bound of the sensitivity analysis for the net present value and benefit cost ratio have therefore been represented in Table 4 to show the sensitivity analysis with the different inputs to the economic model.

Financial and Commercial Analysis

Financial and commercial analysis was undertaken on the shortlisted options. For Options 3 and 4, Jacobs reviewed previous investigations and developed cost estimates based on updated assumptions.

The cost estimate for Option 3 was based on the conversion of 8,300 ML of loss allocations to new medium priority water allocations. The estimate was then scaled up to account for the potential conversion of up to 15,000 ML. The range for Option 3 below represents the preliminary nature of work undertaken on this option to date. The cost estimate for Option 4 was based on a previous cost estimate for Nullinga Dam, escalated to 2017 dollars. Both the previous and revised cost estimates are presented in Table 5 for comparison. The range in Option 4 is based on the same raw capex of \$260 million with different risk and contingency amounts applied by the previous and revised cost estimates.

The demand assessment undertaken for the PBC indicated medium priority water allocations were currently trading at prices from \$2,000 to \$3,000 per ML in the MDWSS, depending on crop type.

⁵ The central case of 12,900 ML of new medium priority water allocations was adopted for the purposes of the economic analysis. The financial analysis involved a range of 8,300 ML to 15,000 ML.


Table 5 Financial Analysis—Key Outcomes

ITEM	OPTION 1 – DO MINIMUM (BASE CASE)	OPTION 2 – IMPROVE MDWSS RULES AND OPERATION	OPTION 3 – MODERNISE MDWSS AND CONVERT LOSSES	OPTION 4 – NULLINGA DAM FOR AGRICULTURE
Water availability				
Additional medium priority water available (ML)	0	4,330 (increased use)	8,300–15,000 (new allocations)	55,400 (new allocations)
Capital costs				
Estimated capital costs – previous (2017\$M)	1.6 ^a	-	28.1 ^b	358
Estimated capital costs – revised, risk adjusted Central Case (2017\$M)	-	-	30 – 51 ^c	323
Operational costs				
Estimated operational costs per annum – Jacobs Central Case (2017\$M)	6.1 ^a	1.0 ^d	0.65	3.6
Revenues				
One-off price for sale of water allocation (2017\$ per ML, medium priority) ^f	-	-	3,058–3,579	4,309–7,531
Fixed annual charges (2017\$ per ML, medium priority) ^g	25–51	- ^e	63–255	48–310
Variable annual charges (2017\$ per ML, medium priority)	5–81	- ^e	- ^e	- ^e
Shortfall—capital costs				
Portion of capital costs unfunded by customer charges (%) ^h	-	-	18–30	42–67

- a. Current renewal and replacement capital expenditure and operational expenditure for the MDWSS (SunWater).
- b. Conversion of 8,300 ML loss allocations to new medium priority water allocations (SunWater).
- c. Conversion of between 8,300 ML and 15,000 ML loss allocations to new medium priority water allocations (Jacobs). Range of loss allocations to be confirmed by further assessment.
- d. Costs incurred over two-year program (Jacobs).
- e. Existing MDWSS charges will continue to be applied.
- f. One-off sale to recover capital costs from water customers. Actual one-off sale revenue likely to be \$2000–\$3,000 per ML allocation based on current market trading data (Jacobs).
- g. Range for Options 3 and 4 represents application of different funding models (Jacobs).
- h. Shortfall percentage based on recoverable capital costs from customers with benchmark purchase price of \$2,500 per ML for new water allocations. This percentage is for illustrative purposes and based on straight recovery of capital costs only (Jacobs). It does not take account of the take-up profile of new water allocations. Movements in the forecast demand for new water allocations will have implications for estimates of the capital costs shortfall.



The financial and commercial analysis was peer reviewed by Aurecon. Aurecon considered the analysis was largely fit for purpose on the basis that a PBC was being prepared. Aurecon noted further assessment of the financial net present value should be a key consideration in any further evaluation of the shortlisted options, to ensure a clear understanding of the costs, revenues and risks.

Delivery Model Analysis

Delivery model analysis was only undertaken for Option 4, as Option 2 would be carried out by government and SunWater as a reform process, and Option 3 would be carried out by SunWater internally as a number of smaller projects.

Analysis was undertaken of both traditional delivery models and Public Private Partnership delivery models. The key findings were:

- The preferred model is Design and Construct, with consideration to be given to potential for Early Contractor Involvement or Early Tenderer Involvement.
- There is no commercially viable Public Private Partnership delivery model, as design, operations and maintenance are likely to be delivered by SunWater.

Market sounding was undertaken with seven construction firms. The market feedback was consistent with the findings of the delivery model analysis, indicating a preference for single package Design and Construct procurement model, and that a Public Private Partnership delivery model was not suitable for Option 4.

Affordability Analysis

Affordability analysis was undertaken for shortlisted Options 2 to 4.

As a reform option, the costs of Option 2 are comprised of operational costs of government wages and consultancy costs, with no capital expenditure. The relative affordability of this option is considered high, subject to the budgetary and resourcing constraints of DNRM and SunWater.

For Option 3, the capital costs of the works, volume of new allocations available from conversion of losses, and sale price of new allocations is critical to affordability. The relative affordability of this option is considered medium to high, subject to further assessment. Further detailed engineering, hydrological and costing analysis is required to better understand affordability and the portion of capital costs able to be recovered from customers. Operational expenditure is generally funded by customers via annual charges, but further detailed assessment will assist to understand affordability considerations.

For Option 4, the capital cost of the dam, volume of new water allocations available and the sale price of new water allocations is critical to affordability. The relative affordability of this option is considered low-to-medium, and is subject to further detailed assessment. The portion of capital costs able to be recovered from customers will depend on a variety of factors, including the resulting dam yield (to match demand) and revised capital expenditure and operational expenditure. Operational expenditure is expected to be fully funded by customers via annual charges, but further detailed assessment will assist to understand affordability considerations.



Preferred Options for Further Development

Option 1: Do minimum (base case) is a viable option as it represents business as usual and provides for incremental expansion of agricultural production on the Atherton Tableland via existing mechanisms. However, assessment has identified water security concerns among irrigators in the MDWSS, with utilisation at 80 per cent in the current dry conditions. It has also identified crop changes which have the potential to impact on the future operations of sugarcane producers and the Tableland Mill as water moves to higher value crops. In comparison, other options provide for additional water availability and have a greater capacity to meet the identified service need.

Option 2: Improve MDWSS rules and operation is recommended to progress to further evaluation. This option primarily involves changes to bulk storage rules and operation. It is low cost, has stakeholder support and projected economic benefits. A key focus of further evaluation will be modelling to ensure that the proposed rule and operational changes will make a difference to water availability. Given its potential to impact on MDWSS operations overall it is recommended implementation involves ongoing consultation with the existing local management entity.

Option 3: Modernise MDWSS and convert losses is recommended to progress to further evaluation. This option is scalable and can be implemented in stages. A key focus of further evaluation will be the capital cost of works and potential yield of new allocations. Depending on the outcomes of these assessments, this option may be cost-effective to address irrigators' water security concerns. A key focus of further evaluation will also be the potential implications of the transition of the MDWSS distribution infrastructure business, assets and liabilities to a new local management entity.

Option 4: Nullinga Dam is not recommended to progress to a detailed business case at this time. Nullinga Dam (via a 'swap' arrangement of existing water allocations from Tinaroo Falls Dam) is not needed for Cairns urban water supply for at least the next 30 years and assessment has revealed limited certainty of information in relation to Nullinga Dam for agricultural use.

Conclusion

Options 2 and 3

Option 2: Improve MDWSS rules and operation and Option 3: Modernise MDWSS and convert losses are considered to meet the identified opportunity to expand agricultural production in the Atherton Tablelands and surrounding region by increasing the availability of supplemented water. These options are lower cost than Option 4, will enhance usage of existing water delivery infrastructure for agricultural production, and have stakeholder support.

However, realisation of the benefits from implementation of these options will be dependent on a number of key factors, as outlined in Table 6.



Table 6 Option 2 and Option 3—Key Dependencies for Success and Risks

OPTION 2 - DEPENDENCY	OPTION 2 - RISKS	OPTION 3 – DEPENDENCY	OPTION 3 – RISKS
Modelling showing that the implementation of rule and operational changes will make a difference to water availability for irrigators in the MDWSS	Modelling does not show any difference negating benefits from reforms	Deliverability and cost of the infrastructure improvements to the distribution infrastructure	Works exceed cost estimates and financial risk exposure to meet shortfall in funding
Ability of government and SunWater to implement improvements and reforms to scheme rules and operation	Appetite from government and SunWater to implement reforms	Ability for SunWater to convert a suitable yield of loss allocations to new water allocations for sale	Water savings are lower than estimated and return on investment is lower with less achieved from the sale of the water
Change in water use practices by irrigators in response to the improvements, and associated increase in agricultural production	Stakeholder risk as changes to rules and operation not accepted Economic risk as benefits not realised	Purchase of the new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production	Financial risk as return does not meet capital expenditure Economic risk as benefits not realised
Local management considerations—a change in management of the MDWSS distribution infrastructure may affect the operation of the scheme	Transition to local management entity results in non-acceptance by new entity of changes to bulk supply rules and operation Ongoing close consultation with the local management entity is recommended during implementation	Limited negative impacts on the existing scheme and owners of existing allocations from the implementation of the option	Impacts on stakeholders

Option 4

Consultation with established industry in the region has indicated a conservative estimate of potential demand of to 72,000 ML of additional water demand within the next 30 years. This future expansion is considered uncertain and is subject to a number of factors, including access to additional land, supply chain constraints, investment in associated production or ‘value-add’ facilities and broader market factors.

On this basis, the trigger for any further consideration of Option 4: Nullinga Dam for agricultural use is recommended to be a satisfactory level of certainty about the demand for new water allocations at a nominated volume and a nominated price (e.g. a significantly large proportion of the dam yield at an appropriate price). This certainty may be developed via an approach from industry to government, or via government commissioning a detailed demand assessment for new water allocations in the region.

Implementation Plan

The further assessment of Option 2 will be undertaken by DNRM and SunWater as the responsible entities for the relevant water instruments in accordance with usual government and business practices. The nature of the further assessment will be subject to resourcing and budgetary constraints within those organisations.



As the estimated capital costs of Option 3 are under \$100 million, SunWater, as the owner and operator of the MDWSS, will undertake the further evaluation of Option 3, with assistance from Building Queensland in accordance with the *Building Queensland Act 2015*.

In March 2017, the Queensland Government and SunWater submitted an Expression of Interest application to the NWIDF seeking a capital contribution towards several of the sub-projects in Option 3 to modernise the existing MDWSS distribution system. This Expression of Interest outlined an implementation plan for that project. It is recommended that implementation plan be adopted for the implementation of Option 3. Any implementation of the Option 3 sub-projects resulting from the application will need to be considered in the context of further evaluation of Option 3 in the future.

A further key focus will be the potential implications of the transition of the MDWSS distribution infrastructure to a new local management entity under the local management arrangements program.



Recommendations

The Nullinga Dam and Other Options Preliminary Business Case recommends that the Queensland Government:

1. Endorse that Option 2: Improve Mareeba-Dimbulah Water Supply Scheme rules and operation progress to further evaluation.
2. Endorse that Option 3: Modernisation of the Mareeba-Dimbulah Water Supply Scheme and conversion of losses progress to further evaluation.
3. Endorse that Option 4: Nullinga Dam for agricultural use not progress to further evaluation via a detailed business case at this time. Nullinga Dam (via a 'swap' arrangement of existing water allocations from Tinaroo Falls Dam) is not needed for Cairns urban water supply for at least the next 30 years and assessment has revealed limited certainty of information in relation to Nullinga Dam for agricultural use.
4. The trigger for any further consideration of Option 4: Nullinga Dam for agricultural use is recommended to be a satisfactory level of certainty about the demand for new water allocations at a nominated volume and a nominated price (e.g. a significantly large proportion of the dam yield at an appropriate price). This certainty may be developed via an approach from industry to government, or via government commissioning a detailed demand assessment for new water allocations in the region.



CHAPTER 1

METHODOLOGY

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

1	METHODOLOGY	2
1.1	Purpose	2
1.2	Background	2
1.3	Risk Approach	3
1.4	Stakeholder Engagement Approach	5
1.5	Options Selection Approach	7

TABLES

Table 1	DEWS Risk Likelihood Table	4
Table 2	DEWS Risk Consequence Table	5

FIGURES

Figure 1	Risk Management Process	4
Figure 2	Risk Matrix.....	4



1 METHODOLOGY

CHAPTER SUMMARY AND CONCLUSIONS

- This chapter outlines the approach to preliminary business case (PBC) development for risk, stakeholder engagement and options selection.
- The risk assessment was based on the Department of Energy and Water Supply (DEWS) risk matrix, in accordance with the department as the Project Owner. Risks were identified and qualified through a series of agency and internal advisor workshops to develop the risk register.
- The stakeholder engagement approach and stakeholder engagement plan was developed with assistance from DEWS, SunWater, Leisa Prowse Consulting, Marsden Jacobs Associates (MJA) and Jacobs.
- Stakeholder engagement was undertaken via a series of channels:
 - formation and meetings of a Stakeholder Reference Group, comprised of regional representatives from a wide variety of stakeholder organisations, including government, industry and economic development groups. The Stakeholder Reference Group process was managed by Leisa Prowse Consulting.
 - interviews between MJA and stakeholders as part of MJA’s demand assessment
 - interviews between Jacobs and stakeholders as part of Jacobs peer review of MJA’s demand assessment and Jacobs testing of the proposed long list and shortlisted options.
- Options selection considered the State Infrastructure Plan (SIP) categories for options assessment (reform, better use, improve existing and new build) and the approach that a range of solutions have the potential to achieve a desired outcome.
- The service need, long list of options, options filtering and shortlisted options process included workshops with key agency stakeholders and Jacobs; Stakeholder Reference Group feedback; and Project Steering Committee consideration.

1.1 Purpose

This chapter outlines the approach to PBC development for risk, stakeholder engagement and options selection.

1.2 Background

Nullinga Dam has a long history, first being proposed in the 1950s as part of the development of the Mareeba-Dimbulah Irrigation Area (MDIA) for tobacco production. Since that time, Nullinga Dam has been proposed to provide a bulk water supply for a variety of uses, most recently Cairns urban water supply.

Given the history of proposed uses for Nullinga Dam, the following initial objectives were developed for the PBC:

- identify and clearly describe the water supply problems/opportunities within the region
- present the Nullinga Dam option along with other options as potential solutions to the identified problems/opportunities
- undertake a preliminary analysis of the shortlisted options



- provide recommendations for a stage 2 Detailed Business Case.

1.3 Risk Approach

This section describes the risk-management approach used to identify options and refine the shortlisted options. It also describes the risk management approach used to select (and design/refine and describe) the preferred options.

Risk-management activities during PBC development have included:

- identifying development risks to ensure those risks are effectively addressed where possible
- identifying proposal risks including risks associated with changes in:
 - proposal background
 - service need
 - options generation and shortlisting
 - strategic and political context
- identifying method risks including:
 - key assumptions (e.g. demand and costs)
 - data availability, accuracy and state of current relevance
 - an approach to delivering the social, environmental, economic, financial assessment¹
- identifying process risks including:
 - stakeholder engagement activities and timing to help ensure the process maximises potential outcomes
- identifying options/project risks including:
 - governance arrangements
 - funding
 - delivery
 - timing.

These risks have been given due consideration and managed during PBC development to ensure the preferred options account for key risks and risk considerations have been incorporated into cost estimates.

1.3.1 Risk Framework

The DEWS risk matrix was utilised in accordance with the department being the Project Owner for the PBC stage.

The risk management process and risk matrix outlined in the following figures reflect a risk management policy and procedure that aligns with AS/NZS ISO 31000:2009 Risk management—Principles and guidelines (DEWS 2015).

¹ Addressed in method, assumptions and limitations sections of each chapter respectively.



Figure 1 Risk Management Process

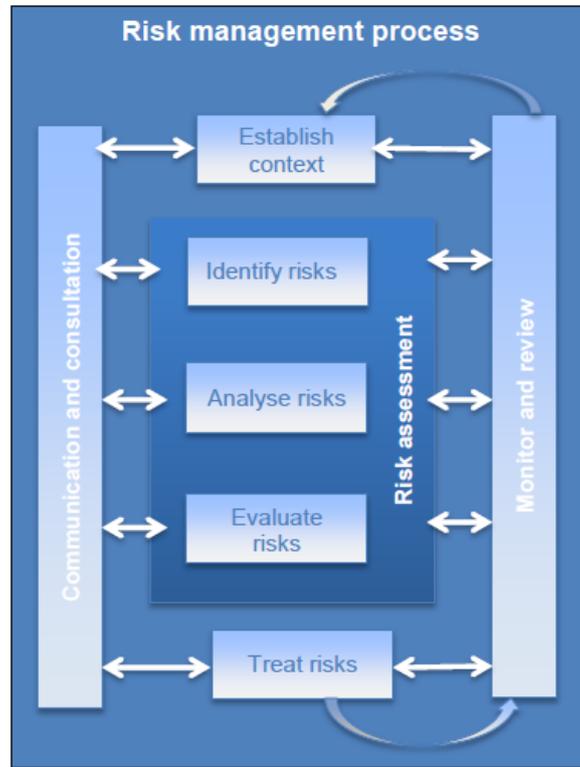


Figure 2 Risk Matrix

RISK ANALYSIS MATRIX					
CONSEQUENCES					
LIKELIHOOD	Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	Medium (11)	Medium (16)	High (20)	Extreme (23)	Extreme (25)
Likely	Low (7)	Medium (12)	High (17)	High (21)	Extreme (24)
Possible	Low (4)	Medium (8)	Medium (13)	High (18)	High (22)
Unlikely	Low (2)	Low (5)	Medium (9)	Medium (14)	High (19)
Rare	Low (1)	Low (3)	Low (6)	Medium (10)	Medium (15)

The DEWS guidance was initially used to interpret the likelihood of risks and consequences as follows.

Table 1 DEWS Risk Likelihood Table

LIKELIHOOD	QUALITATIVE DESCRIPTION	EXAMPLE OF QUANTITATIVE DESCRIPTION
Almost Certain	The event is expected to occur in most circumstances	May occur once a year or more
Likely	The event will probably occur in many circumstances	May occur once every 3 years
Possible	Identified factors indicate the event could occur at some time	May occur once every 10 years
Unlikely	The event could occur at some time but is not expected	May occur once every 30 years
Rare	The event may occur only in exceptional circumstances	May occur once every 100 years



Table 2 DEWS Risk Consequence Table

IMPACT AREA	CONSEQUENCE				
	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
Business delivery	Negligible impact on the effectiveness of the department	Minimal impact on delivery of strategic or business outcomes	Moderate impact on delivery of strategic or business outcomes	Severe impact on delivery of strategic or business outcomes	Strategic or business outcomes unable to delivered
	Minimal impact on the delivery of core services	Minor delays in the delivery of core services	Core services have to be prioritised and or delayed	Delays in providing or prioritisation of critical services required	Failure to provide critical services

The DEWS guidance was then adjusted to include quantitative guidelines to assess the consequence for economic and financial inputs as part of risk adjustments for each option.

1.3.2 Identification and Quantification/Qualification of Risks

The process used to identify and quantify/quality risks for the risk register included:

- Two agency risk workshops were held in February 2017. The risk workshops were facilitated by Jacobs and included representatives from Building Queensland, DEWS, SunWater, Treasury and Corrs Chambers Westgarth.
- Three internal risk workshops, facilitated by Jacobs, were subsequently held in February 2017 to refine the results of the agency risk workshops, and included practice leaders and economic and financial modelling leads. Review of the initial findings and the draft PBC by Building Queensland and relevant government agencies, including the Business Case Review Committee.
- Final agency risk workshop in April 2017 following assurance reviews.

1.4 Stakeholder Engagement Approach

This section documents the stakeholder engagement approach and activities. Stakeholder engagement was a key and valuable input during PBC development to assist with understanding of the service need and the analysis and options assessment.

Stakeholder engagement for the PBC has occurred through the following channels:

- Identification of stakeholders, development of a Stakeholder Engagement Plan and consideration of key risks associated with stakeholder engagement with the assistance of Leisa Prowse Consulting. Key inputs to the Stakeholder Engagement Plan were developed in a workshop between Leisa Prowse Consulting, Building Queensland, DEWS and SunWater.
- Formation and meetings of the Stakeholder Reference Group, comprised of regional representatives from a wide variety of stakeholder organisations. The Stakeholder Reference Group process was managed by Leisa Prowse Consulting.
- Interviews between MJA and stakeholders as part of its demand assessment.



- Interviews between Jacobs and stakeholders as part of Jacobs peer review of MJA's demand assessment and Jacobs testing of the proposed long list and shortlisted options.

The stakeholder engagement process supported the demand assessment and identification of the shortlisted options and assisted in refining the components involved in the shortlisted options.

1.4.1 Stakeholder Engagement Activities

1.4.1.1 Stakeholder Reference Group

The Stakeholder Reference Group met three times during the PBC.

The first Stakeholder Reference Group meeting was held on 26 October 2016 in Mareeba. The purpose of this meeting was to enable key stakeholders to understand the purpose of the PBC and to discuss the water supply problem and opportunities in the region, and regional needs and benefits. Presentations were given by Building Queensland about the PBC and MJA about the demand assessment. Each table was then asked to discuss a series of questions. Notes of the discussion were taken at each table by a nominated scribe, and each table reported-back to the larger group at the end of each discussion.

The second Stakeholder Reference Group meeting was held on 13 December 2016 in Mareeba. This meeting provided an update on the study and sought feedback on the preliminary findings on water demand and a range of potential water supply options. Building Queensland gave a presentation about the initial findings on the demand profile for Cairns and agriculture in the region and the proposed options to be progressed to the next stage of analysis. Each table was then asked to discuss a series of questions relating to the service need in the region and potential options. Notes of the discussion were taken at each table by a nominated scribe, and each table reported back to the larger group at the end of each discussion.

The third Stakeholder Reference Group meeting was held on 21 March 2017 in Mareeba. The purpose of this meeting was to provide an update on the PBC, outline the defined water supply problems and opportunities for the PBC, the options not being progressed and the four shortlisted options. Building Queensland gave a presentation on each of these matters. Each table was then asked to discuss a series of questions relating to the four shortlisted options. Notes of the discussion were taken at each table by a nominated scribe, and each table reported-back to the larger group at the end of each discussion.

1.4.1.2 Marsden Jacob Associates

MJA conducted a two-stage consultation process with stakeholders as part of its demand assessment.

The purpose of the Stage 1 consultation was to gain an understanding of the underlying demand drivers for water in the region and the supply options to address identified future demand. Stage 1 involved discussions with a range of stakeholders from Cairns and the MDWSS including state government departments, local government, water service providers, industry bodies and commercial entities.

The purpose of Stage 2 was to gain an understanding of key stakeholder's views of the proposed four shortlisted supply options agreed with Building Queensland, and focused on the likely cost of the options and stakeholders' willingness to pay the potential water price for each option. The four shortlisted supply options in Stage 2 were: water trading; on-farm water efficiency; conversion of MDWSS losses and Nulling Dam. Key stakeholders involved in the Stage 2 consultations included local government, water service providers and commercial entities.

1.4.1.3 Jacobs

Jacobs consulted with state government departments, water service providers, commercial entities and irrigator representatives as part of its stakeholder engagement.



These discussions were held during January and February 2017. Stakeholder expectations about the potential outcomes of the PBC were carefully managed by a transparent and complete discussion of the staged business case process.

Interviewees provided insightful and diverse perspectives on the long and short-listed options and assisted with further testing of demand.

1.5 Options Selection Approach

This section summarises the approach to options generation, options filtering, shortlisted options and the identification of the preferred option/s.

1.5.1 Service Need

The service need was developed as follows:

- Review background documents to determine previous assessments of the service need. These documents included the Far North Queensland Regional Water Supply Strategy, DEWS Regional Water Supply Security Assessments, Cairns Water Security Strategy and SunWater reports.
- Review the MJA demand assessment and Jacobs's peer review of the MJA demand assessment.
- Present the proposed water demand profile for Cairns and agriculture on the Tablelands to the Stakeholder Reference Group and receive feedback.
- Develop potential definition of the service need via discussion of past problem/opportunity definitions and emerging problem/opportunity definition.
- Conduct a workshop with key agencies to establish and agree on the service need the PBC will address.
- Present the proposed service need to the Project Steering Committee for consideration and endorsement.

Following this process, the service need to be addressed in the PBC was considered to be an opportunity to expand agricultural production on the Atherton Tableland by increasing the availability of supplemented medium priority water allocations.

It was considered there was no Cairns urban water supply service need to be addressed in the PBC. Cairns Regional Council has a portfolio of council owned and operated supply measures that could be implemented to meet future water demand and it was unlikely that Cairns would require an external water source (such as Nullinga Dam) until the very long term.

1.5.2 Long List of Options, Options Filtering and Shortlisted Options

Following clarification of the service need, the long list of options, options filtering process and shortlisted options were developed as follows:

- List all previously considered options. List variations of previous options (e.g. variations of the Nullinga Dam option) supported by analysis and available data. List any new options generated by work on the PBC.
- In consideration of the State Infrastructure Plan policy approach and categories for options assessment develop a proposed long list of options to meet the identified service need.
- In consideration of the Building Queensland Business Case Development Framework develop selection criteria to filter options to a shortlist.



- Present proposed options to be taken forward in the PBC to the Stakeholder Reference Group and seek feedback.
- Conduct a workshop with key government agencies, refine the long list of options and selection criteria, deliberate on options, and agree on a shortlist of options.
- Present the proposed shortlisted options to the Project Steering Committee for consideration and endorsement.

Following this process, the following shortlisted options were identified for further consideration in the PBC:

- Option 1: Do minimum (base case)
- Option 1: Improve MDWSS rules and operation
- Option 2: Modernise MDWSS and convert losses
- Option 4: Nullinga Dam for agricultural use.



CHAPTER 2

PROPOSAL BACKGROUND

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

2	PROPOSAL BACKGROUND	2
2.1	Nullinga Dam	3
2.2	Nullinga Dam Potential	3
2.3	State Government Election Commitment	3
2.4	Developing Northern Australian White Paper and National Water Infrastructure Development Fund	5
2.5	Nullinga Dam as a Water Supply to Cairns	5
2.6	Nullinga Dam as a Water Supply to Irrigated Agriculture	6

FIGURES

Figure 1	Mareeba-Dimbulah Water Supply Scheme and Nullinga Dam Location	4
----------	--	---



2 PROPOSAL BACKGROUND

CHAPTER SUMMARY AND CONCLUSIONS

- Nullinga Dam has a long history, first being proposed in the 1950s as part of the investigations for the Mareeba-Dimbulah Irrigation Area (MDIA) for tobacco production.
- Over the past 10 years, Nullinga Dam has been mentioned as a long-term initiative in many reviews and studies of bulk water supply for Far North Queensland. These have indicated a potential for Nullinga Dam to service the future water supply needs of Cairns (including potential demand from the proposed Aquis Resort) and stimulate additional irrigated agriculture in the region.
- In the 2015 state election, the Queensland Government made an election commitment that Building Queensland would consider Nullinga Dam in recognition of the need for additional water storage for urban and agricultural expansion in the Tropical North.
- In July 2015, the Australian Government made a commitment to provide up to \$5 million for a detailed study of the economic feasibility of Nullinga Dam. This funding was secured from the National Water Infrastructure Development Fund (NWIDF) in August 2016.
- It is not possible for Cairns to efficiently receive water from the proposed Nullinga Dam. Tinaroo Falls Dam and Nullinga Dam would need to operate in conjunction, with Cairns receiving water via releases from Tinaroo Falls Dam down the Barron River for extraction at Cairns. This process would require a 'swap' or 'substitution' of existing water allocations from Tinaroo Falls Dam to water allocations from Nullinga Dam. Irrigators in the MDWSS are likely to have significant concerns with this 'swap' or 'substitution' process as water released from Nullinga Dam may have, or may be perceived to have, different characteristics to water from Tinaroo Falls Dam in relation to price, quality and reliability.
- The potential for Nullinga Dam as a bulk water supply option for Cairns is therefore considered to have significant complexities.
- The MDWSS is the major water resource development in the region and provides water to about 25,000 hectares of irrigated agriculture. Water allocations in the MDWSS are currently fully allocated. Alternative options will need to be evaluated to allow for a potential expansion of irrigated agriculture within the area and surrounding region. The annual level of water use in the MDWSS is inversely related to the amount of rainfall. Historically, the level of utilisation (water use as a percentage of entitlements) is generally 60 to 70 per cent, but has been trending upwards to meet scheme capacity. Dry conditions have persisted since 2012–13 and as a result the level of utilisation in 2015–16 was about 86 per cent.
- The MDWSS is a highly developed irrigation area and has sophisticated irrigators with a history of excellence in large scale agricultural production and innovation. There are approximately 40 major crops grown underpinned by supplemented water supply. In terms of water use, sugarcane is the dominant crop in MDWSS. In terms of production value, perennial tree crops (avocados, bananas and mangoes) and horticulture are the dominant crops in the region.
- There is potential for Nullinga Dam to service additional irrigated agriculture in the region, subject to market appetite.



2.1 Nullinga Dam

The proposed Nullinga Dam site is located on the Walsh River, approximately 55 kilometres south-west of Cairns and 24 kilometres south-south-west of Mareeba. It is situated within the Mareeba Shire Council area and sub-catchments E and F of the Barron Water Plan.

Nullinga Dam was first proposed in the 1950s as part of the original investigations for the development of the MDIA to support tobacco production. However, a decision was made to construct Tinaroo Falls Dam in favour of Nullinga Dam, as it could supply significantly more water to a greater area.

Figure 1 shows the Nullinga Dam proposed site (in the lower middle section of figure), effectively at the Southern border of the MDWSS. Nullinga Dam could provide supplemented water to the Walsh River and Western MDWSS distribution area, as the water from Nullinga would naturally flow west from this section of the scheme.

2.2 Nullinga Dam Potential

Over the past 10 years, Nullinga Dam has been mentioned as a long-term initiative in many reviews and studies of bulk water supply for Far North Queensland. These include the Program of Works, State-wide Water Grid (2007) and the Draft and Final Far North Queensland Regional Water Supply Strategy (2007 and 2010).

These reports and studies have indicated a potential for Nullinga Dam to:

- service the future water supply needs of the Cairns urban community (including potential demand from the proposed Aquis Great Barrier Reef Resort [Aquis], if it proceeds)
- stimulate additional irrigated agriculture in the region. Irrigated agriculture in the Atherton Tableland is a mature sector, so any development would see an expansion of that production base.

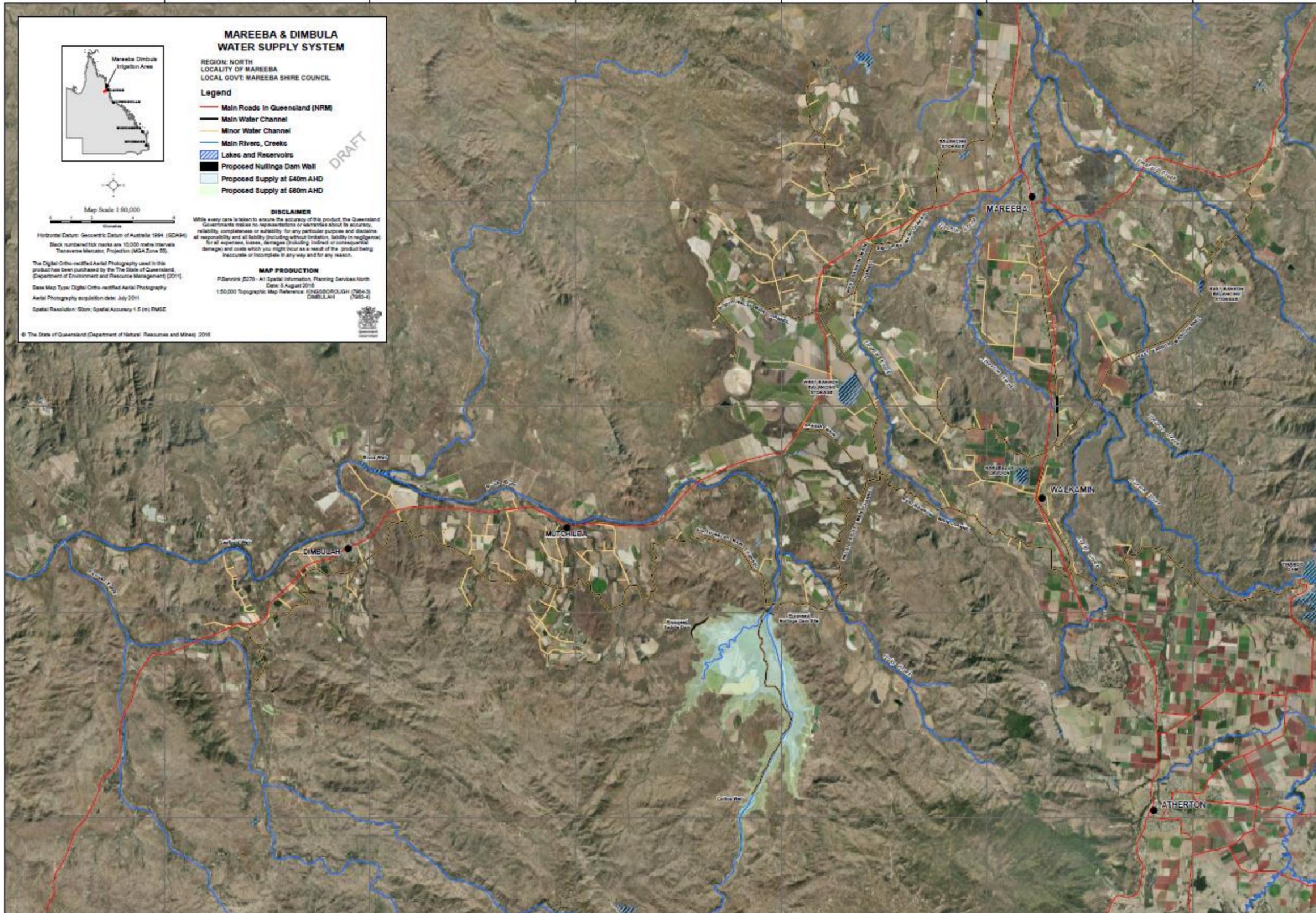
2.3 State Government Election Commitment

During the 2015 state election, the Queensland Government made an election commitment to 'submit an assessment of the Nullinga Dam to Building Queensland for priority consideration in recognition of the need for additional water storage for urban and agricultural expansion in the Tropical North'.

Queensland Treasury Corporation subsequently undertook a high-level analysis of the proposed Nullinga Dam for DEWS, which was provided to Building Queensland for consideration. This high-level analysis has been considered by Building Queensland in the development of the PBC.



Figure 1 Mareeba-Dimbulah Water Supply Scheme and Nullinga Dam Location



Source: DNRM



2.4 Developing Northern Australian White Paper and National Water Infrastructure Development Fund

In July 2015, the Australian Government released the Developing Northern Australia White Paper.

A key component of the White Paper was the establishment of the NWIDF. The objectives of the NWIDF are to undertake detailed economic planning to inform water infrastructure investment decisions, and expedite the construction of water infrastructure.

The White Paper committed up to \$5 million from the NWIDF towards ‘a detailed examination of the economic feasibility of Nullinga Dam’. To implement this commitment, Building Queensland and the Australian Government Department of Agriculture and Water Resources agreed a project plan for a staged examination of Nullinga Dam. The National Project Agreement bilateral schedule securing the NWIDF funding was signed by the respective Ministers of the Australian Government and Queensland Government in August 2016.

This PBC is Stage 1 and will investigate the potential for Nullinga Dam and other options to address the identified future water supply shortfall in the region. Subject to the outcomes of the PBC and Queensland Government approval to proceed, Stage 2 will involve a Detailed Business Case.

2.5 Nullinga Dam as a Water Supply to Cairns

In 2015, CRC Cairns Regional Council adopted the Cairns Water Security Strategy which outlined a preferred strategy for implementing a series of short, medium and long-term options to meet water demand in Cairns over the next 30 years.

All the long-term options in the Cairns Water Security Strategy were stated as subject to further investigation. However, the preferred sequence for the long-term options was listed as first, conversion of MDWSS losses and second, a regional dam, nominally Nullinga Dam.

It is not possible for Cairns to efficiently receive water from the proposed Nullinga Dam due to the locations of Cairns and the Nullinga Dam site. Rather, to supply Cairns with water from the Atherton Tableland area, Tinaroo Falls Dam and Nullinga Dam would need to operate in conjunction, and Cairns would need to receive water via additional releases from Tinaroo Falls Dam down the Barron River for extraction at Cairns.

As the allocations from Tinaroo Falls Dam within the MDWSS are fully allocated, the supply to Cairns from Tinaroo Falls Dam would require a two-step process:

1. Existing water allocation holders from Tinaroo Falls Dam would need to **voluntarily** ‘swap’ their existing water allocations from Tinaroo Falls Dam in exchange/‘substitution’ for newly purchased water allocations from Nullinga Dam.
2. The ‘freed up’ allocations in Tinaroo Falls Dam created by this process would need to be purchased by Cairns Regional Council for water supply to Cairns, and the council would need to put in place appropriate extraction and water treatment infrastructure to access these water allocations from the Barron River and distribute the water within its reticulation network.

Irrigators in the MDWSS are likely to have significant concerns with this ‘swap/substitution’ process. This is because water released from Nullinga Dam may have, or may be perceived to have, the following different characteristics to water from Tinaroo Falls Dam:

- Water pricing—there would need to be a ‘no-disadvantage’ approach to irrigators voluntarily participating in a water allocation swap/substitution. Accordingly, Cairns Regional Council would likely



need to pay the pricing differential including capital charges, so the higher cost would most likely be allocated to the council under this option.

- Water quality—no cost-effective water quality risk mitigation (Nullinga Dam in comparison to Tinaroo Falls Dam) is available and SunWater bulk water contracts traditionally exclude water quality considerations/obligations.
- Water product reliability—the Nullinga Dam yield scenarios modelled to date are based on an assumed Integrated Quantity and Quality Model (IQQM) medium priority monthly reliability of 96 per cent, which matches the current reliability of medium priority water allocations in the MDWSS and Tinaroo Falls Dam. No water supply scheme performs or operates identically, but in theory the reliability characteristics are likely to be able to be made similar, as long as scheme operating rules (e.g. announced allocation and carry over provisions) are also equivalent.

The potential for Nullinga Dam as bulk water supply option for Cairns is therefore considered to have significant complexities.

2.6 Nullinga Dam as a Water Supply to Irrigated Agriculture

The MDWSS is the major water resource development in the Barron Water Resource Plan area and supplies water to approximately 25,000 hectares of irrigated agriculture. Water allocations in the MDWSS are currently fully allocated. Alternative options will need to be evaluated to allow for a potential expansion of irrigated agriculture within the area and surrounding region.

In terms of land area and water use, sugarcane is one of the major crops in the areas, followed by perennial horticulture and broadacre cropping. In terms of perennial horticulture, bananas, mangoes and avocados are the main crops grown in the region. Horticulture dominates the region in terms of the dollar value of production. In recent years, there has been an increase in permanent plantings of high value crops. Such crops require more water as they mature so their demand for allocation will continue to grow.

The climate in Far North Queensland is highly variable. Even within the MDWSS, the average annual rainfall ranges from 1,295 mm at Tinaroo Falls Dam, to 1,032 mm at Walkamin, and 780 mm near Dimbulah.¹ The annual level of water use in the MDWSS is inversely related to the amount of rainfall. Historically, the level of utilisation (water use as a percentage of entitlements) is mostly around 60 to 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 around 86 per cent.

The MDWSS is considered a highly developed irrigation area and has sophisticated irrigators with a history of excellence in large scale agricultural production and innovation. It supports a resilient field and tree cropping sector, livestock and dairy farming, horticulture and some timber production. The area is expected to continue to build on its reputation supported by a strong base in excess of 40 major crops underpinned by supplemented water. A range of elevation, soil types, climate and rainfall exist within and adjacent to the scheme.²

Is it therefore considered there is potential for the proposed Nullinga Dam to service additional irrigated agriculture in the region, subject to market appetite.

¹ Queensland Department of Agriculture and Fisheries, *Queensland Agricultural Land Audit, Far North Queensland*, May 2013, p 216.

² Tablelands Futures Corporation 2013 p.1, <http://www.tablelandsfutures.com/wp-content/uploads/2015/04/Our-Economy-Our-Future-2013-FINAL.pdf>



CHAPTER 3

SERVICE NEED

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

3	SERVICE NEED	2
3.1	Purpose	3
3.2	Current Situation	3
3.3	Method and Activities	11
3.4	Previous Assessments of the Service Need	11
3.5	Cairns Urban Demand	12
3.6	MJA Demand Assessment—Agricultural Demand	13
3.7	Stakeholder Views	17
3.8	Service Need for the PBC	18
3.9	Benefits Sought	18
3.10	Base Case	20

TABLES

Table 1	Cairns Regional Council Water Security Strategy Initiatives.....	3
Table 2	MDWSS Allocations and Use	6
Table 3	Temporary Trading in MDWSS Over Time.....	10
Table 4	Increase in Temporary Trading Price in MDWSS Over Time	10
Table 5	Nullinga Dam Proposed Purposes Over Time	11
Table 6	Marden Jacob Associates Assumptions.....	16
Table 7	Anticipated Benefits from Addressing the Service Need.....	18
Table 8	Rate of Change in MDWSS in Water Deliveries Over Time	21

FIGURES

Figure 1	Forecast Demand and Supply Strategy in Cairns Regional Council Water Supply Strategy	5
Figure 2	MDWSS Operational Systems	7
Figure 3	Water Use by MDWSS Operational Systems.....	8
Figure 4	Water Use and Rainfall in the MDWSS	9
Figure 5	Water Trading and Rainfall in the MDWSS.....	9
Figure 6	MJA Revised Demand Forecast for Cairns Regional Council	12
Figure 7	MJA Agricultural Demand Forecast Scenarios	15
Figure 8	Water Deliveries in the MDWSS 1981–2016	21



3 SERVICE NEED

CHAPTER SUMMARY AND CONCLUSIONS

Urban Demand

- There is no Cairns urban water supply service need to be addressed in the PBC.
- Under current population/demand forecasts, Cairns Regional Council (CRC) has an implementation plan of CRC owned and operated supply measures in place within existing regulatory frameworks to meet its future demand for at least the next 30 years, including the revised proposal for the Aquis Resort. CRC does not have an identified need for water from a new regional source (such as Nullinga Dam) until the very long term.

Agricultural Demand

- The identified service need to be addressed in the PBC is an opportunity to expand agricultural production on the Atherton Tableland by increasing the availability of supplemented medium priority (MP) allocations.
- In addressing this opportunity, two existing issues should be considered:
 - Agricultural production and growth is constrained when irrigators exceed their stated ‘scarcity buffer’ (e.g. 70 to 80 per cent water use as a portion of available allocations) and conserve water to protect longevity of crops at dry times
 - Water cannot be moved to certain areas because of constraints in the MDWSS water distribution system (e.g. East Barron and Arriga areas) and a lack of infrastructure in greenfield areas.
- The benefits of meeting this service need include an increase in value of agricultural production, arising from better use of existing infrastructure and/or the construction of new infrastructure, resulting in more direct and indirect jobs. Flow-on benefits include broader improvements to community health and wellbeing.
- The removal from the service need of the provision of water supply to Cairns removes a critical point of potential conflict between CRC and the Tablelands community.
- The base case represents the business-as-usual scenario and is likely to feature:
 - Little or no increase in water deliveries to the extent that available capacity within water distribution infrastructure has, or is close to being, reached (when available, 2016–17 system usage data will assist to establish if this is the case)
 - Increased moves by the irrigation sector towards on-farm water efficiency and higher value production (to the extent that high-value producers have not already reached optimal water use, as trickle irrigation is widely used on tree crops)
 - Water trading at high values towards high value crops on the most fertile soils within the scheme
 - leading to an expansion of high value horticulture within the region
 - Static or potentially modest expansion of sugarcane production by MSF Sugar and other producers resulting from increased yields due to improvements in on-farm water use efficiency. Given the current water constraints, the base case is unlikely to see expansion of sugar cane without a new source/supply of water allocations.



3.1 Purpose

This chapter summarises the current situation, the method and activities undertaken to determine the service need and stakeholder views. It then defines the service need proposed to be addressed in the PBC and outlines the benefits from addressing the service need and base case considerations.

3.2 Current Situation

3.2.1 Cairns

3.2.1.1 Current Water Supply

CRC has two main water supply sources:

- Copperlode Falls Dam on Freshwater Creek, forming Lake Morris. Water is released from Copperlode Falls Dam into Freshwater Creek with the intake located at Crystal Cascades Weir. Raw water is extracted at the intake and treated at the Freshwater Creek Water Treatment Plant.
- Behana Creek, south of Gordonvale. Water is extracted directly from a small weir in the creek, with extraction rates depending on flow conditions.

These two sources are owned and operated by CRC and operated in tandem on a day-to-day and seasonal basis to meet water requirements in Cairns. CRC has adopted a Level of Service of 26,000 megalitres per annum (ML/a) as the available yield from these sources.

CRC's system provides treated/potable water access to approximately 154,000 people, or about 98 per cent of the population within the Cairns local government area. Industry within the reticulated area is also connected to the reticulation network. Tourism is an additional significant factor for water supply, with over two million visitors to the region providing an additional estimated transient population of up to 40,000 visitors to Cairns on any one night. CRC does not supply water to irrigated agriculture.

3.2.1.2 Water Security Strategy

In 2015, CRC released the Cairns Water Security Strategy, which set out a preferred strategy for implementing a series of short, medium and long-term initiatives to address the future demand for water in Cairns over the next 30 years. The preferred initiatives are provided in Table 1.

Table 1 Cairns Regional Council Water Security Strategy Initiatives

INITIATIVES	COMMENTS	Estimated Yield
Short-term (1–5 years)		
Demand management Smart meters	Currently being undertaken Continue existing initiatives such as community education programs. Also, new initiatives such as water efficient appliances for new residential and non-residential developments	Estimated savings 3,026 ML/a over four programs
Level of Service review	Currently being undertaken May result in increase in current Level of Service yield from Copperlode Falls Dam and existing Behana Creek of 26,000 ML/a	Unknown



INITIATIVES	COMMENTS	Estimated Yield
Behana Creek improvements (including Draper Road Water Treatment Plant Stage 1)	Currently being undertaken Extraction at Behana Creek is currently constrained by existing treatment processes and capacity. Upgrading the water treatment plant will increase the volume of water extracted	1,000 ML/a
Mulgrave River Stage 1	Run of river extraction at Gordonvale	5,000 ML/a
Medium-term (5–10 years)		
Barron River Stage 1 (including Kamerunga Water Treatment Plant Stage 1)	Accessing a small reserve of the Barron River at Lake Placid. Preferred sequence of medium-term options subject to further investigation and comparative assessment	5,500 ML/a
Mulgrave River Stage 2 (including Draper Road Water Treatment Plant Stage 2)	Entitlements held by Mulgrave Mill at Gordonvale on the Mulgrave River could be traded to the CRC. Or further extraction from the Mulgrave River. Preferred sequence of medium-term options subject to further investigation and comparative assessment	8,500 ML/a
Long-term (10–30 years)		
Further development of Mulgrave River water source ensuring cumulative capacity is less than 15,000 ML/a	All long-term options are subject to further investigation of availability, impact and cost Of the final two initiatives, the preferred sequence is (1) conversion of MDWSS losses and (2) new regional supply, nominally Nullinga Dam	
Purchase and utilise part of the 19,000 ML/a Mulgrave Mill water entitlement		
Investigate the possibility of use of appropriately treated water for other purposes		
Conversion of MDWSS operational losses to allocations for urban use by Cairns		
Access water from a future regional dam (e.g. Nullinga Dam)		

Source: Cairns Water Security Strategy, 2015

The Cairns Water Security Strategy was developed between April 2014 and February 2015 with involvement from a community-based Water Security Advisory Group and Technical Project Team. The Cairns Water Security Strategy baseline forecast was:

- Medium population growth forecast as per the Queensland Regional Statistical Information System
- Total system water demand of 418 litres per resident person per day
- An allowance for non-residential demand (including tourism) to grow in direct proportion to population growth.

The Cairns Water Security Strategy is subject to annual review.

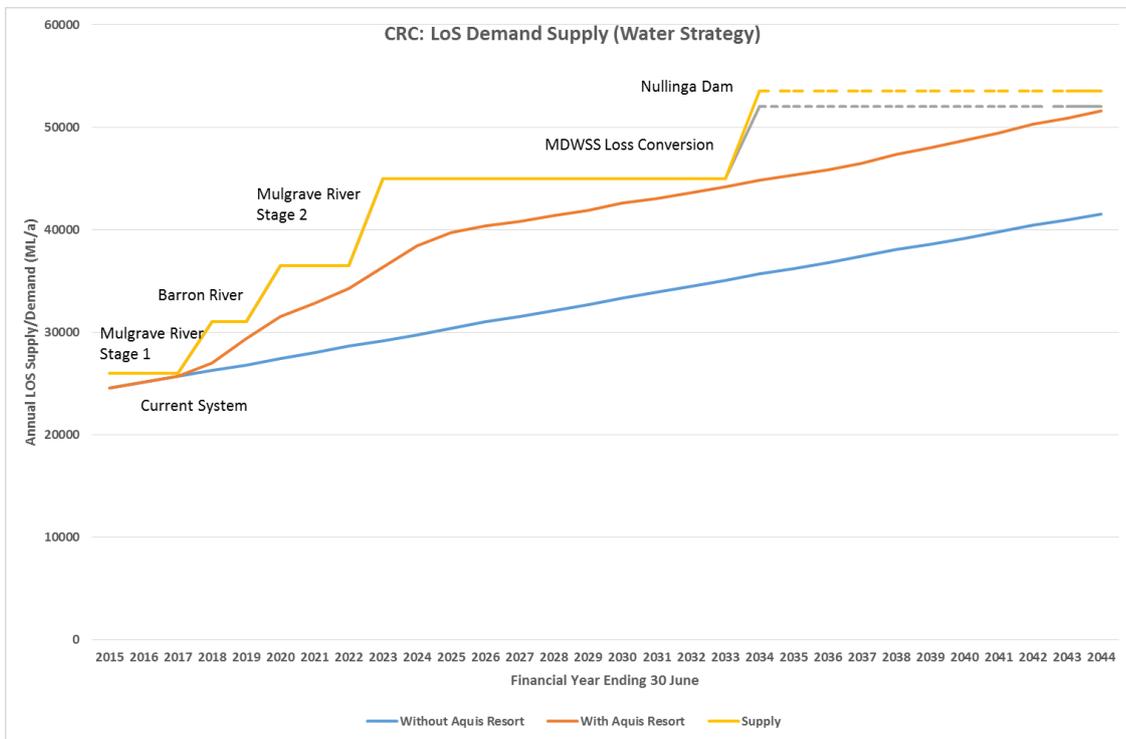


3.2.1.3 Aquis Great Barrier Reef Resort

The proposed Aquis Resort site is at Yorkeys Knob, north of Cairns. At the time of the Cairns Water Security Strategy, the proposed resort had a planned capital investment of \$8 billion, and involved a large entertainment and hotel complex which included casinos, theatres, convention spaces and accommodation for 12,000 guests.

Water demand from the proposed Aquis Resort would be supplied by CRC from its water supply system. CRC consequently modelled two demand forecasts for the Cairns Water Security Strategy, one which included the proposed Aquis Resort ('with Aquis') and one which did not ('without Aquis'). Under the Cairns Water Security Strategy, Cairns would require longer term water supply augmentation from regional sources such as the proposed Nullinga Dam by 2035 if the proposed Aquis Resort was developed. The demand profile in the Cairns Water Security Strategy showing the two scenarios is provided in Figure 1.

Figure 1 Forecast Demand and Supply Strategy in Cairns Regional Council Water Supply Strategy



Source: Cairns Water Security Strategy, 2015

3.2.2 Barron Water Plan area and Mareeba-Dimbulah Water Supply Scheme

3.2.2.1 Barron Water Plan

The Barron Water Plan 2002 area spans over 2,100 square kilometres and comprises these catchments:

- Barron River catchment
- Walsh River catchment upstream of Flatrock gauging station
- Mitchell River catchment upstream of Lake Mitchell.

All supplemented, un-supplemented surface water and groundwater in the plan area is managed in accordance with the Barron Water Plan and the Barron Resource Operations Plan.



3.2.2.2 Mareeba-Dimbulah Water Supply Scheme

The MDWSS is the major water resource development in the Barron Water Plan area and services circa 70 per cent of Far North Queensland's water entitlements.

The MDWSS is currently owned and managed by SunWater and comprised of Tinaroo Falls Dam and an extensive distribution system. Tinaroo Falls Dam stores and releases water for irrigation, town water supply, potential hydroelectricity generation opportunity and recreation purposes. The distribution system is comprised of 12 sub-systems, a number of weirs, 375 kilometres of channels and pipelines and 61 kilometres of drains. The sub-systems and water use profile for each sub-system are outlined in the figure and table below.

The MDWSS currently services around 1,125 customers. The supply values are limited by infrastructure capacity and losses. MDWSS water allocations and use are as follows.

Table 2 MDWSS Allocations and Use

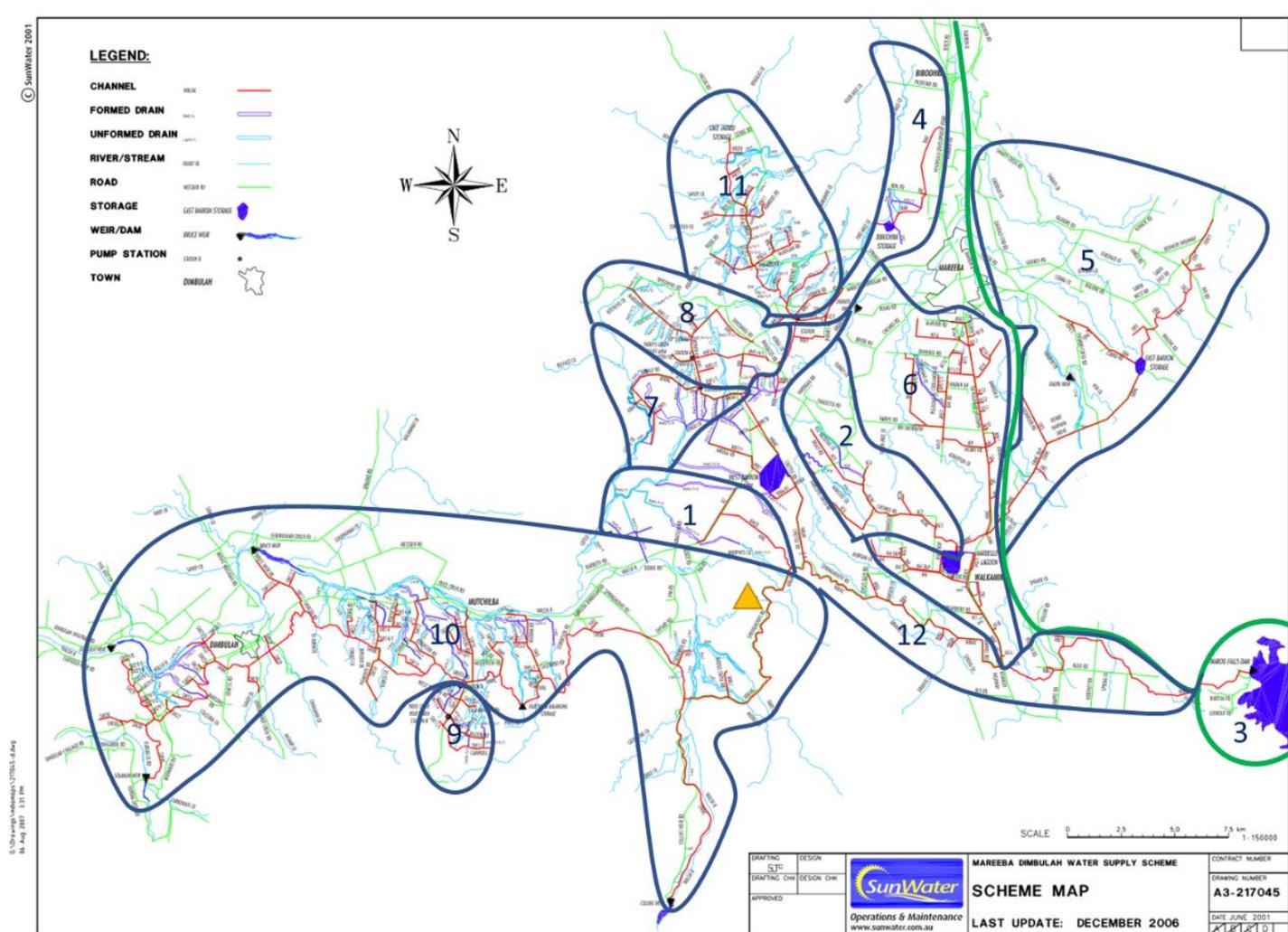
CUSTOMER SEGMENT	WATER ENTITLEMENTS (ML)	WATER AVAILABLE (INCL. CARRYOVER) (ML)	WATER DELIVERED (ML)	TEMPORARY TRADING (ML)	COMMENT
Industrial	1,351	1,341	899	310	Barron Gorge Hydroelectric Power Station
Irrigation	151,412	160,193	125,503	45,413	Agricultural use
Urban	6,655	6,659	4,039	439	Towns: Tinaroo, Mareeba, Mutchilba and Dimbulah.
SunWater	45,006	45,003	31,621	0	Losses
Total	204,424	213,196	162,062	46,162	

Source: SunWater, Annual Report 2015-16 (Scheme Statistics). Note: Data excludes riparian allowance, channel and river harvesting

The *Water (Local Management Arrangements) Amendment Act 2017* was passed by the Queensland Parliament on 16 February 2017 to enable irrigators from regional communities to manage their own water distribution schemes. The Queensland Government is currently investigating transitioning the MDWSS distribution system to LMA. The MDWSS LMA Investigation Board is due to deliver its revised business case to the Queensland Government, setting out how they may operate under local management, by October 2017. The Queensland Government will then consider whether the MDWSS is ready to commence the transition to local management. If this proceeds, the MDWSS distribution infrastructure business, assets and liabilities will be transferred from SunWater to a new local management entity, and SunWater would retain responsibility for Tinaroo Falls Dam as the bulk water supply to the MDWSS.



Figure 2 MDWSS Operational Systems

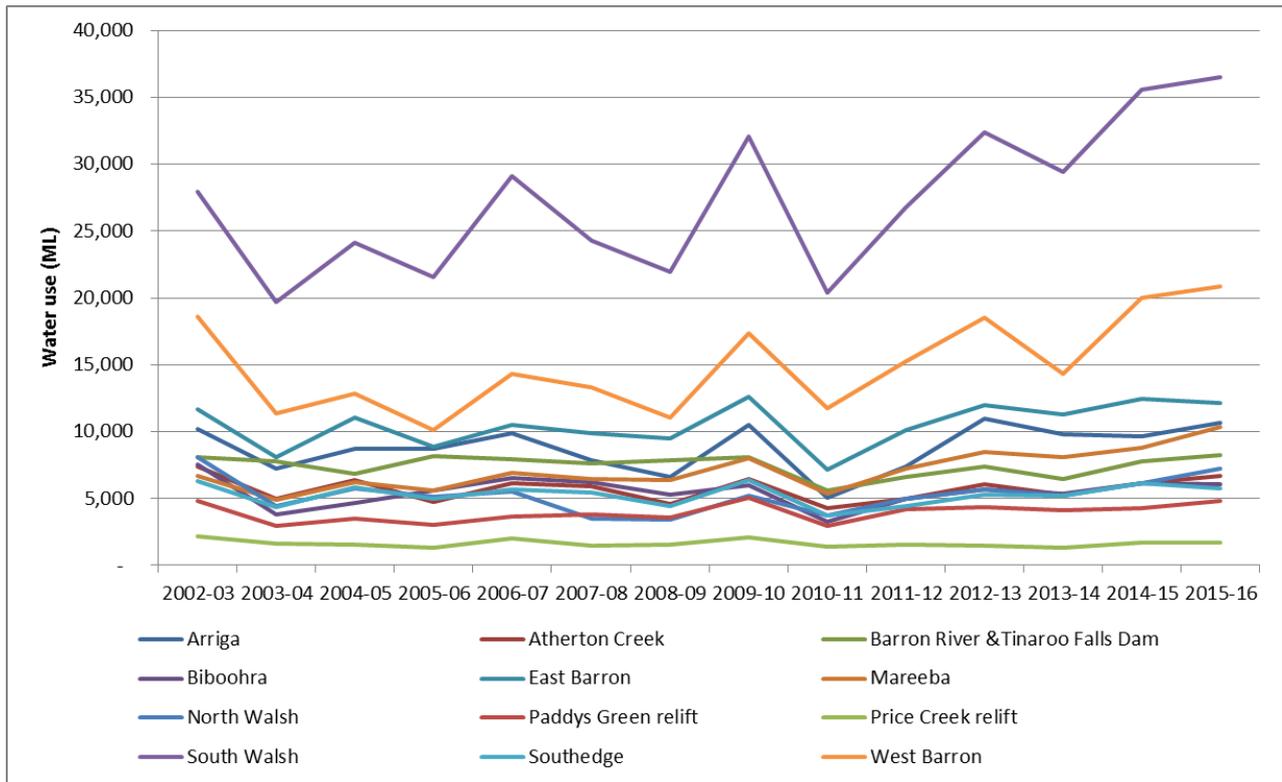


Source: SunWater

Note: 1. Arriga, 2. Atherton Creek, 3. Barron River & Tinaroo Falls Dam, 4. Biboohra, 5. East Barron, 6. Mareeba, 7. North Walsh, 8. Paddy's Green relief, 9. Price Creek relief, 10. South Walsh, 11. Southedge, 12. West Barron. Yellow triangle denotes location of MSF Sugar's Tablelands Mill



Figure 3 Water Use by MDWSS Operational Systems



Source: SunWater and MJA analysis

3.2.2.3 Irrigated Agriculture

Irrigation is the largest component of water use in the MDWSS. The DAF Queensland Agricultural Audit (2013) identified the MDWSS as the most important agricultural area in Far North Queensland.

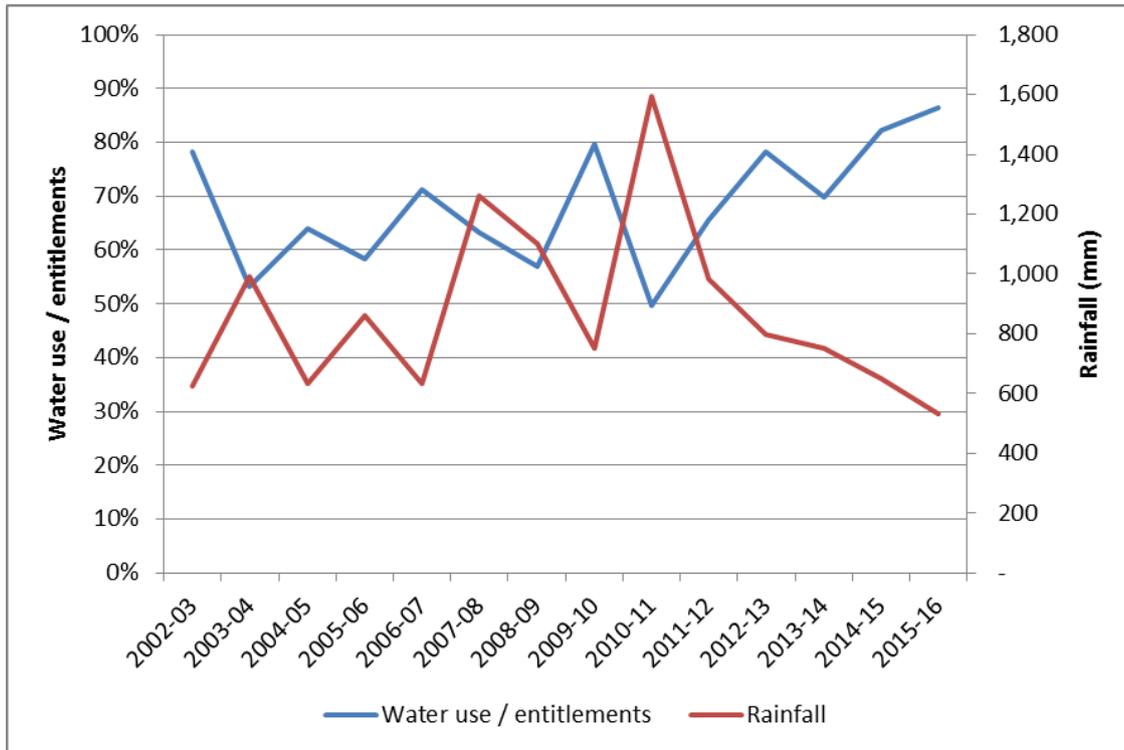
Water allocations in the MDWSS are currently fully allocated. Alternative options will therefore need to be progressed to allow for a potential expansion of irrigated agriculture within the area and surrounding region.

The MDWSS provides water to about 25,000 hectares of irrigated agriculture. The distribution of water within the MDWSS is primarily gravity fed. This means the distance and time-lag associated with supply from Tinaroo Falls Dam to the outer zones in the western area is greater than two days and leads to higher comparative delivery losses/inefficiencies for this area.

Water use in the MDWSS is inversely related to the amount of rainfall. Historically, the level of utilisation (water use as a percentage of entitlements) is generally 60 to 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 as shown in Figure 4.



Figure 4 Water Use and Rainfall in the MDWSS

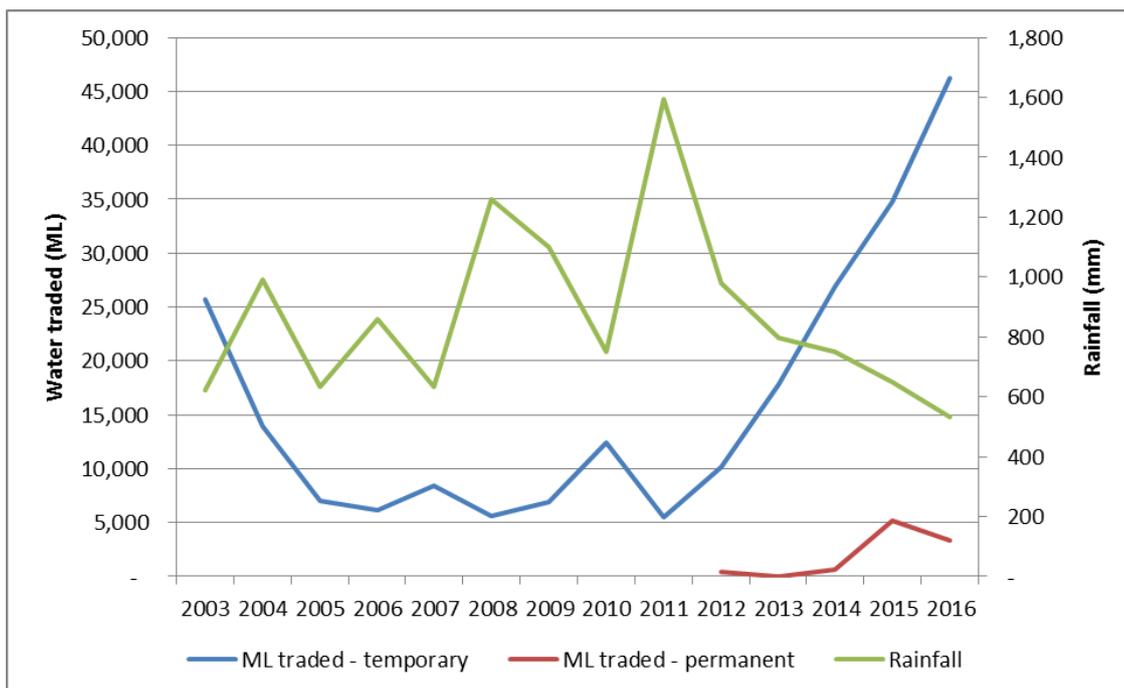


Source: SunWater, http://www.bom.gov.au/climate/averages/tables/cw_031066.shtml and MJA Analysis

3.2.2.4 Water Trading in the Mareeba-Dimbulah Water Supply Scheme

Supplemented water allocation holders in the MDWSS have had the benefit of water trading since 2001. The level of water trading has increased in recent years due to dry conditions and the increasingly high value of crops, as indicated in the figure below.

Figure 2 Water Trading and Rainfall in the MDWSS





Temporary water trading data from SunWater’s recent annual reports outlined in the table below shows a significant increase in temporary trading volumes in the past few years.

Table 3 Temporary Trading in MDWSS Over Time

ITEM	2012–13	2013–14	2014–15	2015–16	CHANGE 2013 TO 2014	CHANGE 2014 TO 2015	CHANGE 2015 TO 2016
Irrigation temporary trading (ML)	26,486	26,089	34,089	45,413	-1%	31%	33%
Irrigation water delivered (ML)	112,265	100,136	119,564	125,503	-11%	19%	5%
Irrigation temporary trading as a portion of irrigation water delivered	24%	26%	29%	36%	10%	9%	27%
Irrigation water entitlements (ML)	151,298	151,563	151,412	151,412	0%	0%	0%
Irrigation temporary trading as a portion of irrigation water entitlements	18%	17%	23%	30%	-2%	31%	33%

Source: SunWater Annual Reports 2012–13, 2013–14, 2014–15, 2015–16

The following table provides an estimate of temporary trading at the increasing temporary trading water price over the same period.

Table 4 Increase in Temporary Trading Price in MDWSS Over Time

ITEM	2012–13	2013–14	2014–15	2015–16	CHANGE 2013 TO 2014	CHANGE 2014 TO 2015	CHANGE 2015 TO 2016
Trading value (\$per ML)	80	100	120	140	25%	20%	17%
Value of temporary trading (\$ million)	2.12	2.61	4.09	6.36	23%	57%	55%

This analysis reveals the temporary trade values have increased over the past few years to exceed the value of the fixed distribution system annual charges (e.g. approximately \$80 per ML). The value of temporary trading is estimated to be \$2.1 to \$6.3 million annually in the MDWSS, demonstrating rising scarcity of water in the scheme.

It is difficult to obtain reliable permanent water trading values because in most cases when DNRM receives notification of water and land sales, the price paid is bundled for the water and land titles together and DNRM uses its judgement to apportion dollars to the different titles.

Price transparency in the market is a key issue as water transfers are facilitated by private parties. For instance, the price of permanent transfers of water from anecdotal evidence is significantly higher than reported by DNRM¹, which shows permanent transfers during September 2016 were \$1,938 per ML (volume

¹ <https://www.business.qld.gov.au/industry/water/managing-accessing/markets-trading/market-information>



weighted average price). Consultation undertaken for the PBC indicates that water is currently (e.g. 2016-17) being permanently traded in the range of \$2,000 to 3,000 per ML—with a midpoint of \$2,500 per ML. It is understood SunWater’s current midpoint for the MDWSS is \$2,600 per ML.

In addition to the trading data, there is evidence the water market in the MDWSS appears to be maturing via the presentation of property by owners (via real estate agents) of water and land as separate values.

3.3 Method and Activities

The service need was developed as follows:

- Review background documents to determine previous assessments of the service need.²
- Review MJA Demand Report and Jacobs peer review of the MJA demand assessment.
- Present the proposed water demand profile for urban water supply for Cairns and agricultural water supply on the Tablelands to the Stakeholder Reference Group and receive feedback.
- Develop a potential definition of the service need via consideration of past problem/opportunity definitions and emerging problem/opportunity definitions.
- Hold internal workshops and workshops with key agencies to establish a proposed service need
- Test the proposed service need via consultation with key regional stakeholders and water customers in the MDWSS.
- Present the proposed service need to the Project Steering Committee for consideration and endorsement.

3.4 Previous Assessments of the Service Need

Nullinga Dam has been proposed to meet a variety of water supply needs over time (see table 5).

Table 5 Nullinga Dam Proposed Purposes Over Time

YEAR	PURPOSE
1950	Tobacco production in the Mareeba-Dimbulah Irrigation Area (no specified volume)
2008	30,000 ML HP for urban water supply to Cairns
2010	Cairns urban water supply and agricultural water supply (no specified volume)
2015	Urban and agricultural expansion in the Tropical North (no specified volume)
2015	Long term option for Cairns urban water supply (no specified volume)
2015	12,500 ML for Cairns urban water supply via substitution of Barron sub-catchment E water entitlements back into the Barron River from Tinaroo Falls Dam Remaining yield of Medium Priority water to the Walsh River part of the MDWSS (estimated between 36,000 to 69,500 depending on the size of the dam)

Given the history of previous assessments, Building Queensland engaged MJA to conduct a demand assessment for the proposed Nullinga Dam for both the Cairns urban and agricultural sectors.

² For example, Far North Queensland Regional Water Supply Strategy, DEWS Cairns Regional Water Supply Security Assessment, CRC Water Security Strategy, SunWater reports and other data.



Building Queensland also wrote to key stakeholders to confirm the outputs of the MJA demand assessment, and engaged Jacobs and Synergies Economic Consulting to peer review the MJA demand assessment, to ensure its robustness.

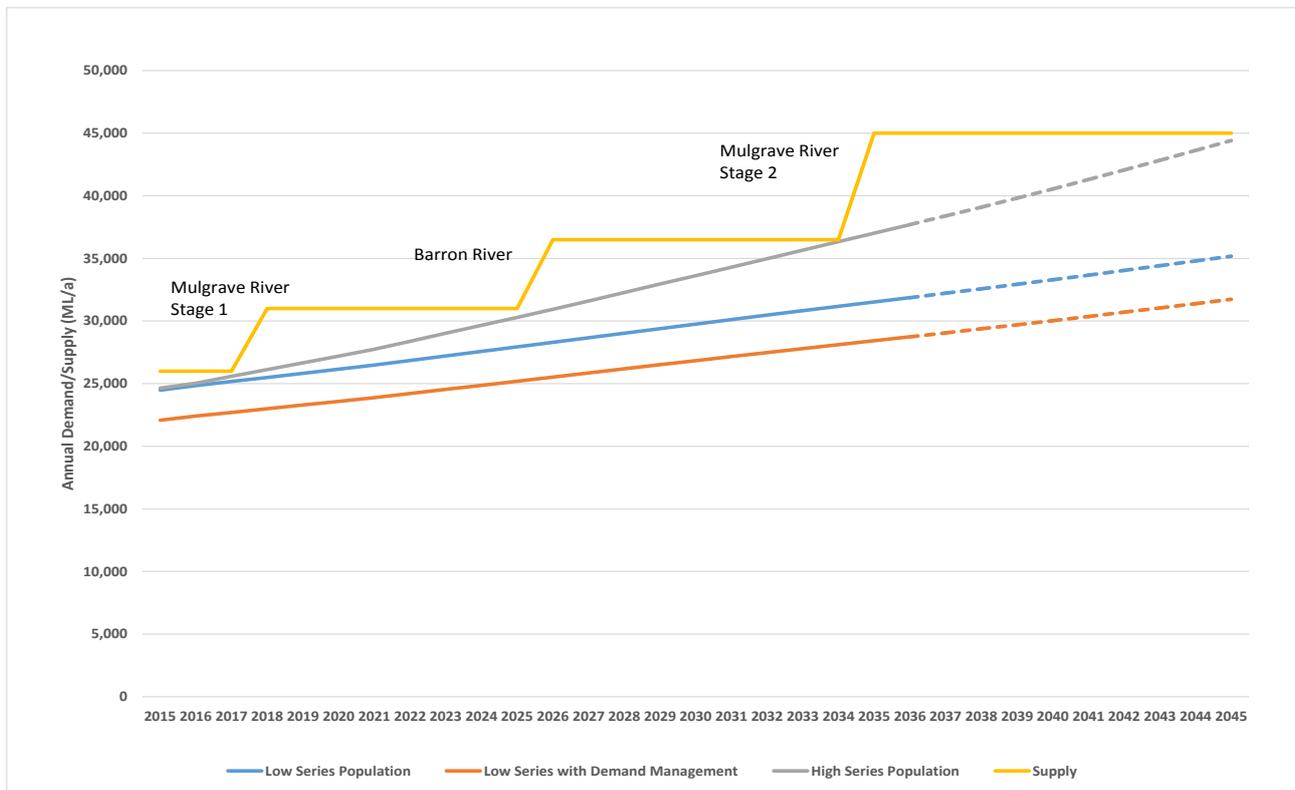
3.5 Cairns Urban Demand

3.5.1 MJA Assessment – Cairns Urban Demand

Key findings from the MJA demand assessment for Cairns urban supply are outlined below.

- In 2016, CRC revisited its water demand forecast in the Cairns Water Security Strategy based on updated population growth projections and revised assumptions regarding the proposed Aquis Resort.
- The revised water demand forecast is shown in the figure below and is based on the low series of the 2015 edition population projection by the Queensland Government Statistician’s Office (QGSO) and a baseline per capita demand of 418 litres per capita per day (L/c/d).³

Figure 6 MJA Revised Demand Forecast for Cairns Regional Council



Source: CRC and MJA analysis.

Notes: (1) Dotted lines are extrapolations of the data sourced from the Queensland Government Statistician’s Office. (2) The augmentation sequence beyond Mulgrave River Stage 1 is for illustrative purposes only. This sequencing will be subject to a further specific comparative assessment.

- The revised water demand forecast by the CRC shows a lower demand profile than the ‘Without Aquis’ scenario presented in Cairns Water Security Strategy, and well below the ‘With Aquis’ scenario.

³ The per capita demand is a composite demand across all sectors including residential, tourism, and other non-residential customers. Further, it is assumed that the proportional demands remain constant over time i.e. demand for one sector does not grow at a higher rate than other sectors.



- CRC's updated water demand forecast means water supply augmentations are now not required until 2019 (comprising Mulgrave Stage 1). This delays the need for augmentations compared with the Cairns Water Security Strategy water demand forecast where water supply augmentations were required by 2017.
- CRC's baseline per capita demand does not take into account demand management initiatives which are predicted to reduce per capita demand from 418 L/c/d to 377 L/c/d over the next 10 years (demand management is a short-term option under the 2015 Strategy as outlined in Table 1 and CRC have subsequently published a water demand management strategy for 2016-2025 with this goal specifically stated and specified measures for implementation). A reduction in per capita demand would consequently enable a deferral of the next supply augmentation (Mulgrave River Stage 1) to potentially beyond 2026, and subsequent augmentations to beyond 2036.
- The revised water demand forecast and predicted timings of future augmentations will be confirmed as part of CRC's development of its Emergency Water Supply Plan, which is scheduled for completion in the second half of 2017.
- CRC is undertaking a review of the Level of Service performance criteria and targets of its water supply system. This could lead to timing of planned augmentations being pushed out should CRC elect to change its Level of Service (e.g. changing system performance triggers or increasing frequency of restrictions).
- Under current population/demand forecasts, CRC has an implementation plan of CRC owned and operated supply measures in place to meet its future demand for at least the next 30 years and does not have an identified need for water from a regional source (such as Nullinga Dam) until the very long term. CRC's supply measures include implementation of a demand management strategy and utilising currently held reserves in the Mulgrave and Barron Rivers through development of water supply and treatment infrastructure. Beneficial water trading opportunities are also identified in the Mulgrave catchment.

3.5.2 Building Queensland Correspondence—Cairns Regional Council

Building Queensland wrote to CRC outlining key findings of the MJA demand assessment and requesting confirmation. CRC responded to Building Queensland confirming the MJA findings subject to a number of provisos which were addressed in the PBC.

3.5.3 Jacobs Peer Review—Cairns Urban Demand

Building Queensland engaged Jacobs to peer review MJA's demand assessment for Cairns urban demand. Jacobs concluded that CRC's process was robust and the Cairns Water Supply Strategy was sound, and there was no Cairns urban water supply problem to solve using Nullinga Dam in the timeframes considered in the PBC.

3.5.4 Synergies Economic Consulting Peer Review—Cairns Urban Demand

Building Queensland also engaged Synergies Economic Consulting to peer review the demand assessments. Based on the evidence presented, Synergies Economic Consulting agreed with the conclusion that the construction of Nullinga Dam is not necessary to meet Cairns urban water supply needs over the next 30 years.

3.6 MJA Demand Assessment—Agricultural Demand

Key findings from the MJA demand assessment for agricultural demand are outlined below.

- There are three key agricultural demand drivers in the region:



- Dry conditions and water security – 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, e.g. avocados and bananas, which require high water security and increasing amounts of water, especially as plantings mature
- Industry growth – consultation with industry in the region indicated potential for up to 72,000 ML of additional water demand 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.
- Recent dry conditions mean that current system utilisation exceeds 80 per cent, which is above the water security buffer generally desired by irrigators. Maintaining a percentage of entitlement holdings as a buffer against dry conditions is desirable for crop longevity.
- Strong growth in permanent plantings of high value crops such as avocados and bananas requires more water so demand will continue to grow, albeit off a relatively small base when compared to sugarcane.
- Growth in water use in the region since 2002-03 has averaged less than 1.0 per cent per annum. Two sub-systems have experienced higher growth: Mareeba (3.5 per cent) and South Walsh (2.1 per cent). Recent years have also seen the limits of specific elements of the delivery system being reached, most notably in the East Barron system, for which peak demands now exceed the capacity of the system.
- Future industry growth in the region may be largely driven by MSF Sugar. MSF Sugar, an integrated grower, processor, marketer and exporter of raw sugar, owns and operates the Tableland Mill within the MDWSS area. The Tableland Mill commenced operations in June 1998. It is the newest and most technologically advanced sugar mill in Australia. Since 2012, the Mill has been owned by Thai based Mitr Phol Group, a large global sugar milling company. MSF Sugar is currently milling about 800,000 tonnes of sugar per year at the Tableland Mill (the mill currently has capacity to mill 930,000 tonnes), of which 400,000 tonnes are under a tolling arrangement from Mossman Mill, owned by Mackay Sugar. In addition, MSF Sugar is the largest water holder in the MDWSS with around 16,350ML of water entitlements.
- Based on analysis of historical water demand and feedback from stakeholder consultation four future agricultural water demand scenarios were developed and assessed:
 - Scenario 1 based on historical growth rates at an operational system level: annual growth rates of 3.5 per cent for Mareeba sub-system and 2.1 per cent for South Walsh sub-system 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, equivalent to QTC’s estimate in the QTC Nullinga Dam Report.
 - 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 an estimate for industry expansion of 72,000 ML by 2018, for illustrative purposes.
- These scenarios should be compared with the annual average growth rate of water deliveries to the MDWSS (including losses) between 1981 and 2016 of 3.6 per cent per annum,⁴ and the Far North

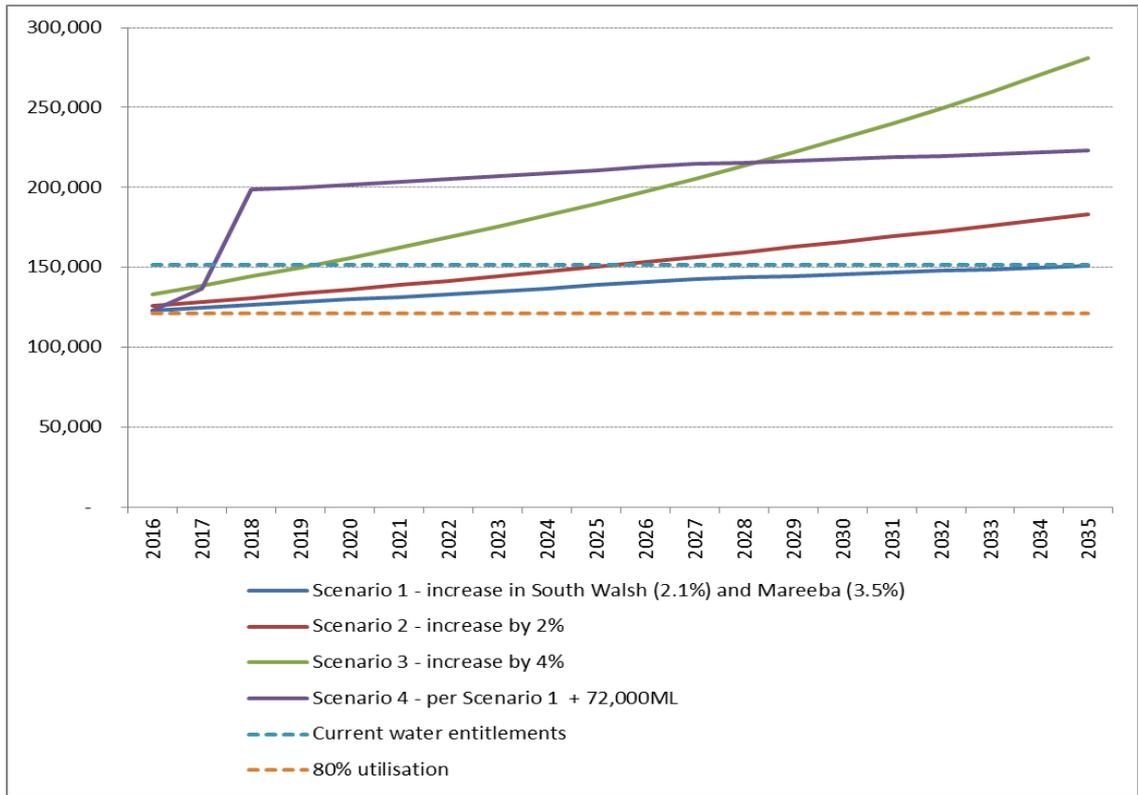
⁴ SunWater annual reports.



Queensland Regional Water Supply Strategy (2010) indication of an average annual growth rate of 1.0 per cent to 2.0 per cent in the MDWSS, up to the limit of existing supplies.

- These scenarios were modelled against the 2012-13 year, just prior to the recent low years of rainfall, to remove the impact of recent dry conditions. Scenario 1 represents the most conservative forecast, scenario 2 a medium forecast, and scenarios 3 and 4 high growth scenarios.

Figure 7 MJA Agricultural Demand Forecast Scenarios



Source: MJA

- Scenario 1 was considered the most likely scenario, in the absence of significant expansion from established industry. Scenario 1 is based on past irrigation demand.
- Based on Scenario 1, there would not be an immediate need for large scale water supply augmentation. However, it would be prudent to undertake small scale water supply augmentation to address irrigators' water security concerns. Where the system is supply constrained it would necessarily constrain future expansion.
- Scenarios 2 and 3 should be interpreted with caution. These scenarios may be driven by the significant uptake in water use in 2015-16 due to prolonged dry conditions. They may also overstate the demand for water longer term.

3.6.1 Building Queensland – Confirmed Demand Assessment

Building Queensland engaged with local government, industry and economic development groups, and large scale commercial irrigators to confirm the demand assessment.



3.6.2 Jacobs Peer Review – Agricultural Demand

Building Queensland engaged Jacobs to peer review MJA’s demand assessment for agricultural demand. Key findings from the Jacob’s peer review are as follows.

- Agricultural demand for new water supplies and willingness to pay has historically been extremely difficult to predict, but while urban supply generally responds to predictable demand based on population growth, the inverse can be true for agricultural water supply where water and land availability drive demand: irrigators cannot expand in schemes that are fully allocated unless a ‘step change’ in supply occurs.
- Generally, irrigators will not allow demand to exceed available supply (due to the risk of losing high-value long life tree crops). Rather, faced with water scarcity (and supply constraints) irrigators will reduce rates of application resulting in constrained agricultural production. Moreover, in dry times and when a scheme reaches capacity, irrigators will forgo future growth via new plantings, rather than risk losing the capital expenditure required to establish new irrigation areas and crops.
- MJA used an incremental approach to assessing agricultural demand, that is, 0.7 to 4 per cent per annum growth. This approach has some limitations and is not considered the most appropriate measure of agricultural demand growth once a system is constrained by supply, which has been the case in MDWSS for the past 2 to 3 years. Agricultural demand is not considered likely to reflect forecast linear growth, particularly when scarcity is experienced. Rather, it will only grow materially if a new supply is developed. The methodology adopted by MJA may therefore understate demand.
- MJA recognised ‘step change’ to an extent in its documentation of potential industrial demand for water allocations, which in the MJA model assumes the following.

Table 6 Marden Jacob Associates Assumptions

SCENARIOS	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Scenario 1	123,148	124,757	126,397	128,068	129,771	131,508	133,278	135,083	136,923	138,800
4 = 1 + Industry growth		12,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Scenario 4	123,148	136,757	198,397	200,068	201,771	203,508	205,278	207,083	208,923	210,800

Source: Marsden Jacobs Associates

- Jacobs cautions against over-reliance on demand Scenarios 1 to 3 (reflecting 0.7 to 4 per cent ongoing annual growth) as they are based on historical incremental growth and may not fully account for recent water scarcity in MDWSS and the way in which irrigators are responding to these supply constraints.
- Jacobs tested the existence of step-change demand with key industry stakeholders in the region at a high-level. Jacobs considers MJA’s Scenario 4 may occur if established industry’s expansion plans do come to fruition, for example, crystallised by a new source of water allocations.

3.6.3 Synergies Economic Consulting Peer Review—Agricultural Demand

Building Queensland engaged Synergies Economic Consulting to peer review the MJA and Jacobs demand assessments. Key findings from the Synergies Economic Consulting peer review are as follows.

- MJA has assembled a reasonable body of evidence to indicate there is no immediate water scarcity in the MDWSS and there is enough supply in the current system to support incremental growth in demand.
- Synergies Economic Consulting agrees with MJA’s conclusion that Scenario 1 represents the most likely scenario for future agricultural demand for water in the region.



- While there is scope for the robustness of the conclusions drawn by MJA to be strengthened by a farm-level financial assessment, the analysis conducted and conclusions drawn by MJA with respect to future demand for irrigation water in the region are considered appropriate for a PBC.
- Based on the available evidence, there is not persuasive evidence of latent demand that supports a step-change in agricultural demand for water on a user pays basis, as proposed by Jacobs. Established industry's expansion plans would represent a quantum change in demand, but the land required for expansion appears to exceed the available limit of suitable land remaining for irrigation in the MDWSS.
- It is not considered appropriate to include established industry expansion in the base case demand forecast, as it remains untested in terms of the strength of the economic case. There has not been sufficient analysis of the viability of expansion of sugar cane production and the economic value of the use of additional volumes of irrigation water for this purpose without more robust evidence.
- Synergies Economic Consulting noted that in the absence of new, major bulk water customers, incremental additions to supply are generally preferable as they are less expensive and have greater scalability, and should be pursued prior to major irreversible supply augmentations being pursued.

3.7 Stakeholder Views

Key stakeholders with expertise and interest in the potential service need include government agencies, local government, industry and regional organisations. This section outlines key observations in relation to stakeholder engagement on the service need.

3.7.1 Cairns Urban Demand

- CRC has developed a Water Security Strategy with both community and technical input which sets out its plan to meet its water security needs for the next 30 years, including consideration of the potential for the proposed Aquis Resort to be developed to its full capacity.
- In the Water Security Strategy, CRC has not prioritised Nullinga Dam or other external water sources, even in their long-term options. Rather, the short and medium term initiatives are focused on CRC owned and operated options.
- CRC's 2016 revised demand forecast indicates that external sources such as Nullinga Dam are not needed by Cairns until the very long term. The revised demand profile for Cairns urban demand (as set out in this Chapter of the PBC) is considered correct.
- If converting MDWSS losses is pursued for agriculture it may remove an option CRC has identified as a possible long-term water supply option. However, this option is strategic planning and not 'as of right' for CRC (in comparison to CRC's current strategic reserve of 4,000 ML in the Barron River).
- In any event, if losses in the MDWSS were converted to allocations, CRC would be in the position of any other buyer in the water market and may seek to purchase converted allocations for urban use.

3.7.2 Agricultural Demand

- There is a regional opportunity for growth in agriculture. There is a perception the existing distribution system is at capacity, or will reach capacity in the near future.
- Water security brings with it certainty for future investment. Increased water supply is directly correlated to confidence to invest (crop expansion and diversification, recreation, tourism, etc.).



- There is a need to provide rigour around the demand projections that will inform sequencing and priorities.
- Water efficiency improvements and water trading are already happening.
- There is a clear stakeholder expectation that options for future water supply should be considered together, as a system.
- There is an acknowledged difference between the east and west areas of the MDWSS, with the east having a larger proportion of higher value crops and sugarcane. This difference also relates to potential price of water, and the equitable management of customers moving to any new scheme.
- Equitable outcomes depend on the cost of water. If the cost of water is too high, additional water supply will not benefit anyone.

3.8 Service Need for the PBC

In consideration of the above analysis, the following service need for the PBC was presented to the Project Steering Committee in February 2017 and endorsed.

There is no Cairns urban water supply service need to be addressed.

CRC has a portfolio of identified water supply measures recognised within existing water resource planning frameworks that could be implemented to meet future demand for at least the next 30 years. It does not have an identified need for water from a regional source (such as Nullinga Dam) until the very long term.

There is an opportunity to expand agricultural production on the Atherton Tableland by increasing the availability of supplemented MP allocations.

In addressing this opportunity, two existing issues should be to be considered:

- Agricultural production and growth is constrained when irrigators exceed their stated scarcity buffer (e.g. 70 to 80 per cent water use as a portion of available allocations) and conserve water to protect longevity of crops at dry times.
- Water cannot be moved to certain areas because of capacity constraints in the MDWSS water distribution system (e.g. East Barron and Arriga areas) and a lack of infrastructure in greenfield areas.

3.9 Benefits Sought

3.9.1 Anticipated Benefits

It is anticipated that addressing the service need may provide the following benefits:

Table 7 Anticipated Benefits from Addressing the Service Need

BENEFIT-RELATED PROJECT OUTCOME	BENEFIT DESCRIPTION	BENEFIT TYPE	BENEFIT UNIT OF MEASURE
Enhanced usage of water delivery infrastructure for agricultural production	Extent to which producers use more of their annual allocation and maximise the utilisation of existing infrastructure	Quantitative Non-Financial	ML of increased use as a portion of nominal entitlements
	Additional Gross Value Product (GVP) of regional agricultural activities (2015 baseline) related to intervention	Quantitative Financial	Dollars (\$)



BENEFIT-RELATED PROJECT OUTCOME	BENEFIT DESCRIPTION	BENEFIT TYPE	BENEFIT UNIT OF MEASURE
Increase in regional employment from enhanced agricultural productivity	Number of direct additional agricultural jobs created	Quantitative Non-Financial	FTEs
Improved use of existing resources through changing water business practices	Extent to which producers use more of their annual allocation and maximise the utilisation of existing water resources	Quantitative Non-Financial	ML of increased use as a portion of nominal entitlements
Change in land use to higher value per hectare crops in suitable areas. Monetised in the CBA	Additional GVP of regional agricultural activities (2015 baseline) related to the intervention	Quantitative Financial	Dollars (\$)
Enhanced confidence to invest in long term business operations and succession opportunities	Level of business confidence within the agricultural sector to make long term investment	Quantitative Financial	Dollars (\$)
Increase in value and flexibility of existing water allocations	Extent to which additional water trading will be undertaken and increase the value of water traded	Quantitative Non-Financial	Volume and dollar value of water traded
Equitable allocation of additional water may add to sense of social cohesion	Extent to which additional water supply adds to the sense of social cohesion	Qualitative	
Reinforce importance of agriculture to the study area (character and identity)	Extent to which additional agricultural production adds to the sense of place and identity	Qualitative	
Positive impacts in relation to community vitality— increase in employment opportunities help to retain/attract people to the area	Amount that implementation adds to the employment and population of the region	Quantitative Non-Financial	Hours
Development of additional community support services and improved community facilities and health	Number of additional community support services developed due to additional short and long term investment	Quantitative Non-Financial	Other Benefit Measure 1
Opportunities for indigenous business development and employment	Number of additional indigenous businesses developed due to additional short and long term investment	Quantitative Non-Financial	Other Benefit Measure 1
Development of new governance and planning support arrangements	Success of implementation of new governance and planning activities	Qualitative	
Opportunities for additional recreation areas	Number of additional recreational activities delivered through new bulk water supply	Quantitative Non-Financial	Hours

3.9.2 Dependencies

There are a number of dependencies in relation to the achievement of these anticipated benefits.

The first key dependency is irrigators responding to any intervention to address the service need, by either:

- changing water use practices
- taking up new water allocations to increase agricultural production (which includes consideration of volume, location, willingness to pay and capacity to pay)
- investing in on-farm infrastructure to service new agricultural production



- changing land use to higher value agriculture.

The second key dependency is the proposed transition of the distribution system of the MDWSS to LMA. If this proceeds, intervention to address the service need will depend upon the proposed approach taken by the MDWSS distribution infrastructure future owners and local irrigators. This response will be essential to produce any of the wider benefits indicated above.

3.9.3 Criticality of Intended Outcomes and Benefits

The anticipated outcomes and benefits are not considered critical to the ongoing functioning of the regional economy or to underpin the future wellbeing of the community in the Atherton Tablelands.

However, community issues including unemployment and an aging population (health and services) may be considered important to address by local governments, Queensland Government and the Australian Government. The Australian Government's NWIDF has stated that regional development is an important objective of the NWIDF.

3.9.4 Conflicts or Opportunities for Collaboration Between Stakeholders

Nullinga Dam has traditionally been proposed as an urban water supply for Cairns and an irrigation water supply for agricultural production on the Atherton Tablelands. Achieving these two water supply needs from one water supply source is complex as it would involve the 'swap' or 'situation' of existing water allocations for new water allocations. The removal from the service need of the provision of water supply to Cairns removes a critical point of potential conflict between CRC and the Tablelands community.

3.9.5 Potential Dis-benefits and Risks to Achieving the Benefits

The Social Impact Evaluation and Environmental Assessment chapters outline the potential low to high areas of dis-benefit for addressing the service need, including impacts on the environment from increased irrigation activity and potential adverse cultural and social impacts.

3.9.6 Potential Initiatives

The potential initiatives that could address the service need are outlined in Chapters 4-6.⁵

3.10 Base Case

The base case is the status quo or business as usual.

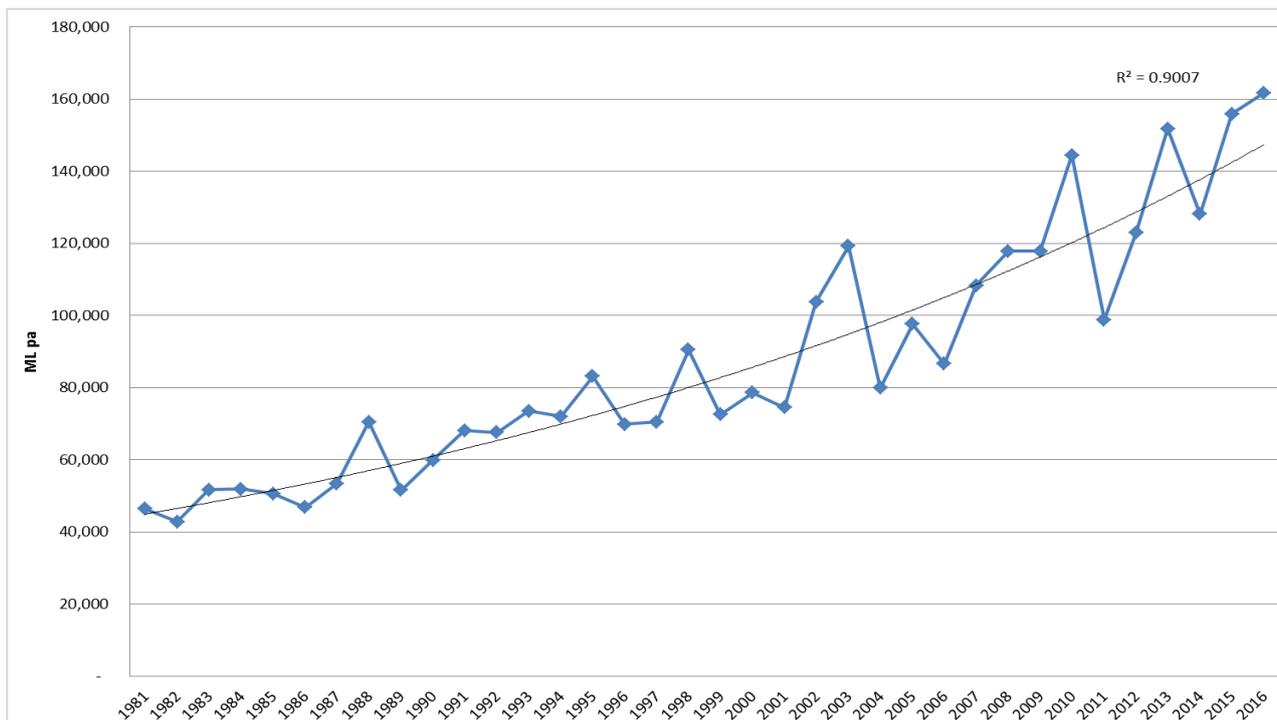
As the service need is an opportunity (rather than a problem), it is considered there is no base case in which any sector will run out of water supply catastrophically. However, when faced with scarcity at dry times, irrigators will reduce application of water on the lowest value crops. Irrigators will also 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.

There has been an upward trend in water deliveries in the MDWSS over time. The water deliveries in the MDWSS between 1981 and 2016 are shown in the figure below and the rate of change since 1990 is shown in the table below. This data shows that for the last 35 years MDWSS deliveries have grown on a geometric average of 3.6 per cent per annum and simple average growth has been 5.1 per cent per annum.

⁵ No Strategic Business Case was prepared prior to the PBC.



Figure 8 Water Deliveries in the MDWSS 1981–2016



Source: SunWater Annual reports; DNRM

Table 8 Rate of Change in MDWSS in Water Deliveries Over Time

WATER YEAR	ACTUAL TINAROO FALLS DAM IRRIGATION DELIVERIES (ML/A)	ACTUAL ANNUAL CHANGE AND SIMPLE AVERAGE (%)	ANNUAL GEOMETRIC AVERAGE (%)
1990	59,851	16.0%	
2000	78,568	8.3%	
2010	144,395	22.5%	
2015	155,887	21.7%	
2016	161,667	3.7%	
Average 1981 to 2016	87,238	5.1%	3.6%
Average of last 14 years	119,649	7.7%	5.3%
Average of last 10 years	130,760	8.3%	6.4%
Average of last 5 years	144,084	11.6%	10.4%
Average of last 2 years	158,777	12.7%	12.3%

Source: SunWater Annual Reports; DNRM

On the basis that water is now fully allocated and demand and water deliveries have levelled out, the economic base case is likely to closely reflect the value of production and employment in 2015-16 going forward. Changes will relate to changes in technology, which may overtime increase labour productivity, marginally reducing jobs in the agricultural sector. This impact on labour may however be countered by increased labour-intensive harvesting, processing and/or packaging, as higher value crops increase on the Tablelands.



Similarly, the base case value of agricultural production from the region may exhibit (modest) increases as higher value crops increasingly replace sugar cane on the most valuable land, subject to water availability. For high value crops, water availability will in part reflect the existing capacity to pay of high-value irrigators, who may be able to identify willing sellers of existing MDWSS allocations if the price is sufficient to entice a sale.

The base case is therefore likely to feature:

- Little or no increase in water deliveries to the extent that capacity has, or is close to being, reached (when available, 2016-17 will assist to establish if this is the case)
- Increased moves by the irrigation sector towards on-farm water efficiency and higher value production (to the extent that high-value producers have not already reached optimal water use - trickle irrigation is widely used on tree crops)
- Water trading at high values towards high value crops on the most fertile soils within the scheme – leading to an expansion of high value horticulture within the region
- Static or potentially modest expansion of sugarcane production by MSF Sugar and other producers resulting from increased yields due to improvements in on-farm water use efficiency. Given the current water constraints, the base case is unlikely to see expansion of sugar cane without a new source/supply of water allocations.

Employment impacts under the base case are somewhat uncertain, depending on crop type and technology in the long term. However, to the extent that gross production values increase, direct and indirect employment may grow at a similar rate.

The base case for environment and social indicators is expected to follow the patterns described in the relevant chapters of the PBC.



CHAPTER 4

OPTIONS GENERATION

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

4	OPTIONS GENERATION.....	2
4.1	Purpose	2
4.2	State Infrastructure Plan	2
4.3	State Infrastructure Plan Analysis	3
4.4	Long List of Options	5

TABLES

Table 1	State Infrastructure Plan Analysis	4
Table 2	Long List of Options	6

FIGURES

Figure 1	State Infrastructure Plan—Options Assessment.....	3
----------	---	---



4 OPTIONS GENERATION

CHAPTER SUMMARY AND CONCLUSIONS

- This chapter outlines the long list of options identified to address the service need.
- The long list of options was generated through consideration of the SIP policy approach and categories for options assessment, analysis of previous assessments, work undertaken for the PBC, and stakeholder consultation. A do minimum (Base Case) option was also included in the analysis.
- The long list of options is:
 - Do minimum*
 - Improve MDWSS rules and operation*
 - Increase in on-farm water efficiency*
 - Improve water trading*
 - Modernise MDWSS distribution infrastructure and convert losses to new water allocations for sale
 - Raise Tinaroo Falls Dam
 - Utilise Quaid Dam/Mitchell Dam and build pipeline
 - Build Nullinga Dam
 - Agricultural use – initially delivery to Walsh River only (no distribution infrastructure)
 - Agricultural use – limited interaction western MDWSS distribution infrastructure
 - Mixed use – Cairns urban and agricultural supply (historical proposed use for Nullinga Dam)
 - Build Nullinga Weir
 - Harvest water from the Johnstone River and build pipeline
- The first four of the long list of options (marked*) will not create any new water allocations.

4.1 Purpose

The purpose of this chapter is to outline the long list of options considered to address the identified service need and how it was generated.

4.2 State Infrastructure Plan

The SIP sets out a framework for options assessment and prioritising future infrastructure projects, as outlined in the figure below.



Figure 1 State Infrastructure Plan—Options Assessment

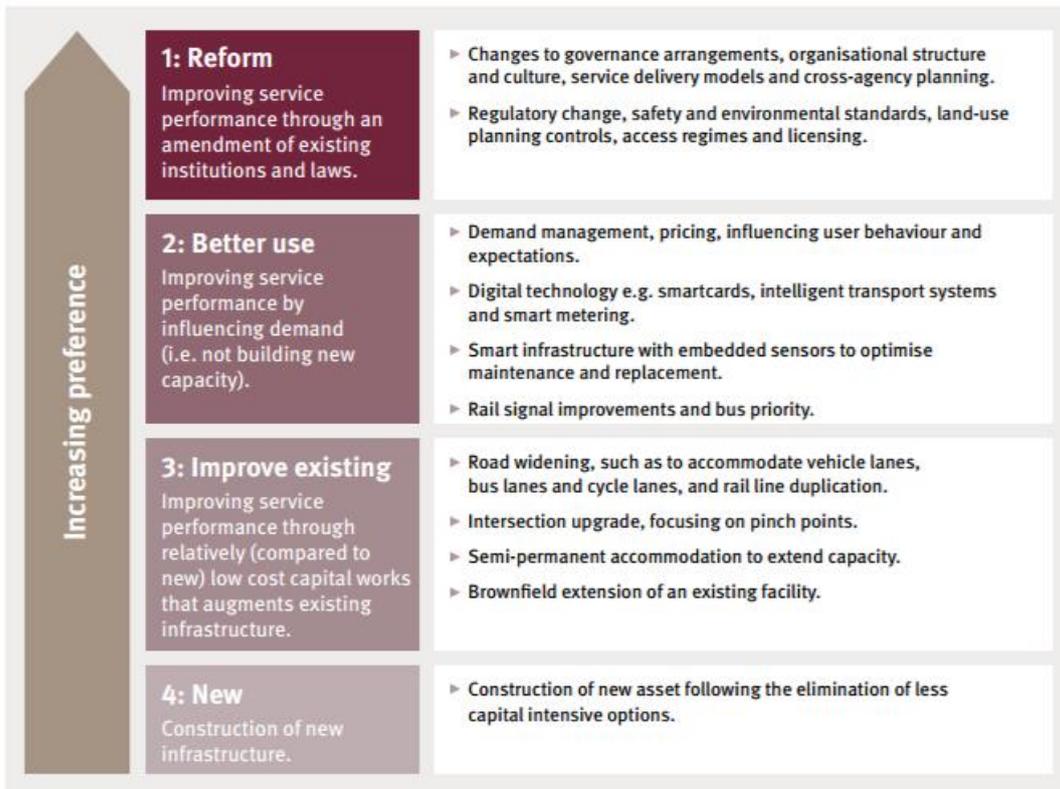


Figure 14: Queensland Government options assessment

The options assessment framework in the SIP recognises there is typically more than one way to solve a problem or address an opportunity, and that in many situations multiple options will be required to achieve the desired outcome. For example, the SIP indicates that a combination of ‘better use’ and ‘improve existing’ may effectively delay the need for new infrastructure, while ‘reform’ in combination with ‘new’ could reduce the cost of new infrastructure.

An additional and important methodological consideration is the inclusion of a do minimum option. This is highly beneficial in the initial option identification process as it can act as a baseline for option assessment and help in needs and option benefit assessment. As such, a do minimum option is described and incorporated in the subsequent options analysis.

4.3 State Infrastructure Plan Analysis

The SIP options categories were used as an initial tool to assist with the development of the long list of options. Using the SIP hierarchy, a range of theoretical water options were considered under each category. The options generated through this process are listed in the table below.



Table 1 State Infrastructure Plan Analysis

OPTIONS	ADDRESS PROBLEM OR REALISE OPPORTUNITY BY	EXAMPLES FOR WATER INFRASTRUCTURE AND PBC
Reform	Amending institutions or laws to improve water service delivery	<ul style="list-style-type: none"> ▪ Change organisational culture (e.g. operational efficiency in SunWater scheme management) ▪ Change governance or organisational structure (e.g. LMA for the MDWSS distribution infrastructure) ▪ Improve water trading institutions (e.g. increase trading transparency and liquidity - Tableland Canegrowers administers a free water trading register for the MDWSS) ▪ Introduce carry-over in MDWSS or raise awareness of carry-over entitlements ▪ Amend programs relating to on-farm efficiency measures
Better use	Change or influence demand and water use practices (without building new capacity)	<ul style="list-style-type: none"> ▪ Improve on-farm water use efficiency (e.g. trickle irrigation, overhead low pressure systems) ▪ Improve water trading (e.g. improve water trading platform and access to trading information) ▪ Introduce demand management programs to change user behaviour (e.g. irrigators placing water orders rather than taking water from the channels without ordering) ▪ Water pricing reform (e.g. reform irrigation prices) ▪ Amend billing frequency
Improve existing	Low cost capex to augment existing capacity (relatively low cost vs new build)	<ul style="list-style-type: none"> ▪ Convert system operational losses from MDWSS ▪ Install variable speed drives at pump stations ▪ Install in-channel control systems and robust cost-effective Supervisory Control and Data Acquisition (SCADA) system or equivalent ▪ Upgrade and automate regulation gates on channels (integrate with SCADA) ▪ New water balancing storages ▪ Channel bank raising
Build new	Build new infrastructure	<ul style="list-style-type: none"> ▪ Build new dam e.g. Nullinga Dam ▪ Build new weirs, if such opportunities exist ▪ Raise other weirs ▪ Raise existing dams (e.g. Tinaroo Falls Dam)



4.4 Long List of Options

Following the SIP analysis, the long list of options was then developed on the basis of the service need, available data, documents and reports and the outcomes of the Stakeholder Reference Group process. This process included listing previously considered options for water supply in the region and variations of previous options (e.g. variations of the Nullinga Dam option), where supported by analysis.

Urban specific or urban only water supply options were not considered for the long list (e.g. urban demand management) as Cairns urban supply was not part of the identified service need. However, for completeness, a mixed use urban/agricultural supply Nullinga Dam option was included in the long list as the mixed-use dam has been the traditional historical proposed use for Nullinga Dam.

The Stakeholder Reference Group also requested the following options be included in the long list of options: raising Tinaroo Falls Dam, utilisation of Quaid/Mitchell Dam, and flood harvesting the Johnstone River and building a pipeline to the Atherton Tablelands.

New options were also included in the long list from work undertaken for the PBC. These options included variations on the Nullinga Dam proposal that excluded urban water supply for CRC and included a focus on agricultural expansion in the Atherton Tablelands.

In developing the long list of options for the Nullinga Dam option, consideration was given to previous assessments of the proposed dam by SunWater which provided for small, medium and large sizes. A decision was made to not take forward three different sizes of dam in the long list on the basis that if Nullinga Dam was a preferred option at the end of the PBC, the size of the dam should be sized to match the volume of credible demand for water from the dam, rather than an arbitrary 'pre-determined' yield.

The long list of options to address the service need is outlined in the table below, grouped under the SIP categories.



Table 2 Long List of Options

OPTION	DESCRIPTION	KEY STAKEHOLDERS	TIMEFRAME	SCALABILITY
DO MINIMUM (BASE CASE)				
Do minimum	Continue with status quo/business as usual	<ul style="list-style-type: none"> ▪ DNRM ▪ SunWater ▪ MDWSS irrigators 	N/A	N/A
REFORM				
Improve MDWSS rules and operation	Review the ROP and ROL with the aim to create new rules and operation procedures to assist in change of irrigators water use patterns (e.g. reform carry over provisions, educate peak flow entitlement and introduce peak flow trading)	<ul style="list-style-type: none"> ▪ DNRM ▪ SunWater ▪ MDWSS irrigators 	Short	High
Increase on-farm water efficiency	Increase irrigators' use of on-farm water use efficiency methods (e.g. promote uptake of irrigation methods on-farm that achieve same or greater crop yield with less water use/losses)	<ul style="list-style-type: none"> ▪ DNRM ▪ DAF ▪ SunWater ▪ MDWSS irrigators 	Medium	High
BETTER USE / IMPROVE EXISTING				
Improve water trading	Remove impediments in current systems to facilitate increased water trading (e.g. introduce real time trading information)	<ul style="list-style-type: none"> ▪ DNRM ▪ SunWater ▪ MDWSS irrigators 	Short	Low
Modernise MDWSS distribution infrastructure and convert losses to new water allocations for sale	Modernise the MDWSS infrastructure and convert distribution losses to new tradeable medium priority water allocations for sale to the market (e.g. improve bulk water meters, build additional balancing storages, pressurise open pipe, install channel monitoring/SCADA, construct channel flow regulating structures and install variable speed drives, where appropriate)	<ul style="list-style-type: none"> ▪ DEWS ▪ DNRM ▪ SunWater ▪ MDWSS irrigators ▪ Affected landholders 	Medium	Medium



OPTION	DESCRIPTION	KEY STAKEHOLDERS	TIMEFRAME	SCALABILITY
Raise Tinaroo Falls Dam	Raise Tinaroo Falls Dam and create new water allocations within the MDWSS for sale from the increased storage area and yield	<ul style="list-style-type: none"> ▪ DEWS ▪ DNRM ▪ SunWater ▪ MDWSS irrigators ▪ Affected landholders ▪ Tablelands Regional Council ▪ Recreational users 	Long	Medium
Utilise Quaid Dam/Mitchell Dam and build pipeline	Utilise Quaid Dam/Mitchell Dam (an existing private, shallow dam) and build a pipeline to the Atherton Tableland for agricultural water supply	<ul style="list-style-type: none"> ▪ Mitchell Dam owner (private) ▪ SunWater ▪ MDWSS irrigators ▪ Mareeba Shire Council 	Long	Low
BUILD NEW				
Build Nullinga Dam for agricultural use – initially for delivery to Walsh River only (no distribution infrastructure)	Build Nullinga Dam for delivery to Walsh River customers – initially no distribution infrastructure, but flexibility to connect in the future. Water deliveries would be made to river bank and other customers of the MDWSS, and further downstream	<ul style="list-style-type: none"> ▪ SunWater ▪ MDWSS irrigators ▪ Entrants in new irrigation scheme ▪ Mareeba Shire Council ▪ Tablelands community 	Long	High
Build Nullinga Dam for agricultural use—limited interaction with western MDWSS distribution infrastructure	Build Nullinga Dam for Walsh River deliveries and distribution to western MDWSS customers (limited interaction with MDWSS including capex for distribution infrastructure)	<ul style="list-style-type: none"> ▪ SunWater ▪ MDWSS irrigators ▪ Entrants in new irrigation scheme ▪ Mareeba Shire Council ▪ Tablelands community 	Long	Medium



OPTION	DESCRIPTION	KEY STAKEHOLDERS	TIMEFRAME	SCALABILITY
Build Nullinga Dam for mixed use—Cairns urban and agricultural supply	Build mixed use Nullinga Dam for Cairns supply urban/agriculture to the MDWSS (allocation swap/substitution of Tinaroo Falls Dam and MDWSS allocations to Cairns Regional Council and provision of new water supply and allocations from Nullinga Dam to the western zones of the MDWSS)	<ul style="list-style-type: none"> ▪ SunWater ▪ MDWSS irrigators ▪ MDWSS water entitlement holders ▪ Mareeba Shire Council ▪ Tablelands community ▪ Cairns Regional Council ▪ Cairns Regional Council residents 	Long	Medium
Build Nullinga Weir for agricultural use	Build a Nullinga Weir (if possible) for agricultural water supply	<ul style="list-style-type: none"> ▪ SunWater ▪ MDWSS irrigators ▪ MDWSS water entitlement holders ▪ Mareeba Shire Council ▪ Tablelands community 	Long	Low
Harvest water from the Johnstone River and build pipeline	Extract water from Johnstone River and build pipeline to the Atherton Tableland region for agricultural water supply	<ul style="list-style-type: none"> ▪ Tablelands Regional Council ▪ Mareeba Shire Council ▪ MDWSS irrigators ▪ Existing MDWSS water entitlement holders ▪ Tablelands community 	Very long	Low



CHAPTER 5

OPTIONS FILTER

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

5	OPTIONS FILTER	2
5.1	Purpose	2
5.2	Method and Activities	2
5.3	Selection Criteria	2
5.4	Option Scoring	3
5.5	Results	3
5.6	Filtering Options—Summary of Key Reasons	5
5.7	Verification and Refinement of Options Filtering	10

TABLES

Table 1	Selection Criteria.....	2
Table 2	Results with Weighted Criteria	4
Table 3	Results with Unweighted Criteria	4



5 OPTIONS FILTER

CHAPTER SUMMARY AND CONCLUSIONS

- This chapter describes the methodology and outcomes of the filtering process used to move from the long list of options to the short list of options.
- The long list of options was filtered against criteria encompassing strategic, legal and regulatory, market, public interest and sustainability considerations, in accordance with the Building Queensland Business Case Development Framework. Direct service need specific considerations such as direct agricultural benefit were also used in the analysis.
- Outcomes were tested against weighted and non-weighted criteria for sensitivity analysis.
- The three highest scoring options were:
 - Improve MDWSS rules and operation
 - Modernise MDWSS infrastructure and convert losses
 - Build Nullinga Dam for agricultural use.
- The highest scoring options were verified and refined through consultation with SunWater, government agencies and commercial irrigators in the region.
- A combination of the next highest scoring options of water trading and on-farm water efficiency measures were included as an additional do minimum option.

5.1 Purpose

The purpose of this section is to explain the options filtering process and summarise how the recommended short list of options was determined.

5.2 Method and Activities

Due to the large and diverse range of long list of options, a filtering process was undertaken to develop a shortlist of options for further consideration in the PBC. This process involved the development of a list of criteria to be applied to the long list of options, in consideration of the Building Queensland Business Case Development Framework requirements and specific service need circumstances. The long list of options was then assessed against these criteria to determine a shortlist of options.

5.3 Selection Criteria

The high-level options filtering selection criteria applied to the long list of options is listed in Table 1.

Table 1 Selection Criteria

SELECTION CRITERIA	
BUSINESS CASE DEVELOPMENT FRAMEWORK CRITERIA	
Strategic Considerations	<ul style="list-style-type: none"> ▪ Strategic alignment of option with government policy ▪ Ability of option to address service need ▪ Policy issues or limitations affecting the option



SELECTION CRITERIA	
Legal and Regulatory Considerations	<ul style="list-style-type: none"> Legislative and regulatory considerations with option Approval requirements for option
Market Considerations	<ul style="list-style-type: none"> Feedback/demand from potential water customers on option Affordability of option for irrigators in the region
Public Interest Considerations	<ul style="list-style-type: none"> Stakeholder engagement—support of government agencies for option Stakeholder engagement—support of/impact on water customers of option Impact on community—avoidance of direct social impacts from option
Sustainability Considerations	<ul style="list-style-type: none"> Future proofing of option Avoidance of direct negative environmental impacts from option Operational flexibility of option
SERVICE NEED SPECIFIC CRITERIA	
Direct agricultural benefit	<ul style="list-style-type: none"> Ability of the option to increase value of agricultural production in dollars per ML
Employment growth	<ul style="list-style-type: none"> Number of jobs able to be created from option
Affordable capex	<ul style="list-style-type: none"> Consideration of size of initial investment of option in dollars per ML

5.4 Option Scoring

To assist with the shortlisting process a qualitative numerical method was developed. Scores were ranked from one to five with higher scores being desirable and low scores indicating potential non-feasibility depending on the criteria.

Scores were defined as:

- Score = 1 is a ‘Cannot proceed’, for example, if an option is not possible technically or does not meet the identified service need
- Score = 2 is technically possible but is a weak qualitative performer
- Score = 3 is neutral/medium qualitative performance
- Score = 4 is a strong qualitative performance
- Score = 5 is exceptional qualitative performance.

5.5 Results

The following tables reproduce the scores for each option with and without weightings. A higher weighting was initially given to key criteria in Table 1 results. A sensitivity analysis was then performed with no weightings in the Table 2 results.

Weighting scores and applying equal weighting to all criteria did not change the scores materially, and all scenarios resulted in the same three highest scoring options. It is considered this demonstrates a robust filtering process, as it avoids achieving a result via application of judgement-based weightings.



Table 2 Results with Weighted Criteria

LONG LIST OF OPTIONS	WEIGHTED TOTAL
Improve MDWSS rules and operation	3.57
Modernise MDWSS and convert losses to new water allocations for sale	3.50
Build Nullinga Dam for agricultural use - initially delivery to Walsh River only (no distribution infrastructure)	3.21
Increase on farm water use efficiency	2.76
Build Nullinga Dam for agricultural use - limited interaction with western MDWSS distribution infrastructure	2.70
Improve water trading	2.26
Do nothing	2.25
Build Nullinga Weir for agricultural use	2.02
Build Nullinga Dam for mixed use - Cairns urban and agricultural water supply	1.88
Harvest water from the Johnstone River and build pipeline	1.39
Raise Tinaroo Falls Dam	1.32

Table 3 Results with Unweighted Criteria

LONG LIST OF OPTIONS	UNWEIGHTED TOTAL
Improve MDWSS rules and operation	3.53
Modernise MDWSS distribution infrastructure and convert losses to new water allocations for sale	3.47
Build Nullinga Dam for agricultural use – initially delivery to Walsh River only (no distribution infrastructure)	3.20
Increase on farm water use efficiency	2.80
Build Nullinga Dam for agricultural use - limited interaction with western MDWSS	2.73
Improve water trading	2.27
Do nothing	2.25
Build Nullinga Weir for agricultural use	2.00
Build Nullinga Dam for mixed use - Cairns urban and agricultural water supply	1.93
Harvest water from the Johnstone River and build pipeline	1.40
Raise Tinaroo Falls Dam	1.33



5.6 Filtering Options—Summary of Key Reasons

5.6.1 Do Nothing Option

OPTION	SHORTLIST	REASONS	STRENGTHS	WEAKNESSES
Do nothing	No	<ul style="list-style-type: none">▪ Status quo▪ Does not meet service need	<ul style="list-style-type: none">▪ Requires no additional government investment	<ul style="list-style-type: none">▪ Does not create new water allocations▪ Does not increase agricultural production



5.6.2 Reform Options

OPTION	SHORTLIST	REASONS	STRENGTHS	WEAKNESSES
Improve MDWSS rules and operation	Yes – Option 2	<ul style="list-style-type: none"> ▪ Crop types have changed towards tree crops and horticulture and water use patterns have changed over the past 5–10 years (opportunity to update rules) ▪ Water ordering is not consistent across MDWSS creating inefficiencies ▪ Carryover provisions exist but could be modified to increase irrigator confidence (and potentially reduce 70-85 per cent buffer—increasing utilisation to 95%+) ▪ Reform examples in other water supply schemes have produced significant benefits (e.g. Nogoia Mackenzie WSS utilises 90–100% each year) 	<ul style="list-style-type: none"> ▪ Meets service need ▪ Cost effective use of existing infrastructure ▪ Makes better use of existing resources ▪ Strong stakeholder support 	<ul style="list-style-type: none"> ▪ Does not create new water allocations ▪ Requires review of regulatory framework ▪ Requires water users to change behaviour ▪ Potential implications for ongoing management should MDWSS transition to LMA



NULLINGA DAM AND OTHER OPTIONS PRELIMINARY BUSINESS CASE

OPTION	SHORTLIST	REASONS	STRENGTHS	WEAKNESSES
Increase on-farm water use efficiency	Yes – Option 1	<ul style="list-style-type: none"> Would deliver minimal additional water and will not alleviate water scarcity materially Already addressed via other government programs and separate (past) funding Per ML can be less cost-effective than other options Not an option that necessarily requires further government investment/intervention (i.e. market drivers are such that it is occurring at present in the irrigation sector to a great extent with the switch from flood to overhead irrigation or trickle irrigation) 	<ul style="list-style-type: none"> Well understood process Implemented by agriculturalists May not require additional government investment (depending on approach) 	<ul style="list-style-type: none"> Majority of cost effective gains already implemented Does not create new water allocations

5.6.3 Better Use/Improve Existing Options

OPTION	SHORTLIST	REASONS	STRENGTHS	WEAKNESSES
Modernise MDWSS distribution infrastructure and convert losses to new water allocations for sale	Yes – Option 3	<ul style="list-style-type: none"> Strong stakeholder support from all sectors if done correctly (without undermining current entitlements) Should be considered before a new large infrastructure (e.g. dam) is constructed, as lower cost option to address current water scarcity and meet the service need 	<ul style="list-style-type: none"> Effective use of existing resources Creates new water allocations Strong stakeholder support 	<ul style="list-style-type: none"> Requires capital investment Potential implications for delivery and recovery of capital costs should MDWSS transition to LMA
Improve water trading	Yes – Option 1	<ul style="list-style-type: none"> Water trading market is currently operating effectively Would not be able to provide long term additional water security for region 	<ul style="list-style-type: none"> Shifts water to highest and best use May not require additional government investment (depending on approach) 	<ul style="list-style-type: none"> Does not create new water allocations Does not readily meet service need
Utilise Mitchell Dam/Quaid Dam and build pipeline	No	<ul style="list-style-type: none"> Shallow and inefficient dam with limited ability to meet the service need Private ownership/governance issues 	<ul style="list-style-type: none"> Makes use of existing infrastructure 	<ul style="list-style-type: none"> Unlikely to meet service need Private infrastructure issues



NULLINGA DAM AND OTHER OPTIONS PRELIMINARY BUSINESS CASE

5.6.4 Build New Options

BUILD NEW	SHORTLIST	REASONS	ADVANTAGES	DISADVANTAGES
Build Nullinga Dam for agricultural use – initially delivery to Walsh River only (no distribution infrastructure)	Yes – Option 4	<ul style="list-style-type: none"> ▪ Simpler implementation process to meet service need compared with other Nullinga Dam options ▪ Avoids Cairns allocation swap/substitution ▪ Avoids issues with water quality and reliability in Nullinga Dam entering MDWSS system (initially) ▪ Avoids mixing different water prices for water in one scheme by creating two schemes ▪ Opportunity to develop new large greenfield area of new irrigation 	<ul style="list-style-type: none"> ▪ Meets service need ▪ Creates new water allocations ▪ Supports continued functioning of existing MDWSS irrigation area 	<ul style="list-style-type: none"> ▪ High capital cost ▪ Long approvals process ▪ Uncertainty over agricultural demand profile and capacity to pay
Build Nullinga Dam for agricultural use - limited interaction with western MDWSS distribution infrastructure	No	<ul style="list-style-type: none"> ▪ More complex (initially) and costly than other Nullinga Dam agricultural options ▪ Cost of distribution infrastructure cannot be determined until the location of demand in the MDWSS is known and understood ▪ Issues with water quality and reliability from Nullinga Dam for existing MDWSS users ▪ Issues mixing different water prices within the one scheme 	<ul style="list-style-type: none"> ▪ Meets service need ▪ Creates new water allocations ▪ Supplies additional water to existing scheme 	<ul style="list-style-type: none"> ▪ High capital cost ▪ Long approvals process ▪ Uncertainty over agricultural demand profile and capacity to pay ▪ More complex than other agricultural options
Build Nullinga Dam for mixed use - Cairns urban and agricultural water supply	No	<ul style="list-style-type: none"> ▪ Most complex and costly Nullinga Dam option to implement - additional complexity and cost not necessary to meet identified service need ▪ Issues with Cairns allocation swap/substitution ▪ Issues with water quality and reliability from Nullinga Dam for existing MDWSS users ▪ Issues mixing different water prices within the one scheme 	<ul style="list-style-type: none"> ▪ Meets service need ▪ Creates new water allocations ▪ Supplies additional water to existing scheme ▪ Supplies additional water to Cairns urban customers 	<ul style="list-style-type: none"> ▪ High capital cost ▪ Long approvals process ▪ Demand from Cairns not apparent ▪ Uncertainty over agricultural demand profile and capacity to pay ▪ Highly complex
Build Nullinga Weir for agricultural use	No	<ul style="list-style-type: none"> ▪ Likely very small yield (e.g. 1,000-2,000 ML) ▪ Limited ability to meet service need ▪ Very high capex (\$/ML) 	<ul style="list-style-type: none"> ▪ Creates new water allocations 	<ul style="list-style-type: none"> ▪ High capital cost ▪ Low yield ▪ Unlikely to meet service need



NULLINGA DAM AND OTHER OPTIONS PRELIMINARY BUSINESS CASE

BUILD NEW	SHORTLIST	REASONS	ADVANTAGES	DISADVANTAGES
Raise Tinaroo Falls Dam	No	<ul style="list-style-type: none">▪ Very high capex to raise dam▪ Potential for inundation of existing developed areas - stakeholders living in areas near Yungaburra and Atherton unlikely to support this option▪ Unlikely to be supported by the Tablelands Regional Council	<ul style="list-style-type: none">▪ Makes use of water supply from existing infrastructure▪ Creates new water allocations	<ul style="list-style-type: none">▪ Very high capital cost▪ Long approvals process▪ Uncertainty over agricultural demand profile and capacity to pay▪ High community impact▪ Low stakeholder support
Extract water from Johnstone River and build pipeline	No	<ul style="list-style-type: none">▪ Likely to have approval issues▪ Significantly high costs due to pipeline (capex and opex)▪ Not considered to be a practical option by government department stakeholders due to its potential environmental impacts on the Johnstone River environmental flows	<ul style="list-style-type: none">▪ Accesses new water supply for region▪ Likely to meet service need	<ul style="list-style-type: none">▪ High capital cost▪ Long approvals process▪ Environmental impacts▪ Uncertainty over agricultural demand profile and capacity to pay



5.7 Verification and Refinement of Options Filtering

The options filtering results were discussed with key stakeholder government agencies in Brisbane and in the Tablelands region, and with irrigators and their representatives. This consultation included discussion of the long list of options, the four options presented in the MJA report and the draft shortlisted options.

There was moderate to strong support from stakeholders for the emerging three highest scoring options.



CHAPTER 6

OPTIONS SHORTLIST

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

6	OPTIONS SHORTLIST.....	2
6.1	Purpose	3
6.2	Stakeholder Consultation on Shortlisted Options	3
6.3	Option 1: Do Minimum (Base Case)	3
6.4	Option 2: Improve MDWSS Rules and Operation	4
6.5	Option 3: Modernise MDWSS and Convert Losses	5
6.6	Option 4: Nullinga Dam for Agricultural Use	7

TABLES

Table 1	Hydrological Assessments of Proposed Nullinga Dam Yield.....	9
---------	--	---

FIGURES

Figure 1	Tinaroo Falls Dam and the Proposed Nullinga Dam	10
----------	---	----



6 OPTIONS SHORTLIST

CHAPTER SUMMARY AND CONCLUSIONS

Option 1: Do minimum (base case)

- As the service need is an opportunity (and not a problem), there is a threshold question of whether there is government appetite to address the opportunity.
- The majority of irrigators in the MDWSS have adopted on-farm efficiency measures and will continue to do so where it creates efficiencies for their businesses operations. The MDWSS is moving towards an efficient market of water, with temporary and permanent trading of water promoting 'highest and best usage'.
- Option 1 is therefore a viable option in its own right in the event that the service need is not considered to be a priority by government at this time.

Option 2: Improve MDWSS rules and operations

- The aim of Option 2 is to review the MDWSS operating rules to increase operational performance of the scheme and reduce current constraints. Key potential opportunities for improvement include consideration of changing the water year, carryover provisions, water ordering, education and potential trading of peak flow entitlements (ML per day) and revising Transmission and Operation Allowances (TOA).
- The success of Option 2 will depend upon a range of factors, including modelling of the rule changes showing an increase in water availability, appetite of government for reform, a change in behaviour by irrigators in response to any improvements made and LMA considerations.

Option 3: Modernise MDWSS and convert losses

- The aim of Option 3 is to conduct a targeted modernisation of the MDWSS distribution infrastructure to increase the amount of water allocations available in the MDWSS. This option is estimated to result in conversion of up to 15,000 ML current distribution loss allocations to new tradeable medium priority water allocations for sale.
- The success of Option 3 will be dependent upon a number of factors, including the costs of works, the ability to convert a suitable yield of loss allocations, irrigators taking up the new allocations and increasing agricultural production, limiting negative impacts on the existing scheme and the level of agricultural production from owners of existing allocations and LMA considerations.

Option 4: Nullinga Dam for agricultural use

- The aim of Option 4 is to develop a new bulk water source for the major expansion of irrigated agriculture in the region. The scope of this option 4 is to design and build a primarily medium priority Nullinga Dam, initially for delivery of water to Walsh River irrigators within and potentially downstream of the MDWSS area, but with the flexibility for commercial (private) distribution solutions to evolve. A "river delivery, bulk only" Nullinga Dam simplifies design, costing, water pricing, stakeholder engagement, water planning and scheme operation.
- No distribution infrastructure for delivery to the MDWSS is included in Option 4. Future connection into the MDWSS would be subject to the result of a process that identifies clear cost effective opportunities for new or augmented distribution infrastructure.



- The success of Option 4 will be dependent on the realisation of a credible demand and economic profile for new agricultural production along the Walsh River, affordability of the option for government and irrigators, the ability to secure approvals to progress the option to construction (including amendments to the Barron Water Plan), deliverability of the option, the take up of new water allocations and increasing agricultural production.

6.1 Purpose

The purpose of this chapter is to describe the shortlisted options. The descriptions underpin the subsequent analysis in the PBC.

6.2 Stakeholder Consultation on Shortlisted Options

Following the options filtering process and determination of a proposed shortlist of options, key regional stakeholders were consulted to further refine the description of the shortlisted options including:

- SunWater officers in Mareeba
- Large irrigators within the MDWSS
- DNRM officers in Mareeba
- DAF officers in Townsville.

6.3 Option 1: Do Minimum (Base Case)

The options filtering process determined a short list of three options for further analysis in the PBC. However, as the service need is an opportunity (and not a problem), there is a threshold question of whether there is government appetite to address the opportunity.

In the MDWSS, there are a high number of SunWater's customers with small holdings. Over 60 per cent of SunWater's customers have less than 50 ML of water entitlements with 41 per cent holding less than 10 ML.

The analysis of the service need and options filtering process included the following conclusions:

- The majority of irrigators in the MDWSS have adopted on-farm efficiency measures 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. For example, for the 2015 harvest season, for farms contracted to the Mossman Mill, over 65 per cent of irrigators have converted their irrigation from flood or furrow to overhead low pressure and only 23 per cent of irrigators are using surface furrow irrigation. Improvements in water efficiency can 'free up' water allocations to support additional production.
- The current operation of the MDWSS is moving towards an efficient market of water, with temporary and permanent trading of water promoting 'highest and best usage' – consistent with government water policy. Permanent trades of water entitlements that are currently not used facilitate industry growth and can activate sleepers (a water entitlement holder who uses none of its allocation over the course of the water year) and dozers (a water entitlement holder that uses very little of its announced allocation over the course of the water year).
- The recent dry conditions have increased water trading activity to address scarcity.

This indicates the do minimum option is a viable option to be pursued as it provides for incremental expansion of agricultural production on the Atherton Tableland via existing mechanisms. If this decision is



made, the analysis of the shortlisted options in the following chapters of the PBC will not be material to any decision in the consideration of the PBC.

However, other options if progressed would provide for additional water availability and have a greater capacity to meet the identified service need. Increased water trading does not increase the existing level of water supply. Instead, it allows greater utilisation of the existing water supply and a number of stakeholders have expressed concern that this could erode the reliability of all water allocation holders, particularly in dry periods. It therefore would not be able to provide long term additional water security for the region.

The ability to improve water efficiency is also principally limited to sugarcane producers because higher value crops are already using spray or trickle systems as the principal irrigation system. Consultation undertaken by MJA indicated that of the 23 per cent of sugarcane producers on surface furrow, a significant proportion would not change to overhead low pressure systems because their soil types were not suitable. Irrigators also commented that changing to subsurface drip can deliver additional water use efficiency savings and improve yield, but at very high costs. There can also be other problems that emerge with subsurface drip, for instance blockages can be hard to locate and fix, and vermin can eat into the pipes. Blockages are understood to present a key challenge with sugarcane because of its fascicule root system, composed of thin roots, which grow and penetrate into the drip systems. Additionally, the change from surface furrow irrigation to pressured irrigation systems does not simply involve the installation of a new system. The new system needs to be carefully designed and specified so that the application rate aligns with soil types (particularly the soil moisture capacity) and new irrigation schedules need to be developed. Also, they are expensive to purchase and install and the expense is typically borne by the producer. There therefore appears limited opportunity to free up water allocations through on-farm water efficiency investment.

A do minimum option does not address expectations in the region in relation to the proposed Nullinga Dam.

6.4 Option 2: Improve MDWSS Rules and Operation

State Infrastructure Plan category: Reform

Option 2 seeks to improve the water supply scheme operating rules (e.g. Resource Operations Plan (ROP) and Resource Operations Licence (ROL)) and operation to increase performance of scheme and reduce current non-physical constraints.

The key aspect of Option 2 is to review the rules and operation of the MDWSS against the changed cropping and water use practices of the modern scheme. Potential opportunities to improve the MDWSS rules and operation include:

1. *Reviewing the water year* to match the current demand patterns within the existing crop mix in the region to better reflect higher announced allocations at the start of the water year. There is currently a real resistance of water users within the MDWSS not to use above 70 to 80 per cent of their individual allocations to ensure water is available for the following water year. With the current water year commencing on 1 July, the scheme starts most years below 100 per cent for medium priority water allocations but sees that lift to 100 per cent over the course of the water year.
2. *Carryover entitlements* exist within MDWSS, but only when Tinaroo Falls Dam is at 75 to 100 per cent capacity. The ability to draw carryover water also only endures for the first six months of the new water year. Not every customer accesses their carryover entitlement. With a change in use of water to more permanent crop types (avocado, banana, etc.) individual water users are reducing water use to make more water available into the future, only to see the water they saved being spread across all water users in the scheme at the commencement of the new water year.



3. *Water ordering* is currently an area of underperformance for the MDWSS. It is estimated that only 40 per cent of customers by number order water in the MDWSS, and only approximately 50 per cent of water by volume is ordered in the MDWSS. This means that 60 per cent of customers do not order water and half the volume of water is not ordered. This results in operational inefficiencies and exacerbates distribution losses.
4. *Peak flow entitlement* exists in the MDWSS and is referred to as Design Flow Rate Entitlement (DFRE). Not all DFREs (i.e. an individual property's peak flow entitlements) have been documented by SunWater and not all irrigators are aware of their specific entitlement in ML per day. As the scheme has developed to maximum use, the need for the DFRE to be better understood by customers has intensified. It is important to ensure the DFRE's are defined across the scheme to allow for continued changes in use. SunWater has commenced this process and it is recommended that it continue.
5. *Seasonal trading* of a portion of the distribution losses allocation would allow unused water to go to productive use. This is to allow the market to determine the highest productive use of this unused water rather than it staying within Tinaroo Falls Dam and being part of the next water year's allocation.
6. *Transmission and Operation Allowance (TOA)* is a volume of water set aside in Tinaroo Falls Dam as part of the Announced Allocation formula for the river transmission losses. This volume is a large percentage of volume of the water allocation to be delivered within the river and could be reviewed to confirm the actual requirement.

It is considered that improvements in water ordering, peak flow trading and carryover use and operations rules would increase water use within the MDWSS without undermining the current supply or reliability of supply.

The success of Option 2 is considered to depend upon a number of factors, including:

- modelling showing the implementation or rule and operational changes will make a difference to water availability
- ability of government/SunWater to implement improvements/reforms to scheme rules and operation
- change in water use practices by irrigators in response to the improvements, and associated increase in agricultural production
- local management considerations – a change in management may affect the management of the scheme operation.

6.5 Option 3: Modernise MDWSS and Convert Losses

State Infrastructure Plan category: Better use/improve existing

The aim of Option 3 is to increase the amount of medium priority water allocations available in the MDWSS for irrigators to increase yields and expand agricultural production. It aims to achieve this at a cost per ML that is cost effective when compared to other options, including major capex options such as Nullinga Dam.

SunWater currently has about 45,000 ML in water allocations for managing transmission losses in the delivery system, comprising 8,000 ML of high priority and 37,000 ML of medium priority entitlements.

There are four main ways that water can be 'lost' in a water delivery system:

- evaporation (water lost to the atmosphere)
- seepage (the movement of water through the beds of irrigation channels)



- leakage (e.g. water lost through channel banks, structures and end of system flows)
- operational losses (e.g. theft, outfalls, unmetered diversions and inaccurate metering).

It is estimated that currently the MDWSS is operating at around 70 to 80 per cent water conveyance efficiency. Elsewhere in Australia where delivery system upgrades have been implemented, it has been possible to lift water conveyance efficiency up to 90 per cent.¹

The key elements of Option 3 are:

1. Undertake engineering and feasibility studies in relation to modernisation of parts of the MDWSS distribution system via a range of infrastructure improvements. This would include obtaining support from DNRM for the proposed loss conversions.

On the basis of preliminary assessments, SunWater has identified 11 potential sub-projects of modernisation works, as follows:

- a. Arriga Main Channel and A02: Construction of 6.5 kilometres pressurised pipeline system to replace open, earth channel and open pipeline.
- b. Mareeba Main Channel: 10 kilometres pressurised pipeline system to replace open, earth channel.
- c. 'M9': Construction of 10 kilometres pressurised pipeline system to replace open, earth channel.
- d. 'EB4': Construction of 4.5 kilometres pressurised pipeline system to replace open, earth channel.
- e. Southedge: Stand-alone earthworks construction of 200 ML balance storage and installation of 25 automated control gates within main delivery channels.
- f. South Walsh: In-channel and stand-alone earthworks construction of additional 100 ML balancing storage and installation of 40 automated control gates within main channels.
- g. Atherton Creek: Installation of 20 automated control gates within main delivery channels.
- h. East Barron: In-channel earthworks construction of additional 20 ML of balancing storage and construction of 13 kilometres of pressurised pipe.
- i. Biboohra Main Channel downstream of storage: Installation of 5 automated control gates.
- j. Biboohra Main Channel upstream of storage: Conversion of 4.5km of open, earth channel and open pipeline to pressurised pipe.
- k. North Walsh: In-channel earthworks construction of additional 5 ML of balancing storage.

There is also a potential for returning water to customers from the end of pipes/channels and potential use of variable speed drives, if appropriate, where water is pumped.

SunWater has estimated the amount of loss allocations able to be saved could be 8,000 to 15,000 ML, depending on the works conducted.

2. Implement infrastructure improvements and apply to DNRM to convert current distribution loss allocations to new tradeable medium priority water allocations created by the loss savings from

¹ Advice from MJA.



infrastructure improvements. The volume would be determined as part of any further detailed investigation and could be done in stages.

3. Sell the new medium priority water allocations on the market.

In its irrigation pricing report the QCA (2012) found that MDWSS may not have excessive distribution loss allocations based on an analysis of historical water delivered. Nevertheless, further investigation of Option 3 could consider whether SunWater can – without implementing new infrastructure – satisfy itself and DNRM that a portion of its distribution loss allocations are not needed. This could allow creation of new water allocation with potentially very limited capex. There is also an opportunity to provide flexibility to seasonally trade distribution losses, where possible dependent on rainfall, storage and yield considerations.

Optimisation of Option 3 from a commercial perspective will be relevant to ensure the option delivers savings at least costs for acceptable risk.

The success of Option 3 is considered to be dependent upon a number of factors, including:

- deliverability and cost of the infrastructure improvements
- ability for SunWater to convert a suitable yield of loss allocations to new allocations for sale
- purchase of new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production
- limited negative impacts on the existing scheme and owners of existing allocations from the implementation of the option
- LMA considerations.

6.5.1 Interaction with Queensland Government Application to NWIDF Capital Component

In March 2017, the Queensland Government and SunWater submitted an Expression of Interest application to the NWIDF seeking a capital contribution towards several of the sub-projects in Option 3 to modernise the existing MDWSS distribution system.

6.6 Option 4: Nullinga Dam for Agricultural Use

The aim of Option 4 is to develop a new bulk water source for the expansion of irrigated agriculture in the region. The scope of inclusions and exclusions for Option 4 are:

1. Design and build a Nullinga Dam primarily for medium priority water allocations open to all customers and in particular for agricultural users, initially for delivery of water to Walsh River customers within and potentially downstream of the MDWSS area, but with the flexibility for commercial distribution systems to evolve. A 'river delivery, bulk only' Nullinga Dam simplifies design, costing, water pricing, stakeholder engagement, water planning and scheme operation.
2. No distribution infrastructure for delivery to the MDWSS or elsewhere is included. Future connection to the MDWSS would be subject to the result of a process that identifies clear cost effective opportunities for new or augmented distribution infrastructure.

DNRM and DAF have reported areas of suitable soils and provided details on the type of crops that may succeed in this region. Up to 9,900 hectares of suitable land for irrigated agriculture has been identified from the proposed Nullinga Dam wall to the end of the Dimbulah area.



There is also potential demand from up to 8,000 hectares of greenfield land near Chillagoe. However, significant bulk transmission losses in the Walsh River would result during the transfer of water and for environmental and commercial reasons delivering to this area may not be preferred.

Irrigation application rates (of water) are likely to range between 8 ML per hectare and 12 ML per hectare annually dependent on a range of variables. At 10 ML per hectare it is theoretically possible for up to 99,000 ML (based on 9,900 hectares) to be used within the MDWSS existing scheme boundaries. In addition, the Arriga area and others are likely to express interest in water allocations as the MSF Sugar mill and extensive farms (including proposed expansion areas) are within a reasonable service area for this option.

The success of Option 4 is considered to be dependent on a number of factors, including:

- realisation of an economic profile for a new irrigation scheme and agricultural production along the Walsh River
- realisation of credible water demand for the dam yield
- affordability of Nullinga Dam for irrigators and government
- ability to secure approvals to progress Nullinga Dam (including amendments to the Barron Water Plan and environmental assessments)
- deliverability of Nullinga Dam within a suitable cost and risk profile
- purchase of new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production.

6.6.1 Potential Yield of Nullinga Dam

Previous assessments of Nullinga Dam have provided for small, medium and large sizes. These sizes have been the subject of hydrological assessment before and during the PBC. The yield estimates are reported in Table 1.

All hydrological assessments have been undertaken to match existing performance of Tinaroo Falls Dam (e.g. holders of Nullinga Dam medium priority allocations would receive the full volume of their allocation with at least the same reliability as a medium priority allocation holder from Tinaroo Falls Dam).



NULLINGA DAM AND OTHER OPTIONS PRELIMINARY BUSINESS CASE

Table 1 Hydrological Assessments of Proposed Nullinga Dam Yield

DAM CAPACITY	1. QLD HYDROLOGY		2. QLD HYDROLOGY		3. OD HYDROLOGY	4. QLD HYDROLOGY	5. QLD HYDROLOGY	
	Potential yield —MP	Potential yield —HP	Potential yield —MP	Potential yield —HP	Potential yield —MP	Potential yield —MP	Potential yield—MP with climate change modelling and environmental releases	
ML	ML	ML	ML	ML	ML	ML	ML	Notes
168,000 (SMALL)	55,398	35	36,000	12,500	50,000	56,000	A – 43,000 B – 45,000 C – 49,000	A – Release median daily flow for each month B – Release quarter of inflows to maximum of 3,000 ML a day between January and March C – Release up to 50ML/day
364,000 (MEDIUM)	78,398	35	59,000	12,500	59,000	Not modelled	Not modelled	
491,000 (LARGE)	88,898	35	69,500	12,500	65,000	84,000	A – 70,000 B – 68,000 C – 76,000	A, B and C as above

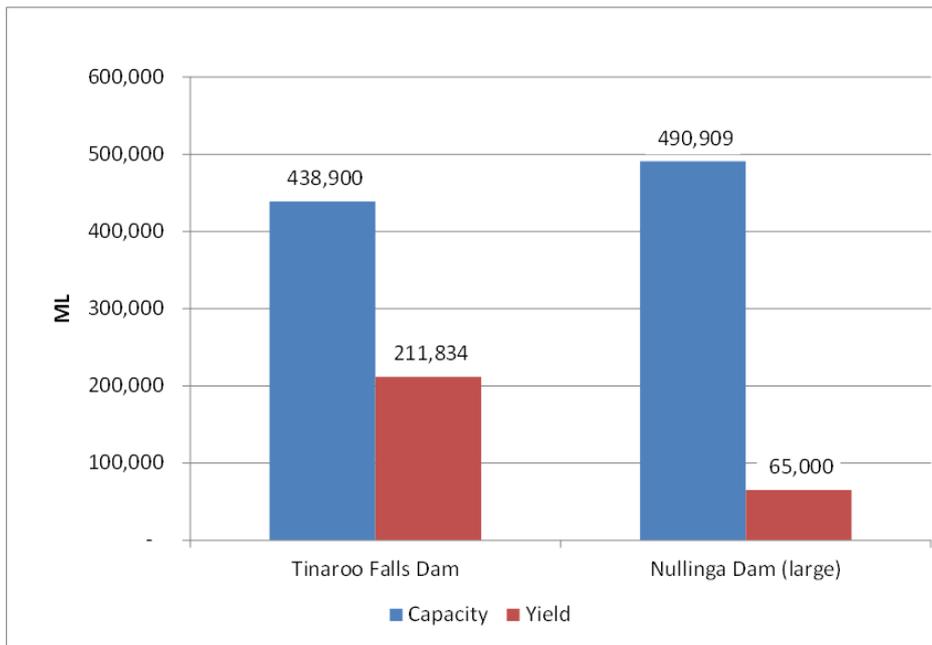
Source: Queensland Hydrology Unit, OD Hydrology.

Notes: Qld Hydrology results based on historical sequence modelling. OD Hydrology results based on stochastic modelling. (1) Nullinga Dam yield accounting for Nullinga Dam to supply the current Tinaroo Falls Dam supply to Zone E. (2) Nullinga Dam yield based on current Tinaroo Falls Dam supply of 19,398 MP/a medium priority (MP) and 35 ML/a high priority (HP) to Zone E being converted to 12,500 ML/s HP for release from Tinaroo Falls Dam down the Barron River for CRC use (extraction from Lake Placid). (3) Nullinga Dam MP yield with no conversion. (4) Nullinga Dam MP yield with no conversion. (5) Nullinga Dam MP yield with no conversion, accounting for climate change modelling and environmental releases.



It should also be noted that Nullinga Dam is less effective than Tinaroo Falls Dam due to yield and hydrology efficiency. The figure below highlights that for a comparable size dam (i.e. a Nullinga Dam the size of Tinaroo Falls Dam), the medium priority yield from Nullinga Dam is much less than Tinaroo Falls Dam. The Nullinga Dam site also suffers from inefficiency issues for irrigation purposes as it can only deliver water to a limited number of existing farms via current delivery infrastructure. This inefficiency is expected as the original decision was to build Tinaroo Falls Dam was based on its more favourable features.

Figure 1 Tinaroo Falls Dam and the Proposed Nullinga Dam



Source: Marsden Jacob Associates

Option 4 has assessed the Nullinga Dam on the basis of the ‘small size’ in previous assessments to allow for analysis against the other shortlisted options. This yield may change with further hydrological assessments.

Regardless, if Nullinga Dam proceeds, it is recommended the size of the dam be determined by further demand assessment and matched the volume of credible demand, rather than an arbitrary ‘pre-determined’ yield.



CHAPTER 7

STRATEGIC CONSIDERATIONS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

7	STRATEGIC CONSIDERATIONS	2
7.1	Purpose	2
7.2	Queensland Government	2
7.3	Australian Government	6
7.4	Local Government	9
7.5	Conclusion	10

TABLES

Table 1	Service Need and Shortlisted Options Alignment with Government Policies and Programs	10
---------	--	----

FIGURES

Figure 1	Water Supply Schemes in Queensland with Unallocated Supplemented Water Available	4
----------	--	---



7 STRATEGIC CONSIDERATIONS

CHAPTER SUMMARY AND CONCLUSIONS

- A review of Queensland Government, Australian Government and relevant local government plans, programs and policies was conducted against the identified service need and shortlisted options.
- The service need and shortlisted options are considered to align with the strategic objectives of various plans, programs and policies, including:
 - Queensland Government
 - State Infrastructure Plan
 - Project Assessment Framework
 - Far North Queensland Regional Water Supply Strategy
 - Cairns Regional Water Supply Security Assessment
 - Queensland Agricultural Land Audit
 - Advancing North Queensland
 - Reef 2050 Plan
 - Australian Government
 - Australia Infrastructure Plan
 - Northern Australia Audit
 - Developing Northern Australia White Paper
 - National Water Initiative
 - National Water Infrastructure Development Fund
 - National Water Infrastructure Loan Facility (NWILF)
 - Reef 2050 Plan
 - Local Government
 - Cairns Regional Council: Our Water Security.

7.1 Purpose

This chapter considers how the identified service need and shortlisted options align with, or contribute to, the strategic objectives of the Queensland Government, Australian Government and relevant local government plans, programs and policies.

7.2 Queensland Government

7.2.1 Infrastructure

7.2.1.1 State Infrastructure Plan

The SIP outlines the strategic direction for the planning, investment and delivery of infrastructure in Queensland. The SIP identifies what the government ultimately wants from its infrastructure and how this



can best be achieved and is designed to provide confidence and certainty to business, industry and the community.

The SIP outlines the following outcomes the Queensland Government is seeking to achieve in relation to investment in the 'water' asset class:

- water supply infrastructure is in place or in train where there is a sound business case and water resources are available
- appropriate solutions, including demand management, are evaluated and implemented after the water needs of local government have been assessed in partnership with the state
- greater use of recycled water has been encouraged by state policies, where it is fit-for-purpose and economically viable
- water demand and the effects of stormwater and sewerage discharge on the environment has been minimised, the effects of flooding mitigated and reuse of water maximised through urban design
- State dams are safe during extreme climate events
- water is regarded as a valuable finite resource and the impact on availability and cost of water use behaviours is recognised by Queenslanders
- the water management and trading framework maximises the efficient use of water and water infrastructure.

The SIP also sets out an approach to options assessment and prioritising further infrastructure projects.

The service need and shortlisted options are considered to align with the aspects of the SIP above by recognising the initiatives in the Cairns Water Security Strategy to meet future water demand in Cairns, and by providing a range of solutions to the opportunity to increase agricultural production in the Atherton Tablelands region, including consideration of water trading, reform and better use of existing infrastructure.

7.2.1.2 Project Assessment Framework

The Project Assessment Framework (PAF) is used across the Queensland Government to ensure a common, rigorous approach to assessing projects at critical stages in their lifecycle, from the initial assessment of the service required, through to delivery.

This PBC is aligned with the PAF process by being completed in accordance with the Building Queensland Business Case Development Framework. The BCDF supplements the Project Assessment Framework by providing detailed guidance on how to complete the assessments required to develop robust business cases, in line with the PAF.

7.2.2 Water Policy

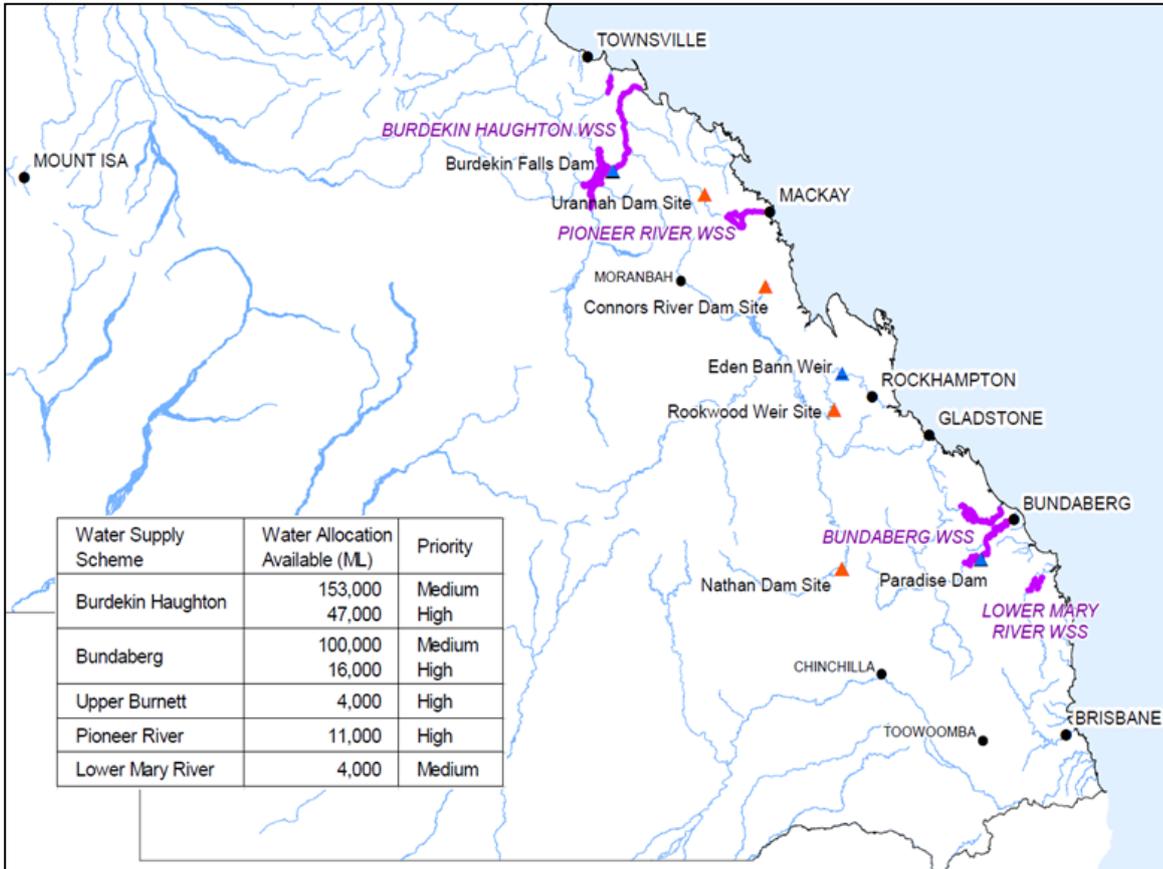
7.2.2.1 Regional Bulk Water Supply Infrastructure

SunWater is responsible for Queensland's regional network of bulk water supply infrastructure outside the South East Queensland area. SunWater's infrastructure supports around 5,000 customers across the mining, power generation, industrial, local government and irrigated agriculture sectors.

Within the SunWater network, there are currently a number of areas within Queensland which have unallocated supplemented water (i.e. available for purchase). These include the water supply schemes in Figure 1. In particular, Paradise Dam (constructed in 2005) in the Bundaberg Water Supply Scheme has underutilised capacity and uptake of water usage has not reached anticipated levels.



Figure 1 Water Supply Schemes in Queensland with Unallocated Supplemented Water Available



Source: SunWater

7.2.2.2 Far North Queensland Regional Water Supply Strategy

The Far North Queensland Regional Water Supply Strategy (FNQRWSS) was released in 2010. At the time, the FNQRWSS provided guidance for management of and planning for future urban, rural and industrial water needs in Far North Queensland while seeking to achieve optimal environmental, social and economic outcomes.

The FNQRWSS considered existing water supply arrangements in the region and sought to identify the most effective ways of meeting the region’s future water supply needs. The FNQRWSS indicated the future water supply shortfall for Cairns was expected to be met by:

- demand management strategies that target a reduction in per capita consumption
- development of local solutions
- alternative water sources such as desalination and fit-for-purpose recycled water and storm water reuse
- access to strategic reserve in Barron River and/or purchase supplemented water from the MDWSS
- further investigation of additional storage sites such as Nullinga Dam to be considered after portfolio of demand and supply side options to meet future requirements have been exhausted.

The FNQRWSS outlined the future potential water supply shortfall for agriculture in the region may be met by:

- on farm efficiency gains



- water trading of sleeper and dozer entitlements
- efficiency improvement in the MDWSS distribution network
- new storages such as Nullinga Dam – subject to a viable business case and necessary approvals.

The PBC has considered the initiatives identified in the FNQRWSS as part of the identification of the service need and the development of the shortlisted options. It is considered that the shortlisted options align with the initiatives set out in the FNQRWSS by incorporating a number of those initiatives in the shortlisted options.

7.2.2.3 Cairns Regional Water Supply Security Assessment

DEWS, in partnership with CRC, released the Cairns Regional Water Supply Security Assessment (Cairns RWSSA) in October 2014. The Cairns RWSSA represented a collaborative approach between DEWS and CRC to establish a shared understanding of the existing security of water supply in Cairns and the capacity to support future growth.

The Cairns RWSSA considered a number of growth scenarios to identify the timing and magnitude of potential water supply risks. It undertook detailed hydrological assessments of the performance of Copperlode Falls Dam and Behana Creek and concluded that, under existing water demands, Cairns could expect to experience Level Four restrictions approximately once every 100 years.

The Cairns RWSSA provided valuable information to the community and water supply planners about the water supply security for Cairns, and provided a foundation for future water supply planning. CRC has continued to review its water demand forecasts considering updated population projections and demand management initiatives.

Building Queensland has worked closely with DEWS and CRC to understand current and future urban water requirements in Cairns. Building Queensland has followed the Cairns RWSSA in developing the service need and shortlisted options for consideration in the PBC, particularly, the conclusion there is no urban water supply problem for Cairns to be addressed in the PBC.

7.2.3 Agriculture

7.2.3.1 Queensland Agricultural Land Audit

The Queensland Agricultural Land Audit was released in May 2013. The Queensland Agriculture Land Audit identifies land important to current and future agricultural production and the constraints to development; and helps to guide investment in the agricultural sector and inform decision making to ensure the best use of our agricultural land in the future.

Chapter Six of the Queensland Agricultural Land Audit covers Far North Queensland and identified significant areas of land suitable for irrigated agriculture. The MDWSS is recognised as a strength of the region, with 25,000 hectares of irrigated agriculture. The Queensland Agricultural Land Audit found many undeveloped areas within the existing scheme with the potential for horticultural production that are favourable for development.

The shortlisted options align with the findings of the Queensland Agricultural Land Audit, having identified significant areas within and adjacent to the existing scheme suitable for future agricultural production, including high-value horticultural production.



7.2.4 Planning

7.2.4.1 Advancing North Queensland

Advancing North Queensland: Investing in the Future of the North was released in June 2016. The strategy outlines five priority areas the Queensland Government will focus on to drive economic development in the region: roads infrastructure, water security, research and innovation, tourism, trade and investment and North Queensland Stadium.

Advancing North Queensland acknowledges water security and water infrastructure are critical to sustain agricultural industries and boost regional development. The Queensland Government committed to progressing feasibility studies funded by the Australian Government under the NWIDF, including this PBC, and continuing to produce Regional Water Supply Security Assessments and working with councils at risk of running out of water due to drought.

The service need and shortlisted options examine the need for potential new water infrastructure for agricultural purposes and support the water security priority area of Advancing North Queensland.

7.3 Australian Government

7.3.1 Infrastructure

7.3.1.1 Australian Infrastructure Plan

The Australian Infrastructure Plan sets out the infrastructure challenges and opportunities Australia faces over the next 15 years and the solutions required to drive productivity growth, maintain and enhance the nation's standard of living and ensure that Australian cities remain world-class. It highlights that infrastructure investment in Northern Australia should enhance our regional productive capacity to take advantage of growing demand for our produce in South-East Asia and China. At the same time, regulatory frameworks and operational arrangements should be aligned with any new infrastructure investments to maximise potential productive capacity.

The Australian Infrastructure Plan notes that successful irrigated agriculture is dependent on producers having access to reliable and secure water resources and that regional water infrastructure that supports irrigated agriculture faces particular challenges because of the increasingly variable climate, growing demand and difference in the ability or willingness to pay. It also notes that the flexibility and autonomy offered by water trading has facilitated the movement of water to higher value uses and increased agricultural production.

The shortlisted options align with the findings of the Australian Infrastructure Plan by considering a range of potential initiatives to increase agricultural production.

7.3.1.2 Northern Australia Audit – Infrastructure for a Developing North

The Northern Australia Audit: Infrastructure for a Developing North was published in 2015 and assessed critical economic infrastructure gaps and requirements to meet projected Northern Australia population and economic growth through to 2031.

The Northern Australia Audit found that water availability varies dramatically in Northern Australia and highlighted significant challenges, including limited existing infrastructure, which are likely to affect the development of Northern Australia. It concluded that for prospective agricultural developments there may be a range of potential water supply options, by which case-by-case evaluation is important, including water trading, expansion of existing irrigation areas and planning new dams.



The shortlisted options align with the findings of the Northern Australian Audit by considering a range of solutions to access new water supplies to provide economic and social benefits to the Tablelands region.

7.3.1.3 White Paper on Developing Northern Australia

The Our North, Our Future: White Paper on developing Northern Australia was released in June 2015. The White Paper outlines the Australian Government's vision for the future of Northern Australia and identifies actions over the next 20 years to unlock the North's full potential.

The development of the right water infrastructure in the right areas is considered key to realising the vision set out in the White Paper. The White Paper announced the establishment of the NWIDF and committed up to \$5 million from the NWIDF to assess the economic feasibility of Nullinga Dam, along with other projects. The White Paper also announced the \$5 billion Northern Australia Infrastructure Facility, providing concessional finance to encourage private sector investment in northern Australia.

The shortlisted options consider Nullinga Dam and other options to address the service need of the opportunity for expansion of irrigated agriculture in the Tablelands region in Northern Australia. This PBC represents progress towards realising the vision set out in the White Paper by considering the economic feasibility of Nullinga Dam and whether it is the right water infrastructure to unlock the potential of northern Australia.

7.3.2 Water

7.3.2.1 National Water Initiative

The Australian Government and each of the States and Territories are parties to the Intergovernmental Agreement on a National Water Initiative (NWI). The NWI is the national blueprint for water reform and represents a shared commitment by governments to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities, and for the environment. The NWI has driven reforms for better water management and use through changes to planning frameworks, water access entitlements, water markets, water pricing, water use efficiency and the integrated management of water.

Pricing Principles have been agreed pursuant to the NWI Agreement and include 'Principle 1: Cost recovery for new capital expenditure', which applies to rural surface and groundwater based systems.¹ For new or replacement assets, Principle 1 generally provides that charges will be set to achieve full cost recovery of capital expenditure (net of transparent deductions/offsets for contributed assets and developer charges and transparent community service obligations) through either:

- a return of capital (depreciation of the Regulated Asset Base (RAB)) and return on capital (generally calculated as rate of return on the depreciated RAB)
- a renewals annuity and a return on capital (calculated as a rate of return on an undepreciated asset base (Optimised Replacement Cost (ORC))

The shortlisted options have considered the NWI Pricing Principles, including the proposed approach to capital investment and lower bound and upper bound pricing.

7.3.2.2 National Water Infrastructure Development Fund

The objective of the NWIDF is to undertake detailed economic planning to inform water infrastructure investment decisions and expedite the construction of water infrastructure. It aims to help secure the

¹ NWI Principle Principles: Principle 1: Cost recovery for new capital expenditure, paragraph 13.



nation's water supplies and deliver regional economic development benefits for Australia by providing access to secure and affordable water to underpin growth in irrigated agriculture, while also protecting our environment. The NWIDF is separated into a feasibility component and a capital component.

Feasibility Component

The NWIDF feasibility component is comprised of \$59.5 million to fund feasibility studies into new water infrastructure across Australia, with funding available over four years from 1 July 2015 to 30 June 2019.

The feasibility component aims to help governments and industry make decisions based on evidence about the best sites for new water infrastructure, and accelerate the completion of thorough business cases. The feasibility assessments also aim to confirm sufficient demand from users to meet the ongoing costs of water supply, so farmers are not burdened with ongoing operational and maintenance costs they cannot afford over the longer term.

Capital Component

The NWIDF capital component is comprised of \$440 million to facilitate the construction of new water infrastructure, with funding available over 8 years from 1 July 2017 to 30 June 2025.

The Australian Government announced \$247.5 million in funding commitments during the 2016 Federal Election. An Expression of Interest (EOI) process is underway to allocate the remaining \$192.5 million, with \$40 million available for infrastructure located in Northern Australia. Applications through the EOI process must be made by the State or Territory government and have the support of the Minister responsible for water, and are subject to a number of eligibility criteria, including:

- matching funding commitments approved by the State or territory
- ready to progress to construction, with all relevant Australian Government and Queensland government approvals in place
- supported by a clear and credible business case demonstrating economic viability over its proposed operational life
- commitment to implementation of NWI consistent management of water resources in the catchment where the infrastructure is proposed.

The EOI Guidelines exclude some activities from receiving funding, including dam safety upgrades and water infrastructure primarily for urban and potable use.

It is considered the shortlisted options align with the objectives of the NWIDF to undertake detailed economic planning to inform water infrastructure investment decisions and stimulate regional economic development benefits. As indicated above, the Nullinga Dam was allocated up to \$5 million to develop a detailed economic feasibility assessment. The shortlisted options include the Nullinga Dam option and consider the feasibility of this option and other options to meet the identified service need for the region, and whether further investigation into Nullinga Dam is warranted at this time.

In March 2017, the Queensland Government and SunWater submitted an Expression of Interest application to the NWIDF seeking a capital contribution towards several of the sub-projects in Option 3 to modernise the existing MDWSS distribution system. If it proceeds, the Nullinga Dam option may seek funding consideration from the Australian Government for a portion of the capital component of the NWIDF, subject to meeting the relevant conditions. An application for funding consideration from the Australian Government for Nullinga Dam is unlikely in the short term, as Nullinga Dam is a number of years away from having the necessary approvals and other conditions required before construction could commence.



7.3.2.3 National Water Infrastructure Loan Facility (NWILF)

The \$2 billion NWILF provides State and Territory governments with concessional loans to co-fund the construction of water infrastructure.

The NWILF is designed to assist State and Territory governments to co-invest in vital water infrastructure. Funding aims to accelerate the construction of major water infrastructure projects such as dams, weirs, pipelines and managed aquifer recharge projects to provide affordable and secure water supplies to support the growth of regional economies and communities across Australia.

The NWILF Investment Guidelines set out the investment priorities for the loan facility which closely align with the eligibility criteria for the NWILF: at least a 51 per cent funding commitment approved by the State; and preference is given to water storage infrastructure, including the construction of dams and weirs that deliver broad public benefits, including through increasing regional water availability and security for water users.

The shortlisted options align with the objectives of the NWILF by investigating the delivery of broad public benefits through expansion of the existing irrigation scheme or new bulk water supply such as Nullinga Dam, with ensuing economic growth for the region. If it proceeds, the Nullinga Dam option may be eligible to access the NWILF, subject to meeting the relevant conditions. However, Nullinga Dam is a number of years away from having the necessary approvals and other conditions required before construction could commence.

7.3.2.4 Reef 2050 Plan

The Reef 2050 Plan was released by the Australian and Queensland Governments in March 2015. The plan is the overarching framework for protecting and managing the Great Barrier Reef until 2050 and outlines management measures for the next 35 years to ensure the outstanding universal value of the Reef is preserved now and for generations to come.

The potential impact of the shortlisted options on the objectives of the Reef 2050 Plan has been considered. The environmental impacts from the Nullinga Dam option on the Great Barrier Reef are expected to be minimal as the Walsh River, as a tributary of the Mitchell River, flows into the Gulf of Carpentaria (which is not part of the Great Barrier Reef or included in the Reef 2050 plan) and associated irrigated agriculture is likely to be located adjacent to the Walsh River. Improvements to the MDWSS rules and operation and modernisation of the MDWSS and conversion of losses may result in a marginal increase in agricultural production, with associated water quality impacts on the Barron River.

7.4 Local Government

7.4.1 Cairns Regional Council

7.4.1.1 Our Water Security: Water Security Strategy

CRC released the Cairns Water Security Strategy in 2015. This document sets out a preferred strategy for implementing a series of short, medium and long-term initiatives to address the future demand for water in Cairns over the next 30 years. The conversion of losses from the MDWSS and Nullinga Dam are identified in the Water Security Strategy as long-term options, subject to further investigation of availability, impact and cost.

The Water Security Strategy is subject to annual review. Building Queensland has consulted closely with CRC to determine the current status of the various initiatives in the Cairns Water Security Strategy and its



updated demand profile. The service need identification and shortlisted options are considered to align with CRC’s 2016 annual review of its Water Security Strategy.

7.5 Conclusion

The review of relevant government programs and policies has concluded that the identified service need and shortlisted options align with, and contribute to, the strategic objectives of various plans and programs of the Queensland Government, Australian Government and CRC. A summary of the alignment is outlined in Table 1.

Table 1 Service Need and Shortlisted Options Alignment with Government Policies and Programs

DOCUMENT	ALIGNMENT
QUEENSLAND GOVERNMENT	
State Infrastructure Plan	The service need and shortlisted options recognise the outcomes sought in the SIP from the ‘water asset’ class and provide a range of solutions to the opportunity to increase agricultural production in the Tableland region, including water trading, reform and better use of existing infrastructure options.
Far North Queensland Regional Water Supply Strategy	Initiatives identified in the FNQRWSS have been considered as part of the identification of the service need. The shortlisted options align with the initiatives set out in the FNQRWSS by incorporating a number of those initiatives in the shortlisted options.
Cairns Regional Water Supply Security Assessment	Development of the service need and shortlisted options has considered the Cairns RWSSA to understand current and future urban water requirements in Cairns.
Queensland’s Agricultural Land Audit	The shortlisted options align with the findings of the Queensland Agricultural Land Audit, having identified significant areas within and adjacent to the existing scheme suitable for future agricultural production, including high-value horticultural production.
Advancing North Queensland	The service need and shortlisted options examine the need for potential new water infrastructure for urban and agricultural purposes and support the water security priority area of Advancing North Queensland.
Reef 2050 Plan	Potential impact of the shortlisted options on the objectives of the Reef 2050 Plan has been considered. Environmental impacts from the Nullinga Dam option on the Great Barrier Reef are expected to be minimal as the Walsh River, as a tributary of the Mitchell River, flows into the Gulf of Carpentaria and associated irrigated agriculture is likely to be located adjacent to the Walsh River. Improvements to the MDWSS rules and operation and modernisation of the MDWSS and conversion of losses may result in a marginal increase in agricultural production, with associated water quality impacts on the Barron River.
AUSTRALIAN GOVERNMENT	
Australian Infrastructure Plan and Northern Australia Audit	Shortlisted options align with the findings of the Australian Infrastructure Plan and Northern Australia Audit by considering a range of potential initiatives to increase agricultural production.
White Paper on Developing Northern Australia	Shortlisted options show progress towards realising the vision set out in the White Paper by considering the economic feasibility of Nullinga Dam and whether it is the right water infrastructure to unlock the potential of northern Australia.
National Water Initiative	Shortlisted options have considered the NWI Pricing Principles, including the proposed approach to capital investment and lower bound and upper bound pricing.



DOCUMENT	ALIGNMENT
National Water Infrastructure Development Fund	Shortlisted options align with the objectives of the NWIDF to undertake detailed economic planning to inform water infrastructure investment decisions and stimulate regional economic development benefits. The Nullinga Dam was allocated up to \$5 million from the feasibility component to develop a detailed economic feasibility assessment. An application has been made under the capital component for the conversion of losses option. If it proceeds, the Nullinga Dam option may be eligible to access the capital component of the NWIDF, subject to meeting the relevant conditions.
National Water Infrastructure Loan Facility	Shortlisted options align with the objectives of the NWILF by investigating the delivery of broad public benefits through expansion of the existing irrigation scheme or new bulk water supply such as Nullinga Dam, with ensuing economic growth for the region. If it proceeds, the Nullinga Dam option may be eligible to access the NWILF, subject to meeting the relevant conditions.
Reef 2050 Plan	See above.
LOCAL GOVERNMENT	
Our Water Security—Water Security Strategy (CRC)	Service need and shortlisted options have considered the Cairns Water Security Strategy in detail and align with CRC’s 2016 annual review of the strategy.



CHAPTER 8

LEGAL AND REGULATORY CONSIDERATIONS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

8	LEGAL AND REGULATORY CONSIDERATIONS.....	2
8.1	Introduction	3
8.2	Water Planning and Pricing Regulatory Context	3
8.3	Mareeba Dimbulah Water Supply Scheme	9
8.4	Water Infrastructure Delivery—Approvals, Land Access and Native Title	10
8.5	Detailed Consideration of Options	10
8.6	Implications of Possible Local Management Arrangements	27
8.7	Risks and Issues for Later Consideration	28

TABLES

Table 1	WROLA Act—Changes to Water Instruments	4
Table 2	Queensland Competition Authority: Cost Risk Mechanisms.....	8
Table 3	Option 2: Changes to Water Act, Water Regulation and Water Instruments	13
Table 4	Option 3: Changes to Water Act, Water Regulation and Water Instruments	15
Table 5	Option 4: Changes to Water Act, Water Regulation and Water Instruments	18
Table 6	Option 4: Approvals	20
Table 7	Deconstruction and Transition of Water Resource Operations Plans and Resource Operations Plans	30



8 LEGAL AND REGULATORY CONSIDERATIONS

CHAPTER SUMMARY AND CONCLUSIONS

Water resource planning and pricing

- Water planning regulation is changing:
 - *Water Reform and Other Legislation Amendment Act 2014* introduced a new water planning framework to provide a more streamlined and responsive approach to water planning, including transitioning content of Resource Operations Plans (ROP) to a suite of new water instruments
 - *Water (Local Management Arrangements) Act 2017* deals with local area ownership and management of channel irrigation schemes.
- The current Barron Water Plan will continue to operate until 19 December 2022. The MDWSS is the only water supply scheme included in the Barron Water Plan area. SunWater is the holder of the Resource Operations Licence for the MDWSS. There are no provisions in the statutory water instruments which provide for development of Nullinga Dam.
- The Barron Water Plan provides water allocations must either be for ‘rural’, ‘distribution loss’ or ‘any’ purpose. Pricing and the sale of allocations is dealt with under the Water Act. SunWater’s approval (as the Resource Operations Licence holder) is required to seasonally trade water allocations.
- The Queensland Competition Authority price path for Sunwater’s irrigation prices for the MDWSS and Mareeba-Dimbulah Distribution System will apply until 30 June 2019.
- The National Water Initiative principles for cost recovery for new or capital expenditure apply to rural surface water systems. The principles include charges will be set to achieve full cost recovery of capital expenditure (net of transparent deductions/offsets for contributed assets and developer charges and transparent community obligations) through either a return of capital and return on capital (upper bound pricing) or a renewals annuity and a return on capital (lower bound pricing).

Option 2: Improve MDWSS rules and operation

- The measures in Option 2 will primarily require changes to the Barron ROP, as deconstructed into the new water instruments, and Resource Operations Licence.
- Unless modification is made to existing bulk releases, no pricing issues are expected, as there are no capital costs and no new allocations created. There have been no identified issues with approvals as this option only proposes changes to the operation of the existing MDWSS rather than physical works to it.

Option 3: Modernise MDWSS and convert losses

- This option will require changes to the Barron Water Plan, Barron ROP (as deconstructed) and Resource Operations Licence.
- A two-step process will be involved in converting ‘distribution losses’ to ‘any’ purpose water allocations: (1) subdivision of the existing ‘distribution loss’ water allocation into two new water allocations; (2) conversion of one of the subdivided water allocations to ‘any’ purpose – the other remaining as ‘distribution loss’.



- SunWater will have the flexibility to sell, lease for a period of years or enter into seasonal water assignments in respect of all or part of that converted water allocation. Prices will need to consider the NWI principles for any government grant (contributed assets). SunWater will also need to make a submission to the QCA to the extent that the option results in capital costs and operation and maintenance costs.
- The works for Option 3 are relatively confined in nature and are unlikely to require many approvals. The limited approvals may be related to vegetation clearing, operational works and riverine protection permits. Some land acquisition may be required. Further investigation will determine the nature of approvals required.
- The potential transfer of the MDWSS to local management may occur prior to, during the course of or following completion of the implementation of Option 3. It will be important to ensure the water charges determined to be payable by customers are sufficient to allow SunWater or a local management 'irrigation entity' to meet all of its liabilities.

Option 4: Nullinga Dam for agricultural use

- The statutory water instruments do not allow for Nullinga Dam: no water is reserved and environmental flow objectives are set at 99 per cent. Changes would be required to the Barron Water Plan, Barron ROP and Resource Operations Licence.
- NRM will have the flexibility to sell the water allocations by public auction, tender or fixed price sale. The terms of sale may be used to facilitate customer pre-commitments by allowing the sale of water conditional upon sufficient water demand and/or the construction of Nullinga Dam. Pricing for new water allocations would need to comply with the NWI principles so that a return on and of contributed capital is not recovered from customers. A referral may be made to the Queensland Competition Authority in relation to pricing practices.
- Nullinga Dam will give rise to environmental impacts, native title, land access and approvals issues. Tenure would be required for the dam wall and inundation area and additional land may be required for construction purposes.

8.1 Introduction

This chapter examines the legal and regulatory aspects of the shortlisted options both from a water resource planning perspective (including pricing) and infrastructure approvals and land access perspective.

Discussion of the relevant legal/regulatory issues for the purposes of this chapter is at a level considered appropriate for the PBC stage. Issues may require more detailed consideration in a DBC stage.

8.2 Water Planning and Pricing Regulatory Context

8.2.1 *Water Act 2000 (Qld) & Water Regulation 2016 (Qld)*

Sustainable water resource management in Queensland is regulated by the *Water Act 2000 (Qld)* (Water Act) and the *Water Regulation 2016 (Qld)* (Water Regulation). The Water Act establishes a system for the planning, allocation and use of water under a sustainable management framework. This concept of 'sustainable management' under the Water Act was recently refined by amendments introduced by the



Water Reform and Other Legislation Amendment Act 2014 (Qld) (WROLA Act) which relevantly commenced on 6 December 2016 and now includes principles of ecologically sustainable development.¹

The *Water (Local Management Arrangements) Act 2017* (WLMAA) was passed by the Queensland Parliament on 16 February 2017. The WLMAA deals with local area ownership and management of channel irrigation schemes, discussed later in this chapter.

Prior to the WROLA Act amendments, water resource planning was implemented via a hierarchy of instruments created under the Water Act:

- Water Resource Plan (WRP)
- Resource Operations Plan (ROP)
- Resource Operations Licence (ROL)
- Distribution Operations Licence (DOL).

Relevant to this PBC, these are the:

- Water Resource (Barron) Plan 2002
- Barron Resource Operations Plan 2005
- Mareeba Dimbulah Water Supply Scheme (MDWSS) Resource Operations Licence dated 17 June 2005 held by SunWater.

There is no DOL for the MDWSS as the distribution infrastructure is operated under the authority of the MDWSS ROL as SunWater is the owner and operator of both Tinaroo Falls Dam and the distribution infrastructure.

8.2.2 New Water Planning Framework

As of 6 December 2016, the WROLA Act amendments introduced a new water planning framework intended to provide a more streamlined and responsive approach to water planning in Queensland. This new framework renamed Water Resource Plans, (now known as Water Plans), and transitioned the content of Resource Operations Plans (ROP) to a suite of water instruments as set out in Table 1.

Table 1 WROLA Act—Changes to Water Instruments

PREVIOUS WATER INSTRUMENT	NEW WATER INSTRUMENT (POST 6 DECEMBER 2016)
Water Resource Plan (WRP)	Water Plan
Resource Operations Plan (ROP)	Water Plan Operations Manual (supplemented water) Water Management Protocol (unsupplemented water) Resource Operations Licence (ROL) Distribution Operations Licence (DOL) Water Licence

Under the new regime therefore ROPs are replaced by the new instruments. The Water Act transitional provisions dealing with these new arrangements provide that various parts of existing ROPs are taken to be

¹ Water Act, section 2(2).



omitted from the ROP and included in another instrument e.g. a ROL or are taken to be omitted from the ROP and taken to be another instrument e.g. an Operations Manual.

The transition to the new planning framework does not affect existing water entitlements or the rules that currently apply to them. It only affects the documents in which they are recorded and the means by which they can be amended in the future.

Further details of the deconstruction and transitioning of specific content of ROPs to the new planning framework is set out in the table 7 at the end of this chapter.

8.2.3 Barron Water Plan

The Water Resource (Barron) Plan 2002, now called the Barron Water Plan, is subordinate legislation prepared under the Water Act.² It sets out the management framework for water resources in the Barron catchment area and outlines outcomes, objectives and strategies for achieving a sustainable balance between water for industry, irrigation and urban use and the environment.

A Water Plan would ordinarily expire 10 years after it was introduced, but in this case, the Minister for Natural Resources and Mines granted an extension under the Water Act such that the Barron Water Plan will continue to operate until 19 December 2022.³

The Barron Water Plan specifies environmental flow objectives (EFOs) and water allocation security objectives (WASOs) and associated performance indicators.

- EFOs – These are the flows specified in the Water Plan as being necessary to protect the environment.⁴
- WASOs – These are the performance standards that the holder of a water allocation can expect from their allocation.⁵

Limited unallocated water is available within the area included in the Water Plan (the Plan Area). There is 300 ML of unallocated water held as a general reserve within subcatchment area B and 4,000 ML of unallocated water held as a strategic reserve in subcatchment area A.⁶ The strategic reserve in subcatchment area A is only available to be taken from the Barron River at Lake Placid for use in the Cairns local government area. There is no strategic infrastructure reserve under the Water Plan.

The Barron Water Plan recognises that, for converting authorisations to water allocations, the purpose of a water allocation must either be for ‘rural’, ‘distribution loss’ or ‘any’ purpose.⁷ For the granting of an unallocated water reserve, unallocated water held as a general reserve must be granted for the purpose of ‘any’ and unallocated water held as a strategic reserve must be granted for the purpose of ‘town water supply’.

The existing MDWSS is the only water supply scheme included in the Barron Water Plan Area. The Plan does not currently provide for, nor contemplate the potential development of, another bulk storage facility such as the Nullinga Dam. The Water Plan would require amendment to allow for the provision of new water allocations from Nullinga Dam.

² Water Act, section 42.

³ Water Act, sections 53-54, Water Resource (Barron) Plan (Postponement of Expiry) Notice 2014 (published in the Government Gazette on 15 August 2014).

⁴ Barron Water Plan, sections 17-18, schedule 5.

⁵ Barron Water Plan, sections 19-20, schedule 6, parts 1 and 2.

⁶ Barron Water Plan, section 24B.

⁷ Barron Water Plan, section 33.



8.2.4 Barron Resources Operations Plan 2005

The Barron Resource Operations Plan 2015 (Barron ROP) was prepared under the Water Act in June 2005 and was subsequently amended in October 2011, June 2013 and September 2015.

The MDWSS is the only Water Supply Scheme included in the Barron ROP. The Barron ROP defines the rules for water supply schemes, water infrastructure and water entitlements within the Barron Water Plan area. In its current form, the Barron ROP does not include a process for the release of an unallocated water reserve that would provide for the potential development of Nullinga Dam as a new bulk storage facility, either as part of the MDWSS or under a new scheme.

As noted above, as of 6 December 2016, ROPs no longer exist – their content has been deconstructed and transitioned over to various other water instruments, primarily the MDWSS ROL and the Operations Manual for the ROL. MDWSS ROL

A ROL can only be held by the owner of the water infrastructure to which the licence applies.⁸ In this case, in conjunction with preparation of the Barron ROP, the ROL for the MDWSS was issued to SunWater on 17 June 2005.

8.2.5 Amending Water Instruments

The Water Act and the water instruments themselves collectively contemplate that amendments may need to be made to the instruments and identify the processes for doing so.

Several of the shortlisted options will require amendments to all or some of the existing water instruments to a certain degree as well as, in the case of Option 4, the creation of new water instruments as part of a new water supply scheme. The specific amendment requirements for the various options are set out in this chapter.

8.2.6 Water Pricing: Water Allocations—Sales and Secondary Trading under the Water Act

8.2.6.1 Sale of New Water Allocations

Several of the shortlisted options will involve the creation of new water allocations, particularly Option 4.⁹

Pricing and sale of allocations is dealt with under the Water Act. The Chief Executive of Department of Natural Resources and Mines (DNRM) has power under the Water Act to release unallocated water by public auction, tender, fixed price sale or grant for a particular purpose.¹⁰ The Chief Executive of DNRM also has the power under the Water Act to set a price for unallocated water.

8.2.6.2 Trading of Existing Water Allocations (Seasonal Assignments and Non-seasonal Assignments)

Water allocation dealing rules (including for the transfer or lease of water allocations) may be prescribed in a regulation, the relevant Water Management Protocol (for permanent trading rules) or the relevant Operations Manual (for seasonal assignments).¹¹

Seasonal water assignment rules are generally those pertaining to non-permanent assignments. Water trading rules however generally contemplate permanent assignments. The WROLA Act amendments have

⁸ Water Act, section 176(2).

⁹ Water Act, section 40.

¹⁰ Water Regulation, sections 16-21.

¹¹ Water Act, section 158.



transitioned seasonal water assignment rules of a ROP to an Operations Manual and water trading rules to a Water Management Protocol (for both supplemented and unsupplemented water).

Under the seasonal water assignment rules for the MDWSS, the approval of the ROL holder (i.e. SunWater) is required to seasonally trade water. Such approval may only be issued where the total water use in a water year for each zone specified in the Operations Manual does not exceed specified maximum water use volumes.

8.2.7 Water Pricing: National Water Initiative Pricing Principles

The Commonwealth and each of the States and Territories of Australia, including Queensland, are parties to the Intergovernmental Agreement on a National Water Initiative dated 25 June 2004 (NWI Agreement). Pricing Principles have been agreed pursuant to the NWI Agreement and include – ‘Principle 1: Cost recovery for new capital expenditure’ – which applies to rural surface and groundwater based systems.¹²

For new or replacement assets, Principle 1 generally provides that charges will be set to achieve full cost recovery of capital expenditure (net of transparent deductions/offsets for contributed assets and developer charges (refer to principle 6) and transparent community service obligations) through either:

1. a return of capital (depreciation of the Regulated Asset Base (RAB)) and return on capital (generally calculated as rate of return on the depreciated RAB); or
2. a renewals annuity and a return on capital (calculated as a rate of return on an undepreciated asset base (Optimised Replacement Cost (ORC))).

Paragraph 1 above reflects ‘*upper bound pricing*’ and paragraph 2 reflects ‘*lower bound pricing*’ from the NWI Agreement.

8.2.8 Water Pricing: QCA Act and Report

8.2.8.1 QCA Price Paths

Under the *Queensland Competition Authority Act 1997* (Qld) (QCA Act), the Minister (being the Treasurer and Minister for Trade and Investment) may refer a monopoly business activity to the Queensland Competition Authority (QCA) for an investigation about the pricing practices relating to the activity.¹³

As a result of a Ministerial referral under the QCA Act, in May 2012, the QCA delivered its Final Report SunWater Irrigation Price Review: 2012-17 (QCA Report). The QCA Report sets various price paths in relation to SunWater’s irrigation prices for, amongst others:

- the Mareeba-Dimbulah Water Supply Scheme
- the Mareeba-Dimbulah Distribution System.

The current irrigation price paths apply from 1 July 2012 to 30 June 2017 and the government has proposed to continue the current irrigation pricing policies for the period from 1 July 2017 to 30 June 2019.

The price paths are set to reflect efficient operational, maintenance, and administrative costs, and prudent and efficient expenditure on renewing and rehabilitating existing assets through a renewals annuity. The return on and of prudent augmentation capital expenditure would be recovered as part of the renewals annuity. The price paths exclude, relevantly, a rate of return on existing assets although, in recommending

¹² NWI Principle Principles: Principle 1: Cost recovery for new capital expenditure, paragraph 13.

¹³ QCA Act, section 23.



practices, the QCA is required to (amongst other things) provide for a commercial return on, and of, prudent capital expenditure in respect of augmentation assets constructed after 30 June 2012.

To address the risks which SunWater may face due to potential changes in market conditions for inputs, or as a result of regulatory imposts, the QCA has recommended that, depending on the circumstances, cost risks may be managed through the mechanisms set out in Table 2.

Table 2 Queensland Competition Authority: Cost Risk Mechanisms

MECHANISM	CONDITION
End of regulatory period revenue adjustments (which impact future prices)	Only efficient costs beyond SunWater’s control should be eligible, on receipt of a relevant submission from SunWater
Price review triggers to allow a review of costs (and prices) during the regulatory period	Initiated only if SunWater is able to demonstrate material differences between forecast and efficient costs that it is unable to manage, and that the differences could not have been reasonably forecast at the time prices were set. The QCA did not pre-define a threshold for a review trigger but rather will make an assessment on application from SunWater or customers.
Cost pass-through mechanisms to allow adjustments to prices during the regulatory period	Cost pass through may be appropriate when the nature of costs can be reasonably foreseen and the subsequent change unambiguous. Government imposed regulatory imposts are relevant.

The QCA has noted that it expects that most cost variations should be resolved through end-of-period adjustments except potentially for electricity and flood damage costs, once known. This expectation may sit fairly comfortably with the timing of options involving changes to the existing MDWSS.

8.2.8.2 Distribution Charges and Water Charges under SunWater’s Standard Supply Contracts

Under SunWater’s standard supply contract (SunWater Supply Contract, Channel and Pipeline Standard Conditions Schedule 3 Version 2) (Standard Channel SC), a customer must pay to SunWater the Distribution Charges for specified Distribution Services.

Distribution Charges are determined based on the Regulated Charge, being *“a charge payable to SunWater for any service to be provided under this Agreement as set as a rate or charge or required to be charged for the Customer by SunWater, under any Law.”*

The relevant prices recommended by the QCA’s price paths form the basis of the Regulated Charges and, consequently, the Distribution Charges, which are charged to the relevant customers under the MDWSS. Any changes to the relevant prices as recommended by the QCA’s price paths therefore flow through to customers under SunWater’s Standard Channel SC.

A similar mechanism applies under SunWater’s Supply Contract River Standard Conditions Schedule 3 Version 2 (Standard River SC) in relation to the Water Charges which a customer must pay to SunWater for specified Release Services. Bulk water services are provided in accordance with the Standard River SC.

8.2.8.3 Changes to the Terms of a Supply Contract

Under both the Standard Channel SC and Standard River SC, SunWater may amend the terms and conditions of the contract on each five-year anniversary of the contract (i.e. the Review Date) provided SunWater has undertaken prior consultation with a customer (or group representing the customers) and provided three months’ notice to the customers.



If accepted by the customer in writing, then as and from the relevant Review Date, the relevant supply contract will be replaced by a new agreement with the new terms and conditions.

If the customer does not accept the new terms and conditions by the relevant Review Date, SunWater may:

- elect to continue to supply the relevant services on the existing terms or
- terminate the supply contract as and from the date of such notice.

8.3 Mareeba Dimbulah Water Supply Scheme

The Water Act provides that a water supply scheme is a water supply scheme for which a ROL or interim ROL licence has been issued.¹⁴ A ROL has been issued for the MDWSS (this replaced an Interim ROL which was issued in December 2004 and applied for an interim period until the ROL was issued in June 2005).

The MDWSS is owned and operated by SunWater in accordance with the Water Act, Barron Water Plan, Barron ROP (as deconstructed) and the ROL.

The existing hierarchy of water instruments recognise the MDWSS as follows:

- The Barron Water Plan includes the MDWSS within the Water Plan Area and specifies WASOs for high priority and medium priority water within the MDWSS.
- The Barron ROP is the primary document setting out details of the MDWSS. It lists details of the infrastructure which comprises the MDWSS as well as monitoring and reporting requirements for the ROL (this content has transitioned over to the ROL itself). The Barron ROP also sets out the following specifically for the MDWSS:
 - Operating rules
 - Environmental management rules
 - Water sharing rules (including carryover rules)
 - Water allocation change rules (including procedures for changing the purpose of water allocations); and
 - Seasonal water assignment rules.

This content is now taken to be included in the new instruments, with the environmental management rules included in the ROL, the operating rules, water sharing rules and seasonal assignment rules included in the Operations Manual and the water allocation change rules included in the Water Management Protocol.

The ROL for the MDWSS authorises Sunwater (as the licence holder) to interfere with the flow of water, to the extent necessary to operate the water infrastructure to which the licence applies in accordance with the Barron ROP.

The Scheme presently involves 204,000 ML of allocation for urban, irrigation or industrial use (45,000ML of which is held by SunWater for distribution losses).

Option 3 involves investing in the MDWSS to improve existing infrastructure such that 'distribution loss' water allocations can be converted to medium priority water allocations. Part 3 of the Barron ROP contains Water Allocation Change Rules, including identification of permitted and prohibited changes.

¹⁴ Water Act, schedule 4.



A two-step process would be involved in converting ‘distribution losses’ to ‘any’ purpose water allocations as follows:

1. Subdivision of the existing ‘distribution loss’ water allocation into two new water allocations – one would remain a ‘distribution loss’ and the other would be available for conversion.
2. This would be followed by conversion of one of the subdivided water allocations to ‘any’ purpose.

8.4 Water Infrastructure Delivery—Approvals, Land Access and Native Title

Quite apart from the water resource planning regulatory context discussed above, there will be a range of legal issues involved in the delivery of new infrastructure or modification to existing infrastructure relevant to some of the options.

These issues will be most significant for Option 4 i.e., a new Nullinga Dam, but may also have some relevance for Option 3 to the extent that option involves new infrastructure or modifications of existing infrastructure.

Delivery of any infrastructure project (including water related infrastructure) will require consideration of a range of issues including:

- environmental impact assessment for both Commonwealth and State purposes
- planning and environment approvals
- land access and compulsory acquisition issues
- native title and Aboriginal cultural heritage.

8.5 Detailed Consideration of Options

8.5.1 Option 2: Improve MDWSS Rules and Operation

The option under consideration involves reforming the existing MDWSS to improve efficiencies. The measures that might be implemented as part of this option include:

- 2A—Altering the water year to commence at a different time of year
- 2B—Altering existing carryover rules in the Scheme and link to improved water ordering practices
- 2C—Incentivise improved water ordering practices
- 2D—Improve access to peak flow entitlements by enabling greater flexibility through trading of peak flow entitlements
- 2E—Allow seasonal trading of any unused portion of the distribution loss allocation;
- 2F—Modify the existing Transmission and Operation Allowance.

Option 2A: Alter the Water Year

Under the Water Act and Water Regulation, the water year is effectively the accounting period for the relevant Water Plan, ROL, Operations Manual, water sharing rules or seasonal water assignment rules as stated in the relevant plan, manual, licence or rules.¹⁵

In this case, the water year for the MDWSS is currently defined in the ROP and is referenced as part of the water sharing rules – it is the period from 1 July to 30 June the following year. Following the deconstruction

¹⁵ Water Act, schedule 4; Water Regulation, section 142.



of the Barron ROP as of 6 December 2016, the water year is now deemed to be specified in the Operations Manual.

Changing the water year would require a change to the Operations Manual.

Option 2B: Alter the Carryover Rules and Improve Water Ordering Practices

Currently the carryover rules are set out in part two of the ROP as part of the Water Sharing Rules and the methodology published by SunWater for determining the volume of water permitted to be carried over by each water user. An application for a carryover is currently made pursuant to an application form maintained by SunWater. The form contains conditions under which the carryover is permitted. Automatic carryovers have been considered but are not favoured.

While automatic carryovers would immediately make a larger total volume available from the Scheme (which may or may not be taken up), it might also result in compromising the cap on water permitted to be carried over identified in section 28(2) of Part two of the ROP. It might also result in a reduction in the 'full to empty' period for Tinaroo Falls Dam which supplies the Scheme.

The preferred approach is to continue to require an application for carryover to be made consistent with the existing carryover rules but to link approval to improved water ordering history thereby helping to minimise system losses.

Linking carryover approval to improved water ordering has been suggested as a means of inducing better water ordering practices in the MDWSS. Existing entitlement holders can currently satisfy their entitlement (or part of it) from water sitting in channels without placing orders. SunWater accommodates the practice by ensuring there is sufficient water in the channels to allow this to occur. This in turn adds to system/distribution losses.

As the carryover rules are set out in the Water Sharing Rules of the Barron ROP, this content is now deemed to be part of the new Operations Manual for the MDWSS. As such, any changes to the carryover rules will need to be made by way of an amendment to the Operations Manual via the process outlined above. The process to amend the Water Supply Contract is set out in section 9.2.8.3 of this chapter. Such changes may include amending the condition that provides that the carryover arrangements for the water year stop when Tinaroo Falls Dam spills to instead provide that the carryover arrangements stop when Tinaroo Falls Dam stops overflowing.

Option 2C: Incentivise Water Ordering

This option is designed to prevent unnecessary releases of water which result in unnecessary losses linked to poor ordering practices in the Scheme.

Option 2D: Improve Access to Peak Flow Entitlements

Improving access to peak flow entitlements essentially relates to the capacity of the scheme channel system having been originally engineered on the basis of supplying 75mm of irrigation water to 50 per cent of what were then tobacco suitable soils over 12 days. A one in three roster system was assumed during design and implemented in the irrigation scheme.

The system operates on this three-day roster basis according to which, the water user takes three times the daily entitlements every three days to fill dams.

Some irrigators in the Scheme currently collaborate on an informal basis to take their design flow rate entitlement in ways which best suit their operations. These arrangements are purely informal. The proposal involves formal recognition of trading in design flow rate entitlement in the Scheme.



At present, the Water Sharing Rules in the Barron ROP do not contemplate trading of peak flows. SunWater's distribution rules and access conditions set out in its standard pipelines/channels contract outlines the peak flow arrangements for the MDWSS.

Amendments would need to be made to the Water Sharing Rules (which are now contained in the Operations Manual) to enable such trading to occur. The existing MDWSS ROL would also require amendment to set out requirements for SunWater to record details of the peak flow trading undertaken in a water year. Amendments would also need to be made to SunWater's distribution rules and access conditions in the Water Supply Contract to reflect the new peak flow trading arrangements. The process for making such amendments is set out in section 9.2.8.3 of this chapter.

Option 2E: Allow seasonal trading of any unused portion of the distribution loss allocation

Seasonal trading of a portion of the distribution losses allocation would allow unused water to go to productive use. The market would determine the highest and best use of the unused allocation, rather than it staying within Tinaroo Falls Dam and being incorporated into the next year's allocation.

Under the Water Act, seasonal water assignments of water managed under a ROL can only occur with the consent of SunWater (as ROL holder).¹⁶ The seasonal water assignment rules under the ROP (which are now set out in the Operations Manual) provide that a ROL licence holder must not approve a seasonal assignment of a water allocation if the purpose of that water allocation is 'distribution loss'.¹⁷ This prohibition would need to be removed to enable seasonal trading of distribution losses.

To go one step further and enable use for productive uses, the seasonal water assignment rules would also need to provide that a seasonally traded distribution loss may be used for any purpose.¹⁸

Seasonal water assignments are treated separately to water allocation dealings under the Water Act and Water Regulations. The latter include, among other things, changing the purpose for which water may be taken under an allocation – i.e. converting a 'distribution loss' allocation to an allocation to be available for 'any' purpose. There is no such process prescribed for seasonal water assignments, and in practice, the ability for seasonally traded distribution losses to be used for another purpose has been prescribed by a ROP. The Water Act may benefit from amendment to clarify that seasonal water assignment rules may allow an allocation to be used for the purposes prescribed by the Operations Manual.

The formula to be applied to calculate any unused portion of the distribution loss would need to be set out in the Operations Manual to provide transparency around the availability of this water from year to year.

Option 2F: Modify the existing Transmission and Operation Allowance

The Transmission and Operation Allowance (TOA) is set out in the ROP as an allowance for the river transmission operations expected to occur in running the system to the end of the water year – i.e. transmission losses. TAO varies with the announced allocation for medium priority water allocations and is linearly interpolated month by month under the ROP. The volume of the TOA comprises a large percentage of the volume of water allocation to be delivered within the Barron River and could be reviewed to confirm the actual requirement (which is suspected to be much less). Possible modification of the TOA essentially

¹⁶ Water Regulation, section 61.

¹⁷ Barron ROP, section 44(2).

¹⁸ An example of such rules can be found in the Fitzroy Basin Resources Operations Plan, September 2014, Amended September 2015.



involves altering the environmental flow objectives set out in the Barron Water Plan and altering the release volumes set out in the Barron ROP.

Bulk releases to the Barron River are required to be made under the Barron ROP to maintain specified daily flow volumes.¹⁹

Hydrological assessment may demonstrate that the entirety of these bulk releases are unnecessary for the purposes of achieving the EFOs and the WASOs, in which case, the bulk release flow volumes could be modified to ‘free up’ water for reallocation to use by irrigators. In any such assessment, the ecological outcomes of the Water Plan would need to be observed (see Barron Water Plan section 14).

This option would require amendment to the minimum and maximum river flow volumes set out in the Barron ROP. This content now forms part of the ROL so this document would require amendment in addition to the Barron Water Plan.

8.5.1.1 Water Act, Water Regulation and Water Instrument Changes

The changes that each of the Option 2 measures may require to the Water Act, the Water Regulation and the water instruments are outlined in Table 3.

Table 3 Option 2: Changes to Water Act, Water Regulation and Water Instruments

OPTIONS	WATER ACT & WATER REGULATION	BARRON WATER PLAN	BARRON ROP COMPONENT (AS DECONSTRUCTED)	MDWSS ROL
2A – Change the water year	No change.	No change.	Amend ‘water year’ definition set out in the Water Sharing Rules which are now taken to be an Operations Manual.	No change.
2B – Change the carryover rules	No change.	No change.	Amend carryover rules set out in the Water Sharing Rules which are now taken to be an Operations Manual.	Amend monitoring and reporting requirements for carryover rules which have transitioned from the ROP to the ROL to ensure they align with the new Operations Manual provisions.
2C – Incentivise water ordering	No change.	No change.	Amend carryover rules set out in the Water Sharing Rules which are now taken to be an Operations Manual. Amendment may also be required to SunWater’s Water Supply Contract as set out in section 8.5.1.	Amend monitoring and reporting requirements for carryover rules which have transitioned from the ROP to the ROL to ensure they align with the new Operations Manual provisions.

¹⁹ Barron ROP, Chapter 3, Part 1.



OPTIONS	WATER ACT & WATER REGULATION	BARRON WATER PLAN	BARRON ROP COMPONENT (AS DECONSTRUCTED)	MDWSS ROL
2D – Introduce trading of Design Flow Rate Entitlement	No change.	No change.	Potentially amend seasonal water trading rules which are now set out in the Operations Manual. ²⁰	Potentially amend reporting requirements to reflect any records to be maintained by SunWater about the peak flow trading.
2E – Allow seasonal trading any unused portion of the distribution loss allocation	Possible change to clarify seasonal water assignment rules may allow an allocation to be used for the purposes prescribed by an Operations Manual.	No change.	Remove prohibition on seasonally trading ‘distribution losses’ and insert provision allowing such water to be used for ‘any’ purpose. Also, insert formula for the calculation of unused ‘distribution losses’. See amendment process set out in section 8.5.1	Amend monitoring and reporting requirements for seasonal water assignments which have transitioned from the ROP to the ROL to include the volume of ‘distribution losses’ that remains unused in a water year, the volume of that allocation that is seasonally traded and the purpose for which is used. See amendment process set out in section 8.5.1
2F - Modify the existing Transmission and Operation Allowance	No change.	Amend EFOs to reflect modified releases.	Amend Environmental Management Rules which are now taken to be the Operations Manual. See amendment process set out in section 8.5.1	Possible amendment to reflect new bulk release requirements, including possible amendments to Environmental Management Rules. See amendment process set out in section 8.5.1

8.5.1.2 Pricing Issues

Option 2F: Modify existing Transmission and Operation Allowance

If Option 2F is adopted, the Chief Executive of DNRM would need to comply with sections 16 to 21 of the Water Regulation in relation to the release and sale of new water allocations relating to unallocated water resulting from the modification of the Transmission and Operation Allowance. Market forces will determine the sale price which the Chief Executive of DNRM is able to achieve in relation to the sale of new water allocations for available water created as a result of Option 2E.

Other Option 2 Measures

No pricing issues are expected under the other proposed measures in Option 2 as no capital costs are expected to be involved and no water allocations are expected to be created.

8.5.1.3 Approvals

No approvals issues arise for the various Option 2 measures as these only involve changes to the operation of the existing MDWSS rather than any physical works,

²⁰ It is assumed that such trading would only occur on a seasonal basis. To the extent that permanent water assignments were proposed for Design Flow Rate Entitlements, amendments would need to be made to Water Management Protocol.



8.5.1.4 Land Acquisition Issues

No land should need to be acquired for Option 2.

8.5.2 Option 3: Modernise MDWSS and Convert Losses

This option involves improvements to existing Scheme infrastructure generally in accordance with a range of measures to be identified by SunWater (in a preliminary way). These improvements would be intended to reduce system losses and would include new balancing storages.

This would be coupled with the conversion of SunWater’s existing 45,000 ML loss allocation (or part of it) to tradable medium priority allocations, pursuant to the two-step process described in section 9.3 of this chapter.

8.5.2.1 Water Act, Water Regulation and Water Instrument Changes

The changes that Option 3 will require to the Water Act, the Water Regulation and the water instruments are outlined in Table 4.

Table 4 Option 3: Changes to Water Act, Water Regulation and Water Instruments

OPTION	WATER ACT & WATER REGULATION	BARRON WATER PLAN	BARRON ROP COMPONENT (DECONSTRUCTED)	MDWSS ROL
Convert ‘distribution loss’ allocation to ‘any’ purpose allocation	While unlikely, possible change to Water Regulation section 73 to resolve ambiguity about conversions which increase consumptive pool of water.	Amend EFOs to reflect new flow levels. See amendment process set out in the Supplementary Report.	Amend to reflect increased supply levels available for ‘any’ purpose, medium priority water. See amendment process set out in the Supplementary Report.	Amend Environmental Management Rules which are now included in the ROL to reflect new environmental flow levels. See amendment process set out in the Supplementary Report.

8.5.2.2 Pricing Issues

Water Pricing: Sale or Trade of Converted Water Allocations

If Option 3 is adopted and part of SunWater’s existing water allocation in relation to distribution losses is converted to a medium priority water allocation for any purpose, SunWater will have the flexibility to sell, lease for a period of years or enter into seasonal water assignments in respect of all or part of that converted water allocation, subject to the rules and procedures in the Water Regulation and, to the extent applicable, the water management protocol for the Barron Water Plan.

SunWater would be able to enter into contracts to effect such dealings with the converted water allocation on terms determined by SunWater. As part of such dealings, SunWater can put in place contractual arrangements to facilitate customer pre-commitments. For example, such dealings may provide that the relevant sale, lease or seasonal assignment only takes effect upon the satisfaction of certain conditions precedent such as:

- sufficient demand being pre-committed
- if the customers are asked to pre-commit before finalisation of the detailed business case, completion of the detailed business case and relevant decision to proceed being made



- completion of the construction and commissioning of the relevant investments to the MDWSS.

Further, as noted in section 9.2.6.2, to the extent the dealing is:

- the transfer or lease of a water allocation then, unless the relevant Water Management Protocol or Operations Manual provides otherwise, the dealing is subject to:
 - the relevant public consultation process being undertaken
 - the approval of the Chief Executive of DNRM) being obtained
- a seasonal water assignment of a water allocation which is managed under a ROL, the dealing will be subject to the consent of the ROL licence holder being obtained.

In the QCA Report, to provide a positive incentive for SunWater to reduce distribution losses, the QCA recommended that the proceeds from the sale of a water allocation converted from water losses should be retained by SunWater and excluded from estimates of its maximum allowable revenue (MAR) although SunWater should be prohibited from ‘double charging’ through its annual water charges.

Water Pricing: NWI Pricing Principles

Option 3 will result in the development of new water assets to which paragraph 13 of the NWI Pricing Principles would apply.

In relation to the sale, lease or seasonal water assignments of all or part of SunWater’s converted water allocation, market forces will determine what SunWater is able to recover.

As noted in section 9.0, paragraph 23 of the NWI Pricing Principles states that ‘new contributed assets ... should be excluded or deducted from the RAB or offset using other mechanisms so that a return on and of the contributed capital is not recovered from customers’. The NWI Pricing Principles would apply to Option 3 in the event that funding from the NWIDF capital component contributed to this option.

QCA Price Paths

As noted in section 8.2.8, the current irrigation pricing policies outlined in the QCA irrigation price paths will continue until 30 June 2019. Therefore, to the extent investment in the MDWSS:

- results in capital costs, SunWater will need to make a relevant submission to the QCA to determine if:
 - an adjustment to the current price paths, or
 - an end of regulatory period revenue adjustment,
 can be made to allow for the recovery of:
 - the return of capital and;
 - the return on capital,
 in respect of those capital costs; or
- results in material changes to SunWater’s operation and maintenance costs or requires changes to the renewals annuity as originally forecast for the purposes of setting the price paths, SunWater will need to make a relevant submission to the QCA to determine if:
 - an adjustment to the current price paths; or
 - an end of regulatory period revenue adjustment,



can be made to allow for the recovery of such operation and maintenance costs or changes in the renewals annuity.

8.5.2.3 Approvals

The works associated with Option 3 which primarily involve construction of balancing storages, channel upgrades, conversion of channels to pipes and automation of gates, would be relatively confined in nature and are unlikely to require many approvals. Further investigation will determine the nature of the approvals required.

The limited approvals which are anticipated may be required include:

- Approval to clear vegetation under the *Vegetation Management Act 1999* (Qld) and an associated development permit for operational works for clearing native vegetation under the *Sustainable Planning Act 2009* (Qld).
- Development Permit for operational works for the construction of a referable dam under the *Sustainable Planning Act 2009* (Qld) and an associated Certificate of Failure Impact Assessment under the *Water Supply (Safety and Reliability) Act 2008* (Qld) (i.e. if applicable for the proposed balancing storages depending on their specific characteristics).
- Development Permit for operational works for constructing or raising waterway barrier works under the *Sustainable Planning Act 2009* (Qld).
- Development Permit for operational works for taking or interfering with water from a watercourse under the *Sustainable Planning Act 2009* (Qld).
- Development permit for reconfiguring a lot under the *Sustainable Planning Act 2009* (Qld) (e.g. if required to secure land tenure arrangements for balancing storage sites).
- Water permit under the *Water Act 2000* (Qld) to take water for temporary construction purposes.
- Riverine protection permit under the *Water Act 2000* (Qld) to excavate, place fill or destroy vegetation in a watercourse.
- Permit to interfere with native plants and animals (habitat) under the *Nature Conservation Act 1992* (Qld).
- Cultural heritage due diligence investigations.

A development permit for a material change of use under the Mareeba Shire Council Planning Scheme and *Sustainable Planning Act 2009* (Qld) is unlikely to be required, but an operational works permit for earthworks may be necessary.

8.5.2.4 Land Acquisition Issues

This option does not require additional land to duplicate existing channels or pipelines.

Land may be required for the construction of the proposed balancing storages. This tenure could be secured by ownership of the land or a long-term lease. An easement would not be sufficient security of tenure due to the long-term operation of the proposed works. If the land is currently held under a lease under the *Land Act 1994*, the existing permitted use might not allow it to be used for the purpose of balancing storage infrastructure.



8.5.3 Option 4: Nullinga Dam for Agricultural Use

Option 4 involves the construction of a new dam on the Walsh River, within the existing Water Plan Area. The dam option would involve construction of a dam (of presently indeterminate size and capacity) which would not initially at least, supply water into the MDWSS. Consequently, it would essentially create a new scheme in the planning area.

It should be noted that there is no provision for water reserved in the current ROP which would enable the dam to be built as part of the existing Scheme. Additionally, the environmental flow objectives for EFO nodes 10 and 11 are set at 99 per cent which would not allow the new dam to be built.

There are currently no unsupplemented water users in the area likely to be impacted by construction of the dam.

Table 5 Option 4: Changes to Water Act, Water Regulation and Water Instruments

OPTION	WATER ACT & WATER REGULATION	BARRON WATER PLAN	BARRON ROP COMPONENT (DECONSTRUCTED)	MDWSS ROL
Construct Nullinga Dam to meet pre-sold demand commitments	No change.	Amend to reflect new bulk water supply scheme for the Nullinga Dam (separate to the MDWSS).	Amend Operations Manual to reflect the new water supply scheme for the Nullinga Dam (separate to the MDWSS, but still within the one Operations Manual). Alternatively, a new Operations Manual could be prepared specifically for the Nullinga Dam.	No change to the MDWSS ROL, but a new ROL will be required for the new Nullinga dam infrastructure.

8.5.3.1 Pricing Issues

Water pricing: Sale of New Water Allocations and Customer Pre-commitments

If a new Nullinga Dam is constructed, the Barron Water Plan will need to be amended to provide for the increased volume of water which is available for allocation.

Presently the Barron Water Plan does not provide an alternative process for the release of unallocated water from the dam and therefore the Chief Executive of DNRM) would need to comply with sections 16 to 21 of the Water Regulation in relation to the release and sale of water allocations relating to unallocated water resulting from the new dam.

The Chief Executive of DNRM will then have the flexibility of selling the water allocations by public auction, tender or fixed price sale. Importantly, the Chief Executive of DNRM may decide the terms of sale. This flexibility regarding the terms of sale may be used to facilitate customer pre-commitments. For example, the water allocations may be sold subject to conditions precedent such as:

- sufficient demand being pre-sold
- if the customers are asked to pre-commit before finalisation of the detailed business case, completion of the detailed business case and relevant decision to proceed being made
- completion of the construction and commissioning of the Nullinga Dam.



Also, appropriate provision would need to be made in the contract for the sale of a water allocation for the purchaser of the water allocation and the dam's owner/proponent to enter into an appropriate supply contract as required by section 147 of the Water Act.²¹

Water pricing: NWI Pricing Principles

Option 4 will result in the development of new water assets to which paragraph 13 of the NWI Pricing Principles would apply.

Market forces will determine the sale price which the Chief Executive of DNRM) is able to achieve in relation to the sale of new water allocations for available water created as a result of the construction of the Nullinga Dam under Option 4.

Paragraph 23 of the NWI Pricing Principles states that 'new contributed assets ... should be excluded or deducted from the RAB or offset using other mechanisms so that a return on and of the contributed capital is not recovered from customers'.

QCA Price Paths

The construction of new bulk water assets, such as Nullinga Dam, has not been considered by the QCA in setting the relevant price paths for the MDWSS, or price paths independently of the Scheme. As a result, consideration will need to be given as part of a detailed business case for the Nullinga Dam as to whether the Minister should make a referral to the QCA under section 23 of the QCA Act in relation to the pricing practices relating to the Nullinga Dam to ensure the State's compliance with the NWI Pricing Principles (unless the State decides not to apply the NWI Pricing Principles in this case).

8.5.3.2 Approvals

A new dam will lead to the environmental impact, native title, land access and approvals issues discussed in section 9.4 of this chapter. Specific approvals anticipated to be required for Option 4 are set out in Table 6.

²¹ Water Act, section 147.



Table 6 Option 4: Approvals

APPROVAL	DESCRIPTION	LEGISLATION	TIMING	RESPONSIBLE AUTHORITY
COMMONWEALTH APPROVALS				
Approval of a 'controlled action'	If the construction or operation of the dam will have, or is likely to have, a significant impact on a matter of national environmental significance.	<i>Environment Protection & Biodiversity Conservation Act 1999 (Cth)</i> <i>Note: Engage Early – Guidance for proponents on best practice Indigenous engagement for environmental assessment under the EPBC Act 1999</i>	Post EIS if a 'controlled' action. Estimate 18 months for EIS after which approval would issue with conditions.	Department of Environment & Energy
STATE APPROVALS THROUGH THE INTEGRATED DEVELOPMENT ASSESSMENT SYSTEM (IDAS) APPLYING UNDER THE SUSTAINABLE PLANNING ACT 2009 (QLD)*				
Environmental Impact Statement (while not an approval in itself, the Coordinator-General's EIS Assessment Report may include conditions which apply to the approvals set out below and which may be applied directly to the project).	Required for infrastructure projects declared to be a 'coordinated project' under the <i>State Development and Public Works Organisation Act (Qld)</i> .	<i>State Development and Public Works Organisation Act (Qld)</i>	Estimate 18 months for EIS process.	Coordinator-General
Development permit for a material change of use for 'utility installation' or undefined use under local planning scheme	Likely to be required if no steps taken to remove need for assessment under planning scheme (see section 9.4 of this chapter).	<i>Sustainable Planning Act 2009 (Qld)*</i> <i>Sustainable Planning Regulation 2009 (Qld)*</i> Mareeba Shire Council Planning Scheme January 2016	Post EIS. Estimate 18 months for EIS process. While application can be made during EIS process no decision can be made until EIS assessment report complete. Preference is to await EIS outcome as this can affect how	Mareeba Shire Council



APPROVAL	DESCRIPTION	LEGISLATION	TIMING	RESPONSIBLE AUTHORITY
			<p>application is structured and supporting information.</p> <p>If required, and if application is code assessable estimate 4 months. If impact assessable estimate 10 months.</p>	
Environmental Authority for an Environmentally Relevant Activities (ERA)	<p>Prescribed ERA - ERA 16 (Extractive and screening activities).</p> <p>Other ERAs may also be involved (subject to more detailed assessment at later stages of planning)</p>	<p><i>Environmental Protection Act 1994</i> (Qld)</p> <p><i>Environmental Protection Regulation 2008</i> (Qld)</p>	<p>Post EIS but prior to construction.</p> <p>Application can be made while EIS progressing but cannot be decided until EIS assessment report completed.</p> <p>Estimate five months.</p>	Department of Environment and Heritage Protection, State Assessment Referral Agency
Development permit for operational works for clearing native vegetation	<p>Two stage process. First, application to be for a 'relevant purpose' under section 22A of <i>Vegetation Management Act 1999</i> (Qld) – relevant purpose includes clearing for coordinated project under <i>State Development and Public Works Organisation Act 1971</i> (Qld). Then, application for development permit for clearing of native vegetation. Offsets will apply.</p> <p>Not required if clearing is on land the subject of a CID.</p>	<p><i>Vegetation Management Act 1999</i> (Qld)</p> <p><i>Sustainable Planning Act 2009</i> (Qld)*</p> <p><i>Sustainable Planning Regulation 2009</i> (Qld)*</p>	<p>Post EIS but application can be made during EIS process. Application cannot be decided until after EIS assessment report.</p> <p>Estimate six months.</p>	Department of Natural Resources & Mines, State Assessment and Referral Agency (SARA)



APPROVAL	DESCRIPTION	LEGISLATION	TIMING	RESPONSIBLE AUTHORITY
Development permit for operational works for construction of a referable dam	Subject to failure impact assessment, Nullinga dam may be classified with a Category 1 or Category 2 failure impact rating under the <i>Water Supply (Safety and Reliability) Act 2008</i> (Qld) in which case it is a 'referable dam' for which a development permit is required under the <i>Sustainable Planning Act 2000</i> (Qld).	<i>Sustainable Planning Act 2009</i> (Qld)* <i>Sustainable Planning Regulation 2009</i> (Qld)* <i>Water Supply (Safety and Reliability) Act 2008</i> (Qld)	Post EIS. (as above)	Department of Energy & Water Supply, SARA
Development permit for operational works for constructing or raising waterway barrier works	Waterway barrier works may be undertaken at various locations as part of the project.	<i>Water Act 2000</i> (Qld) <i>Sustainable Planning Act 2009</i> (Qld)* <i>Sustainable Planning Regulation 2009</i> (Qld)* <i>Fisheries Regulation 2008</i> (Qld)	Post EIS. (as above)	Department of Agriculture and Fisheries, SARA
Development permit for operational works for taking or interfering with water from a watercourse, lake or spring	Construction of the Nullinga Dam is likely to involve the taking or interfering with water from a watercourse which triggers the requirement for a development permit under the <i>Sustainable Planning Act 2000</i> (Qld).	<i>Water Act 2000</i> (Qld) <i>Sustainable Planning Act 2009</i> (Qld)* <i>Sustainable Planning Regulation 2009</i> (Qld)*	Post EIS (as above)	DNRM, SARA
Development permit for the removal of quarry material from a watercourse	Extraction of sand, gravel and rock from the watercourse triggers a requirement for a development permit under the <i>Sustainable Planning Act 2000</i> (Qld).	<i>Water Act 2000</i> (Qld) <i>Sustainable Planning Act 2009</i> (Qld)* <i>Sustainable Planning Regulation 2009</i> (Qld)*	Post EIS (as above)	DNRM, SARA
Development permit for reconfiguring a lot	Lot reconfiguration may be required to secure appropriate tenure for the project.	<i>Land Act 1994</i> (Qld) <i>Sustainable Planning Act 2009</i> (Qld)*	As above and depending on sequencing of land acquisition.	Mareeba Shire Council



APPROVAL	DESCRIPTION	LEGISLATION	TIMING	RESPONSIBLE AUTHORITY
		<i>Sustainable Planning Regulation 2009 (Qld)*</i>		
Building works	Development application for works requiring assessment against the Building Act 1975 (Qld) and assessable against the Mareeba Shire Council Planning Scheme July 2016.	<i>Building Act 1975 (Qld)</i> <i>Sustainable Planning Act 2009 (Qld)*</i> <i>Sustainable Planning Regulation 2009 (Qld)*</i>	Post EIS (prior to construction) Estimate 4 months.	Mareeba Shire Council
STATE APPROVALS (NON IDAS)				
State Development Area approvals	If State Development Area declared, a Development Scheme will be required. This will replace local government planning scheme. SDA approval will be development permit under the Development Scheme.	<i>State Development and Public Works Organisation Act 1971 (Qld)</i>	Post EIS (see above) Estimate nine months (or less) depending upon whether Coordinator-General requires public consultation.	Coordinator-General
Cultural Heritage Management Plan	Required where an EIS is required for a project to manage potential impacts on items of Aboriginal cultural heritage significance.	<i>Aboriginal Cultural Heritage Act 2003 (Qld)</i>	Suggest parallel to EIS. Aboriginal parties likely to be interested in EIS as relevant stakeholders.	Department of Aboriginal and Torres Strait Islander Partnerships
Regional interests development approval	Final location selection may result in project impacting on a protected area of regional interest for which approval is required under the <i>Regional Planning Interests Act 2014 (Qld)</i> .	<i>Regional Planning Interests Act 2014 (Qld)</i>	Post EIS (prior to construction)	Department of Infrastructure, Local Government and Planning



APPROVAL	DESCRIPTION	LEGISLATION	TIMING	RESPONSIBLE AUTHORITY
Water Permit	Taking water for a temporary purpose (e.g. for construction)	<i>Water Act 2000</i> (Qld) Barron ROP	Post EIS (prior to construction)	DNRM, SARA
Riverine protection permit	To excavate, place fill or destroy vegetation in a watercourse (unless such works are exempt under the <i>Riverine Protection Permit Exemption Requirements</i>).	<i>Water Act 2000</i> (Qld) <i>Riverine Protection Permit Exemption Requirements</i>	Post EIS (prior to construction)	DNRM, SARA
Permit to clear native plants	A licence, permit or authority, or an exemption is required to 'take' protected plants.	<i>Nature Conservation Act 1992</i> (Qld) <i>Nature Conservation (Wildlife Management) Regulation 2006</i> (Qld)	Post EIS (prior to construction)	DEHP
Damage mitigation permit	Where the confirmed breeding place of a native animal that is endangered, vulnerable, near threatened or least concern wildlife species is tampered with by the project.	<i>Nature Conservation Act 1992</i> (Qld) <i>Nature Conservation (Wildlife Management) Regulation 2006</i> (Qld)	Post EIS (prior to construction)	DEHP
Species management program	Required to address large impacts where potential breeding places of endangered, vulnerable, near threatened or least concern species, or essential habitat for these species are involved.	<i>Nature Conservation Act 1992</i> (Qld) <i>Nature Conservation (Wildlife Management) Regulation 2006</i> (Qld)	Post EIS (prior to construction)	DEHP
Forestry Act Permit	Depending on the interference with State forests and/or State-owned forest products and/or quarry material, a sales permit may be required to dispose of forest products and/or quarry material.	<i>Forestry Act 1959</i> (Qld)	Post EIS (prior to construction)	Department of Agriculture and Fisheries
Allocation Notice	To authorise the removal of quarry material from a watercourse.	<i>Water Act 2000</i> (Qld)	Post EIS (prior to construction)	DNRM



APPROVAL	DESCRIPTION	LEGISLATION	TIMING	RESPONSIBLE AUTHORITY
Certificate of Failure Impact Assessment	Required to be undertaken for referable dams to determine whether the Nullinga dam has a Category 1 or Category 2 failure impact rating.	<i>Water Supply (Safety and Reliability) Act 2008</i> (Qld)	Post EIS (prior to submission of the application for a development permit for operational works for the dam under the <i>Sustainable Planning Act 2000</i> (Qld))	DEWS
Disposal permit to remove and treat or dispose of contaminated soil from land on the Environmental Management Register or Contaminated Land Register	Required if contaminated soil is to be removed from site.	<i>Environmental Protection Act 1994</i> (Qld)	Post EIS (prior to construction)	DEHP
Road corridor permit	Required to construct, maintain, operate or conduct ancillary works and encroachments on a State controlled road.	<i>Transport Infrastructure Act 1994</i> (Qld)	Post EIS (prior to construction)	DTMR, SARA
Approval to interfere with State controlled roads	Required for works on State controlled roads.	<i>Transport Infrastructure Act 1994</i> (Qld)	Post EIS (prior to construction)	DTMR, SARA
Approval to interfere with a local road	Approval for carrying out works on a road or interfering with a road or its operation.	<i>Local Government Act 2009</i> (Qld) <i>Local Law No. 1 (Administration) 2011</i>	Post EIS (prior to construction)	Mareeba Shire Council
Oversize load permit	Required for heavy machinery and oversized loads to be transported on the road network.	<i>Transport Infrastructure Act 1994</i> (Qld)	As needed during construction	Queensland Police Service
Flammable and combustible liquids licence	Required for the storage of flammable and combustible liquids on site during construction.	<i>Work Health and Safety Act 2011</i> (Qld)	Post EIS (prior to construction)	Queensland Treasury



APPROVAL	DESCRIPTION	LEGISLATION	TIMING	RESPONSIBLE AUTHORITY
Hazardous chemicals notification	Required where the use, handling or storage of hazardous chemicals at a workplace exceeds manifest quantities, or is a Major Hazard Facility	<i>Work Health and Safety Act 2011 (Qld)</i> <i>Work Health and Safety Regulation 2011 (Qld)</i>	Post EIS (prior to construction)	Queensland Treasury

***Note:** The *Sustainable Planning Act 2009 (Qld)* and the *Sustainable Planning Regulation 2009 (Qld)* are due to be replaced by the *Planning Act 2016 (Qld)* during the course of 2017. The approval concepts and requirements will remain largely the same as those under the existing legislation.



8.5.3.3 Land Acquisition Issues

This option does not currently require additional land to duplicate existing channels or pipelines.

Tenure would be required for the wall and associated structures and infrastructure of any new dam and the inundation area and flood margin.

Additional land may be required for construction/lay down. Access licenses or short-term leases are likely to be sufficient for those purposes.

A public utility easement may be used for water storage – but only for areas outside the storage area at full supply level.²²

8.6 Implications of Possible Local Management Arrangements

In 2012, the Queensland Government initiated an investigation into the feasibility of SunWater's eight channel irrigation schemes being transferred to local ownership and management. This culminated in the *Water (Local Management Arrangements) Amendment Act (LMA Act)* being passed by the Queensland Parliament on 16 February 2017.

The LMA Act will amend the Water Act to introduce a new chapter 4A which will facilitate the transfer of the business, assets and liabilities of SunWater in relation to a 'declared channel scheme' to an 'irrigation entity' and for the divestment of the irrigation entity from the State. The transfer of each 'declared channel scheme' will be subject to agreement on transfer terms and sufficient customer support.

Each of the Emerald, Eton, St George and Theodore channel schemes is a 'declared channel scheme'. The MDWSS is not currently a declared channel scheme, however, it may subsequently be declared to be one by regulation.

An 'irrigation entity' is a corporation established for the purposes of the transfer of a declared channel scheme and to which the State provides financial support, under a funding arrangement, for the corporation to undertake the transfer of the declared channel scheme.

We understand that the State is establishing special purpose vehicles, each of which will be owned by the State, to which the relevant declared channel scheme will be transferred. Following such transfer, ownership of the relevant special purpose vehicle will pass to customers of the declared channel scheme under an arrangement being managed by the State.

Customers of the MDWSS are currently preparing a revised business proposed for submission to the State. Consideration of this business proposal will inform the State with regards to the MDWSS becoming a 'declared channel scheme'.

The potential transfer of the MDWSS to local ownership is relevant in the circumstances where Option 3 is adopted and capital improvements are made to the MDWSS infrastructure.

It is possible that transfer of the MDWSS may occur prior to, during the course of, or following completion of the implementation of Option 3.

If the transfer of the MDWSS to local ownership were to occur prior to implementation of Option 3 then it would be up to the 'irrigation entity' which then owned the MDWSS as to whether and, if so, how it would proceed with Option 3.

²² Land Act, section 362(5); Land Title Act, section 82(5).



If the transfer of the MDWSS were to occur during the implementation of Option 3, the new chapter 4A of the Water Act would allow the Minister, by a gazette notice, to transfer any contracts which may have been entered into by SunWater in relation to the implementation of Option 3 including any agreement for the sale, lease or seasonal water assignment of all or part of the water allocation to be converted from the existing losses allocation.

If the transfer of the MDWSS to local ownership were to occur after the completion of Option 3, the 'irrigation entity' would be transferred ownership of the enhanced MDWSS infrastructure but would also likely assume all liabilities of SunWater relating to those scheme enhancements, e.g. any loan from the Commonwealth.

Therefore, it will be important to ensure that the water charges determined to be payable by customers following implementation of Option 3 are sufficient to allow SunWater, and potentially a locally owned 'irrigation entity' to meet all of its liabilities in relation to the Option 3 improvements.

For the purposes of Option 4, it is considered premature in the Preliminary Business Case to consider possible local management arrangements. Option 4 does not yet involve consideration of a new distribution system.

8.7 Risks and Issues for Later Consideration

This section identifies some possible risks and other issues arising out of the foregoing discussion that may require more detailed consideration at later stages of the business case and planning processes.

8.7.1 Option 2: Improve MDWSS Rules and Operation

- Identify scope of work required to support creation of new allocation if modification of TOA is to be pursued and new allocation created as a result.
- Setting preconditions on carryover entitlement, related to water ordering may prove contentious, from a water user point of view in particular and give rise to legal challenge.
- Depending on how contentious the proposed measure becomes, the regulator may also see it as problematic.
- With Option 2F, the proposed modification of environmental flows, for which there is no current allocation in the scheme, but which is regulated by the Water Plan in a way that might give rise to a new allocation being created in favour of SunWater will need to be preceded and supported by significant hydrological and ecological evidence. It will be necessary to demonstrate that the EFO Objectives in section 14 of the Water Plan will not be compromised.

Other stakeholders, such as NGO's, catchment groups, recreational users and traditional owners may also see that particular measure as contentious giving rise to the risk of legal challenge. Depending upon the extent of the proposed modification the regulator may also have some difficulty with what is proposed.

Consequently, the approach to this measure should ideally, be conservative and be undertaken with appropriate consultation.

8.7.2 Option 3: Modernise MDWSS and Convert Losses

Identify scope of work required to support subdivision/change application for existing distribution loss allocation.

As with aspects of Option 2, Option 3 will need to be supported by convincing information dealing with the extent to which the proposed works will result in savings to distribution losses.



It may be possible to demonstrate this in advance of the relevant applications by modelling. However, the greater likelihood is that the works will first need to be constructed then the applications (subdivision and conversion) will need to be made. This raises the risk of the capital investment being made without the hoped-for return being guaranteed, namely the successful conversion of the distribution loss allocation. Some discussion with the regulator will need to be undertaken prior to implementing this option to defray this risk to the extent possible bearing in mind that the regulator, as a matter of administrative law could not commit to any particular decision ahead of an application being made.

8.7.3 Option 4: Nullinga Dam for Agricultural Use

If Option 4 proceeds to a Detailed Business Case (now or in the future), due diligence to be undertaken in respect of possible new supply contracts to determine if the supply contracts are on the same terms and conditions as the Standard Channel SC or Standard River SC for the existing MDWSS to avoid possible perception of one scheme being treated very differently to another.

A tenure and native title audit should be conducted to identify the land required for the project and the current ownership of, and interests (including native title), in the relevant land and waters.

Undertake more detailed consideration of approvals pathway in terms of options described in section 9.5 and in table 6.

Prepare a coordination plan for environmental assessment, consultation with stakeholders, consultation with traditional owners in particular, land identification and acquisition strategy, approvals and water instrument issues.

8.7.4 Generally

Review required amendments to water instruments having regard to particular options chosen including sequencing of amendments.

Identify technical (hydrological, ecological) data required to support amendments and prepare program for preparation of same.



Table 7 Deconstruction and Transition of Water Resource Operations Plans and Resource Operations Plans

ORIGINAL INSTRUMENT	CONTENT	NEW INSTRUMENT
Water Resource Plan	All content.	Water Plan
Resource Operations Plan	Water supply scheme provisions relevant to: <ul style="list-style-type: none"> ▪ Monitoring and reporting arrangements ▪ Infrastructure details, including any full supply level stated in the ROP ▪ Authority to use water courses to distribute water ▪ Environmental management rules ▪ Matters relating to the implementation of, and compliance with, the ROP. 	Resource Operations Licence
	Water supply scheme provisions relevant to: <ul style="list-style-type: none"> ▪ Operating rules (excluding the authority to use watercourses to distribute water) ▪ Water sharing rules ▪ Seasonal water assignment rules. 	Operations Manual (applies to supplemented water)
	Provisions stating the responsibilities for the holder of a distribution operations licence (other than the responsibilities of the resource operations licence holder under an Operations Manual).	Distribution Operations Licence
	Provisions relevant to: <ul style="list-style-type: none"> ▪ ROP zones, including water management area zones and water supply scheme zones ▪ Water management areas, subcatchment areas or sub artesian areas ▪ The criteria and process for granting, refusing, amending or otherwise dealing with water licences, other than the criteria and process for deciding applications for a seasonal water assignment or for relocation of a water licence ▪ The volume(s) of unallocated water reserved or available to be released. 	Water Plan
	<ul style="list-style-type: none"> ▪ Provisions that have not found a new home under one of the above instruments <u>and</u> deal with a matter relevant to the usual content of a water management protocol (i.e. the management of unsupplemented water, although an exception is water trading rules for both supplemented and unsupplemented water). 	Water Management Protocol (generally applies to unsupplemented water)
	Provisions that have not found a home under any of the above instruments.	No new instrument – provisions cease to have effect.



CHAPTER 9

MARKET CONSIDERATIONS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

9	MARKET CONSIDERATIONS	2
9.1	Purpose	3
9.2	Market Sounding	3
9.3	Market Feedback	3
9.4	Conclusion	8

TABLES

Table 1	Market Feedback on Potential Options for Water Supply	5
Table 2	Marsden Jacob Associates – Evaluation of Options Based on Market Feedback	6



9 MARKET CONSIDERATIONS

CHAPTER SUMMARY AND CONCLUSIONS

- Market sounding was undertaken as part of the demand assessment and Stakeholder Reference Group via industry representatives. The market sounding process assisted to understand the key demand drivers, level of interest in making an additional volume of water available to the market, market feedback on potential options for water supply and willingness to pay for additional water.
- The key demand drivers for agriculture are dry conditions and water security, changes in crop profile and industry growth, in particular, MSF Sugar's expansion plans. Demand is impacted by a number of matters, including, water costs, electricity costs, capacity constraints in the distribution infrastructure, crop selection and maturity, different irrigation practices and biosecurity threats.
- Market feedback indicated that interest in additional water allocations is expressly subject to price.
- Market feedback indicated the options analysis should consider the interrelationship of components within the entire system rather than individual options in isolation. Specific comments included:
 - Option 1: Do minimum (Base Case): Water trading and efficient water use methods are already happening and should be prioritised ahead of Nullinga Dam or another bulk water source.
 - Option 2: Improve MDWSS rules and operation: Large commercial irrigators were supportive of this option but expressed proper modelling and consideration of implications of each sub-option is important and the potential for Local Management Arrangements in scheme and resulting impacts should be considered.
 - Option 3: Modernise MDWSS and convert losses: There was general support for this option. Interest for new water allocations will be based on price – particularly for lower value crops. More needs to be done to prove up the concept, options, price and market the water e.g. sale or lease of allocations, pay-back period for investment. This is a cheaper option for new water allocations than Nullinga Dam.
 - Option 4: Nullinga Dam for agricultural use: Demand for water allocations from this option will depend on where water can be delivered to, the cost of developing land for irrigation and prevailing water and commodity market conditions at the time. A river delivery dam option (no distribution system) makes sense, but the design should consider future connection to MDWSS.
- Advance Cairns, the peak regional advocacy and economic development agency in Tropical North Queensland, submitted to the Stakeholder Reference Group that Cairns urban water supply should have been considered in the Nullinga Dam option. This is inconsistent with CRC's Cairns Water Supply Strategy.
- Willingness to pay surveys indicated a price range of \$1,500 to \$4,000 per ML for new water allocations. This price was dependent on crop type and location, with sugarcane at the lower end.



9.1 Purpose

This chapter summarises market considerations related to the service need and shortlisted options.

A separate market sounding process was undertaken to inform the proposed procurement strategy. The approach and outcomes of this process are documented in Chapter 17.

9.2 Market Sounding

9.2.1 Objectives

A market sounding process was undertaken with key regional stakeholders to assist in understanding:

- the key demand drivers in the region
- the level of interest in making an additional volume of water available to the market
- market feedback on potential options for water supply
- the willingness to pay for additional water.

9.2.2 Approach

Market sounding was undertaken as part of the demand assessment by MJA and Jacobs. Market information was also obtained through the Stakeholder Reference Group process.

The MJA market sounding exercise assessed demand for additional water in the region and potential options to meet the identified demand. MJA carried out the market sounding in a two-stage process over the period October 2016 to November 2016 as follows:

- Stage 1—Consultation with a range of stakeholders to understand demand drivers in the region and potential supply options to address that demand.
- Stage 2—One-on-one interviews with key stakeholders to consider specific water supply options and their willingness to pay for additional water.

Following the MJA assessment, Jacobs peer reviewed the MJA assessment. This involved consultation with a range of irrigators in the MDWSS over the period January and February 2017.

The Stakeholder Reference Group contained representatives from a wide variety of local government, industry and economic development groups in the region. Some Stakeholder Reference Group members also participated in the market sounding process. Market sounding was undertaken via the Stakeholder Reference Group to test the following issues:

- the water supply problem and opportunities in the region
- preliminary findings on water demand and a range of potential water supply options.

Organisations that participated in the market sounding process included representatives from local government, industry and economic development groups, and large scale commercial irrigators.

9.3 Market Feedback

9.3.1 Key Demand Drivers for Agricultural Water

The market feedback indicated there are three key agricultural demand drivers in the region:

- Dry conditions and water security—Persistent low rainfall since 2012–13 has resulted in higher than average level of water utilisation and emerging water security concerns by irrigators. Recent dry



conditions mean that the current system utilisation exceeds 80 per cent, which is above the water security buffer generally desired by irrigators.

- Crop profile—Changes in crop profile in the region to higher value permanent plantings, e.g. avocados and bananas. These crops require high water security and increasing amounts of water, especially as plantings mature, so their demand for water allocations will continue to grow.
- Industry growth—In particular, MSF Sugar, an integrated grower, processor, marketer and exporter of raw sugar with potential for expansion.

The demand for water is, however, impacted by a number of matters, including:

- the cost of water (if it is too expensive it will not benefit anyone)
- the cost of electricity (e.g. pumping) for both the distribution system customers, and irrigators' own on-farm costs
- capacity constraints in the distribution infrastructure
- crop selection and maturity (water use increases for maturing perennial crops)
- different types of irrigation practices (e.g. drip)
- biosecurity threats (e.g. disease in bananas).

The majority of industry representatives expressed an expectation that utilisation of water allocations would increase and were confident there is room for agricultural expansion in the region by moving to higher value crops.

9.3.2 Interest in Additional Water Available to Market

MSF Sugar was considered to be the major driver behind any significant growth in demand for additional water. Other large scale commercial irrigators also indicated a potential demand for new water allocations, if they eventuate. Overall, a short-term water demand for 14,000 ML was identified and, should a series of conditions eventuate, a potential future demand of 72,000 ML was identified.

The interest in new additional water allocations is expressly subject to price.

9.3.3 Market Feedback on Potential Options for Water Supply

Market sounding participants generally expressed the following outcomes would be achieved from a new water supply in the region:

- Water security for users
- Certainty for future investment
- Growth in domestic and international markets for the regional economy.

Feedback on the different options presented as part of market sounding is summarised in Table 1.



Table 1 Market Feedback on Potential Options for Water Supply

OPTION	MARKET FEEDBACK
General	<ul style="list-style-type: none"> ▪ Must consider the interrelationship of components within the entire system rather than individual options in isolation
Do minimum	<ul style="list-style-type: none"> ▪ Water trading is already happening ▪ The majority of irrigators in the region have already adopted efficient water use methods ▪ Savings to date have been taken up by production growth and increases in water intensive, high-value crops ▪ These measures should be prioritised ahead of Nullinga Dam or another bulk water source
Improve MDWSS rules and operation	<ul style="list-style-type: none"> ▪ Large commercial irrigators were supportive of this option ▪ Proper modelling and consideration of implications of each sub-option is important and to test the cumulative impact of changes ▪ Crop mix and the potential for full utilisation should be considered ▪ Considering hydrology, rainfall and farming patterns of the region, amending the water year to start in the first 1–5 months of the calendar year should be looked at ▪ Water ordering can be improved ▪ Support for review of current carryover provisions to enable greater flexibility and use of this water ▪ In practice, the scheme still operates as though water is attached to land and to access peak flow rights (ML per day entitlements) large commercial irrigators are still purchasing land with which such rights are associated ▪ Consideration of this option should include potential for Local Management Arrangements in scheme and impacts
Modernise MDWSS and convert losses	<ul style="list-style-type: none"> ▪ General support for option from all participants ▪ Interest in new water allocations for this option will be based on price – particularly for lower value crops compared with higher value crops ▪ More needs to be done to prove up the concept, options, price and market the water e.g. sale or lease of allocations, pay-back period for investment ▪ Release of additional water allocations onto the market may drive price down ▪ Likely to be progressive take up as infrastructure works are completed and losses are converted ▪ Cheaper option for new water allocations than Nullinga Dam because it can be progressively implemented—most efficient use of available resources
Nullinga Dam for agricultural use	<ul style="list-style-type: none"> ▪ Demand for water allocations from this option will depend on: <ul style="list-style-type: none"> – where water can be delivered to – the cost of developing land further for irrigation – prevailing water and commodity market conditions at the time ▪ Whether dam is economically viable will depend on costs and benefits of different sizes. Bigger dam can lead to more water for more users ▪ Water quality is a concern. Walsh River catchment is different to the Barron catchment ▪ Efficiency of river delivery needs to be considered. Not the same system as current delivery in MDWSS, the yield of Nullinga Dam may be affected by losses incurred through river delivery. ▪ ‘Bulk only’ option without distribution system makes sense, but design should consider future connection to MDWSS. Water will only be accessible to river frontage land unless private infrastructure is developed. There are potential conflicts in private distribution systems as opposed to delivery infrastructure owned and operated by the water service provider ▪ Given comparative yield to Tinaroo Falls Dam, the Nullinga Dam option may not be the ‘silver bullet’



In addition to the above, Advance Cairns submitted to the Stakeholder Reference Group that Cairns urban water supply should have been considered in the Nullinga Dam option. In making this submission, Advance Cairns suggested that there should have been a comparative analysis of Cairns Water Security Strategy medium-term initiatives and Nullinga Dam and that these are not mutually exclusive options. Advance Cairns also suggested the Nullinga Dam option in this form does not provide a long-term solution for Cairns urban water supply.

As indicated in Chapter 4, there are considerable complexities in Nullinga Dam providing an additional water supply for Cairns. Furthermore, the progression of Council owned and operated options identified in the Cairns Water Security Strategy is considered to be a matter for CRC and not a matter for consideration in this PBC.

9.3.4 Willingness to Pay for Additional Water and Cost-Effectiveness

Differing results were reported from market sounding about the willingness to pay for additional water allocations.

9.3.4.1 Marsden Jacobs Associates

MJA’s consultation on willingness to pay made the following findings:

- Anecdotal evidence suggests the price of additional water allocations is currently about \$2,700 per ML for permanent transfers, which is the implied willingness to pay for new water allocations.
- Sugarcane growers in general would have the lowest willingness to contribute towards the cost of new water supply options, likely around \$1,500 per ML for additional water allocations,¹ although larger operations could potentially afford to pay a higher price.
- Growers of higher value crops such as avocados and bananas may be willing to pay about \$2,500 to \$2,700 per ML for additional water allocations, and potentially more for high priority water entitlements.

MJA’s conclusions from this analysis are set out in Table 2.

Table 2 Marsden Jacob Associates—Evaluation of Options Based on Market Feedback

OPTION	COST EFFECTIVENESS	CAPACITY TO MEET FUTURE DEMAND	LEVEL OF USER FUNDING TOWARDS TOTAL COST	COMMENTS	NEXT STEPS
Water trading	High	Low	High	Does not provide additional water supply and is rated low in relation to capacity to meet future demand However, permanent transfers of water can support expansion of higher value crops and temporary transfers of water can provide short term water security	Consider improvement in transparency and ease of trading

¹ Based on information provided by DAF, the gross margin for cane growers range from \$1,500 to \$2,500 per hectare, which is about \$150 to \$250 per ML of water.



OPTION	COST EFFECTIVENESS	CAPACITY TO MEET FUTURE DEMAND	LEVEL OF USER FUNDING TOWARDS TOTAL COST	COMMENTS	NEXT STEPS
On-farm water use efficiency measures	Low	Low	Medium	Does not rate highly on any criteria Majority of irrigators in the region have already adopted water efficient methods – limiting the volume of water to be gained Greater proportion of SunWater’s water charges are fixed rather than variable and irrigators may have less incentive to invest in water efficiency technologies ² . Irrigators may require some incentives to invest in more efficient technologies as the potential cost of \$4,000 per ML exceeds the implied willingness to pay	Not recommended
System loss conversion	High	Medium	High	Cost-effective option to address water security concerns Irrigators would likely be able to fund the total cost of the project at a cost of \$2,000 to \$3,500 per ML	Proceed to next stage analysis – engineering and hydrology study including cost estimates
Nullinga Dam	Low	High	Low	Without a firm commitment from industry about expansion plans and government demonstrating that a subsidy would support the achievement of net economic public benefits, Nullinga Dam is not justified at this time Expensive option and a substantial government contribution would be required	Proceed to next stage analysis only if industry provides firm commitment on expansion plans

Source: Marsden Jacob Associates

9.3.4.2 Jacobs

Jacobs’s consultation on the willingness to pay for new water allocations indicated:

- At current scheme annual charges, generally stakeholders agreed that the new going rate was \$2,500 per ML including for sugarcane.
- Some sugarcane growers indicated a willingness to pay of \$2,000 to \$3,000 per ML for MP allocations.

² Mareeba Dimbulah Water Supply Scheme http://www.sunwater.com.au/_data/assets/pdf_file/0018/19053/Fees_-And-Charges_Schedule_-_Mareeba_2016-17.pdf



- Horticulture/tree crop business indicated that water was worth \$3,000 to 4,000 per ML in general terms particularly on existing irrigation areas with highly productive soils and in particular in areas where MDWSS delivery capacity is constrained (e.g. East Barron channel).

These values are higher than those reported to MJA. This may be due to the fact MJA consultation was undertaken in October-November 2016 and Jacobs's consultation was undertaken in early 2017.

9.4 Conclusion

The market sounding has indicated that there is demand for new MP water allocations within the region, but that it is significantly price sensitive. The market feedback also expressed the source and release of any new water allocations needs to be considered in combination with the current system.

Based on the feedback received, there is general support for Option 2 and Option 3, and Option 3 appears to be cost-effective and affordable for irrigators.

In comparison, the market sounding indicates that the ability to deliver the Nullinga Dam option will require some level of government subsidy in order to be affordable to irrigators in the region.



CHAPTER 10

PUBLIC INTEREST CONSIDERATIONS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

10	PUBLIC INTEREST CONSIDERATIONS.....	2
10.1	Purpose	3
10.2	Defining the Public Interest	3
10.3	Impact on Stakeholders	3
10.4	Stakeholder Consultation and Social Licence	6
10.5	Public Access and Equity	7
10.6	Consumer Rights	7
10.7	Safety and Security	8
10.8	Privacy	8
10.9	Conclusion	8

TABLES

Table 1	Regional Key Stakeholders—Interest in or Impacts of Shortlisted Options	4
Table 2	Queensland Key Stakeholders—Interest in or Impacts of Shortlisted Options.....	5
Table 3	National Key Stakeholders—Interest in or Impacts of Shortlisted Options.....	6
Table 4	Public Access Aspects of Each Shortlisted Option	7
Table 5	Equity Aspects of Each Shortlisted Option	7
Table 6	Consumer Rights Considerations for Each Shortlisted Option.....	7

FIGURES

Figure 1	Stakeholder Group Categories	4
----------	------------------------------------	---



10 PUBLIC INTEREST CONSIDERATIONS

CHAPTER SUMMARY AND CONCLUSIONS

- Initial public interest effectiveness criteria are met through all shortlisted options conforming to Australian Government objectives including developing Northern Australia and providing water security to sustain agricultural industries and boost jobs and regional development.
- Additional public interest effectiveness criteria are met through all shortlisted options conforming to the Queensland Government planning objectives including developing water infrastructure/additional supplies in the order of the State Infrastructure Plan hierarchy: reform (Option 2), better use of existing (Option 3); and new build (Option 4). For this reason, it is considered that the options should be prioritised in this order.
- All three options will have a range from limited to significant impacts on key stakeholders, including customers and the local community (although most are positive).
- Stakeholder consultation identified a clear need for additional water for agricultural growth with many additional benefits identified.
- There is significant social licence for all shortlisted options to proceed, however, a limited to moderate number of local stakeholders have been consulted to date.
- Option 2: Improve MDWSS rules and operation will impact mainly on existing irrigation customers, SunWater and various Queensland Government Departments. Marginal increases in production will have minor impacts on various other stakeholders.
- Option 3: Modernise MDWSS and convert losses will impact mainly on existing irrigation customers and other irrigators within existing scheme boundaries. It will increase the volume of production and have moderate positive flow on effects for local processors. It may impact on local tourism operators and raise environmental concerns for the local community. Option 3 will place greater pressure on SunWater (or a local management entity) to deliver the project including capital works, convert losses with government and deliver water in accordance with scheme rules. Government processes will ensure that this is done appropriately.
- Option 4: Nullinga Dam for agricultural use will impact on landholders living in the inundation area, residents of the Walsh River catchment and potentially downstream communities. Construction will impact on residents and on local infrastructure. It will raise limited, moderate and potentially some significant environmental considerations.
- Option 4 will greatly increase irrigated agricultural production area and values in the area and place demands on SunWater (or another proponent) and the Queensland and Australian Government departments as part of their role in seeking, assessing and making planning and other approvals.
- Public access is not a consideration for Options 2 and 3. Public access to Nullinga Dam (Option 4) for recreational purposes was identified by stakeholders as a legitimate matter for discussion – as the community may seek Nullinga Dam as a potential source of increased amenity and tourism.
- Equity concerns for all options focus on the ability of elderly, non-English speaking and disadvantaged members of the community to participate in further planning and consultation exercises.



10.1 Purpose

The purpose of this chapter is to assess whether the shortlisted options are in the public interest and to ensure that, on balance, they provide equitable outcomes for all stakeholders.

10.2 Defining the Public Interest

The Queensland Office of the Information Commissioner states:

Public interest considerations are those affecting the good order and functioning of the community and government affairs, for the well-being of citizens.

Public interest considerations are generally common to all members of, or a substantial segment of, the community, as distinct from matters that concern private or personal interests. However, some public interest considerations can apply for the benefit of an individual.’POF¹

Public interest considerations are initially based around the effectiveness of the shortlisted options (individually) in meeting government objectives.

The shortlisted projects each conform to broad government objectives in terms of developing Northern Australia and providing water security to sustain agricultural industries and boost jobs and regional development.

To further refine the public interest aspects of the options under consideration, this chapter identifies stakeholders with an interest in the project and provides an assessment of:

- Potential impacts of the shortlisted options on these stakeholders
- Public access and equity issues
- Consumer rights
- Security
- Privacy.

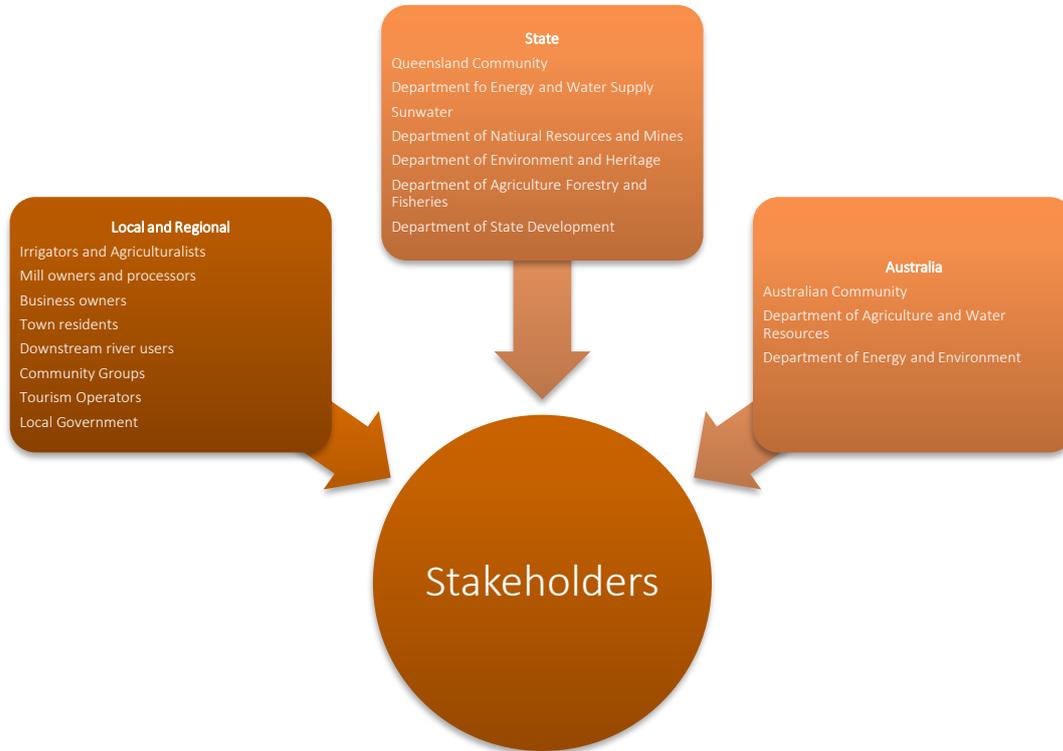
10.3 Impact on Stakeholders

A stakeholder is defined as any person who may be impacted directly or indirectly by the project and/or who may have an interest or influence over the success of the project. Stakeholders associated with the project have been broadly categorised as shown in Figure 1.

¹ Queensland Office of the Information Commissioner, *Public Interest Balancing Test*, <https://www.oic.qld.gov.au/guidelines/for-government/access-and-amendment/decision-making/public-interest-balancing-test>, accessed 27 January 2017



Figure 1 Stakeholder Group Categories



Tables 1 to 3 outline the potential interests and impacts on stakeholders identified for each option. Table 1 outlines *regional* considerations for each shortlisted option. Table 2 outlines *statewide* considerations for each shortlisted option. Table 3 outlines *national* considerations for each shortlisted option.

Table 1 Regional Key Stakeholders—Interest in or Impacts of Shortlisted Options

STAKEHOLDER	DESCRIPTION	INTEREST IN OR IMPACTS OF PROJECT		
		OPTION 2	OPTION 3	OPTION 4
Irrigators and Agriculturalists	Irrigators and other land holders undertaking agricultural activities in the boundaries of the MDWSS	Changes in long established water use and behaviours to maximise water usage and production	Access to greater volumes of water to increase production levels. Potential land resumption	Access to significantly greater volumes of water and potential expansion into new sites for irrigation. Loss of access to property Land resumption
Mill owners and processors	Owners of sugarcane and fruit processing enterprises in the Tablelands agricultural area	Marginal interest mainly from integrated grower processor perspective	Greater volume of product for processing	Far greater volume of product for processing and additional value adding
Business Owners	Owners of businesses that	Minor interest mainly from incremental	Minor demand from new infrastructure	Major demand from new infrastructure



STAKEHOLDER	DESCRIPTION	INTEREST IN OR IMPACTS OF PROJECT		
		OPTION 2	OPTION 3	OPTION 4
	support irrigation activities	increase in demand from improved scheme performance	construction activities	construction activities
Town Residents	Residents in towns and surrounding areas in Tablelands Agricultural area	No impact	Changes to flow regimes in local creeks and waterways. Potential loss of supply in some areas	Disruption of normal activities, additional traffic and employment opportunities
Downstream River Users	Residents and agriculturalists in downstream areas of Walsh River	No impact	Minor impacts	Significant impacts from damming of Walsh river and changes in river hydrology and land use patterns
Community Groups	Community groups active in the MDWSS	No impact	Impacts on Mareeba wetlands may raise concerns	Environmental impacts from dam may raise significant community concerns
Tourism Operators	Tourism operators active in the MDWSS	No impact	Impacts on Mareeba wetlands may affect existing tourism businesses	Environmental impacts from dam may impact on tourism operations
Local Government	Mareeba and Tableland Local Governments	No impact	Minor impacts from increased planning and development applications	Major impacts from construction and operational phases of project including impacts on local infrastructure

Table 2 Queensland Key Stakeholders—Interest in or Impacts of Shortlisted Options

STAKEHOLDER	INTEREST IN OR IMPACTS OF PROJECT		
	OPTION 2	OPTION 3	OPTION 4
Queensland community	No impact	Greater production and employment Minor concern over environmental impacts	Potential Queensland Government subsidy Far greater production and employment Major concern over environmental impacts



STAKEHOLDER	INTEREST IN OR IMPACTS OF PROJECT		
	OPTION 2	OPTION 3	OPTION 4
SunWater	Short-term impacts on staffing and management from rule changes Need for engagement, equity and transparency in establishing scheme reform	Medium-term impacts on staffing and management from loss reduction program Need for engagement, equity and transparency in establishing loss reduction production	Significant organisational impacts
DAF DEWS DNRM DEHW DSD	Need to redefine scheme rules requiring additional resourcing	Minor impacts. Changes to loss allocation framework	Alteration of Water Resource Plans Significant role in dam and environmental approvals Soil capability mapping Regional planning

Table 3 National Key Stakeholders—Interest in or Impacts of Shortlisted Options

STAKEHOLDER	INTEREST IN OR IMPACTS OF PROJECT		
	OPTION 2	OPTION 3	OPTION 4
Australian Community	No impact	Greater production and employment Concern over environmental impacts	Far greater production and employment Major concern over environmental impacts
Department of Agriculture and Water Resources Department of Energy and Environment	No impact	Potential funding support for construction	Funding support for construction. Major role in environmental approvals process

10.4 Stakeholder Consultation and Social Licence

It is not possible to determine a social licence for the shortlisted options from the consultation undertaken for the PBC, however a number of observations can be made:

- There is broad stakeholder acceptance of the identified drivers for urban growth (population and tourism). However, the agricultural drivers also need to consider other factors, such as electricity costs, distribution infrastructure, irrigation types and crop types.
- Stakeholders agree that water trading and water efficiency (on farm and system-wide) measures should be priorities, as they are already well-used tools.
- There is an expectation these options be considered as a system rather than in isolation, and that interrelationships between options are considered.



- There is broad stakeholder acceptance of Nullinga Dam, or other bulk water source. However, the comparative yield of Nullinga Dam and Tinaroo Falls Dam resulted in an observation that Nullinga Dam may not provide the ‘silver bullet’ solution that some stakeholders were expecting.
- There is an appreciation that construction of a bulk water source requires a considerable lead time for impact assessment and approvals processes to occur. Stakeholders expect that these lead times will be considered.

Broader consultation beyond regionally based individuals and organisations will be required to test the wider social licence considerations. Stakeholder consultation has been targeted and conducted at a regional level. A full business case for any of the three shortlisted options would need a far broader scope of consultation.

10.5 Public Access and Equity

Issues regarding public access and equity aspects of the shortlisted options are addressed in Tables 4 and 5.

10.5.1 Public Access

Table 4 Public Access Aspects of Each Shortlisted Option

OPTION	PUBLIC ACCESS ASPECTS
Option 2	No public access impacts identified.
Option 3	Limited public access impacts identified. Some minor potential impacts during construction phase. Additional infrastructure will have limited public access.
Option 4	Significant public access issues during construction phase. New dam may have potential for recreation and enhanced public access when completed.

10.5.2 Equity

Table 5 Equity Aspects of Each Shortlisted Option

OPTION	EQUITY ASPECTS
Option 2	Consultation identified that a minority of existing irrigation licence holders are elderly or from non-English speaking backgrounds. Consultation regarding scheme rule changes will need to account for vulnerable groups.
Option 3	Similar to Option 1—broader consideration will need to be given to ensure equitable treatment in terms of siting of new infrastructure. Equity considerations in terms of sale of water need to also be considered.
Option 4	Groups downstream of dam may be from disadvantaged backgrounds and unable to participate fully in the consultation process without additional support. Equity consideration in sale of water to also be considered.

10.6 Consumer Rights

Issues regarding consumer rights aspects for each of the options are addressed in Table 6.

Table 6 Consumer Rights Considerations for Each Shortlisted Option

OPTION	CONSUMER RIGHTS CONSIDERATIONS
Option 2	Changes in scheme rules could potentially impact on existing consumer and customer rights.
Option 3	Changes to irrigation patterns because of loss reduction technologies will impact on existing drainage irrigation patterns.
Option 4	Potential compulsory land acquisition.



10.7 Safety and Security

The project will be developed to address applicable security, health and safety requirements. The regulatory and legislative frameworks that may inform the reference project within a detailed business case include:

- *Aboriginal Cultural Heritage Act 2003 (Qld)*
- *Building Act 1975 (Qld)*
- *Disability Discrimination Act 1992 (Qld)*
- *Environment Protection & Biodiversity Conservation Act 1999 (Cth)*
- *Environmental Protection Act 1994 (Qld)*
- *Fisheries Regulation 2008 (Qld)*
- *Forestry Act 1959 (Qld)*
- *Land Act 1994 (Qld)*
- *Local Government Act 2009 (Qld)*
- Mareeba Shire Council Planning Scheme January 2016
- *Nature Conservation Act 1992 (Qld)*
- *Regional Planning Interests Act 2014 (Qld)*
- *Sustainable Planning Act 2009 (Qld)*
- *Transport Infrastructure Act 1994 (Qld)*
- *Vegetation Management Act 1999 (Qld)*
- *Water Act 2000 (Qld)*
- *Water Supply (Safety and Reliability) Act 2008 (Qld)*
- *Water Reform and Other Legislation Amendment Act 2014*
- *Water (Local Management Arrangements) Amendment Act 2017*
- *Work Health and Safety Act 2011 (Qld).*

10.8 Privacy

Information received from the public during the PBC stakeholder consultation process will be treated in accordance with the *Information Privacy Act 2009 (Qld)*.

10.9 Conclusion

Initial public interest effectiveness criteria are met through all shortlisted options conforming to Australian Government objectives including developing Northern Australia and increasing agricultural production.

In addition, public interest effectiveness criteria are met through all options conforming to the Queensland Government planning objectives including developing water infrastructure/additional supplies in the order of the SIP hierarchy: reform (Option 2), better use of existing infrastructure (Option 3); and new build (Option 4).

All three shortlisted options will have a range from limited to significant impacts on key stakeholders, including customers and the local community (although most are positive).



Stakeholder consultation identified a clear need for additional water for agricultural growth with many additional benefits identified.

It is not possible to determine a social licence for the shortlisted options from the consultation undertaken for the PBC. Stakeholder consultation has been targeted and conducted at a regional level only. A full business case for any of the three shortlisted options would need a far broader scope of consultation.

Option 2: Improve MDWSS rules and operation will impact mainly on existing irrigation customers, SunWater and various other Queensland Government departments. Marginal increases in production will have minor impacts on various other stakeholders.

Option 3: Modernise MDWSS and convert losses will impact mainly on existing irrigation customers and other irrigators within existing scheme boundaries. It will increase the volume of agricultural production and have moderate positive flow on effects for local processors. It may impact on local tourism operators and raise environmental concerns for the local community. Option 3 will place greater pressure on SunWater (or a local management entity) to deliver the project including capital works, convert losses with government and deliver water in accordance with scheme rules. The government's processes will ensure that this is done appropriately.

Option 4: Nullinga Dam for agricultural use will impact on landholders living in the inundation area, residents of the Walsh River catchment and potentially downstream communities. Construction will impact residents and local infrastructure. It will raise limited, moderate and potentially some significant environmental considerations.

Option 4 will greatly increase irrigated agricultural production area and values in the area and place demands on SunWater (or another proponent) and the Queensland and Australian Government departments as part of their role in seeking, assessing and making planning and other approvals.

Public access is not a consideration for Option 2 and 3. Public access to Nullinga Dam (Option 4) for recreational purposes was identified by stakeholders as a legitimate matter for discussion – as the community may seek Nullinga Dam as a potential source of increased amenity and tourism.

Equity concerns for all options focus on the ability of elderly, non-English speaking and disadvantaged community members to participate in further planning and consultation exercises.



CHAPTER 11

SUSTAINABILITY CONSIDERATIONS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

11	SUSTAINABILITY CONSIDERATIONS	2
11.1	Purpose	2
11.2	Overview	2
11.3	Approach	2
11.4	Sustainability Assessment – Results	3
11.5	Conclusion	6

TABLES

Table 1	Sustainability Contribution Rating Table	3
Table 2	Option 2 Sustainability Assessment.....	3
Table 3	Option 3 Sustainability Assessment.....	4
Table 4	Option 4 Sustainability Assessment.....	5
Table 5	Summary of the Sustainability Assessment.....	6



11 SUSTAINABILITY CONSIDERATIONS

CHAPTER SUMMARY AND CONCLUSIONS

- A sustainability assessment has been conducted to identify and document sustainability considerations relevant to the shortlisted options.
- Each option was assessed against its potential contribution to the thirteen sustainability goals listed in the Building Queensland BCDF.
- Option 2 Improve MDWSS rules and operation has been assessed as having the least impact on sustainability goals which is reasonable given the reform nature of that option.
- Option 3 Modernise MDWSS and convert losses and Option 4 Nullinga Dam for agricultural use have very similar impacts on sustainability as both options have a level of uncertainty, including positive and negative impacts.
- While Option 4 has stronger positive impacts on sustainability, this is offset by two major negative impacts in relation to preserving healthy landscapes and loss of habitats and biodiversity.
- Option 3 has fewer positive impacts and three medium negative sustainability goal impacts related to preserving healthy landscapes, biodiversity and the liveability and amenity of urban centres.
- On balance, the preliminary sustainability assessment has identified that Option 4 has a stronger positive impact on sustainability goals but would benefit from a detailed business case stage assessment.

11.1 Purpose

The purpose of this chapter is to identify sustainability considerations relevant to the shortlisted options.

11.2 Overview

Using a sustainability assessment assists with documenting the economic, social and environmental impacts of the project, not just its financial performance. This chapter outlines the:

- approach taken to complete the sustainability assessment
- results of the sustainability assessment for each shortlisted option, presented against thirteen sustainability goals to demonstrate the impacts of the options on key economic, environmental and social dimensions.

11.3 Approach

The sustainability assessment considered the extent the options contribute to the relevant sustainability goals presented in the Building Queensland BCDF. Information gathered in the economic, social and environmental chapters is used as the basis for this assessment.

Each option was assessed against each goal and scored according to the criteria in Table 1.



Table 1 Sustainability Contribution Rating Table

SUSTAINABILITY IMPACT CONTRIBUTION	DESCRIPTION
Uncertain Impact	Based on current data, there is significant uncertainty about the impact of the option on the goal
No Impact	Option makes no impact of the sustainability goal
Minor Positive Impact	Option makes a minor positive impact of the sustainability goal
Medium Positive Impact	Option makes a medium positive impact of the sustainability goal
Major Positive Impact	Option makes a major positive impact of the sustainability goal
Minor Negative Impact	Option makes a minor negative impact of the sustainability goal
Medium Negative Impact	Option makes a medium negative impact of the sustainability goal
Major Negative Impact	Option makes a major negative impact of the sustainability goal

11.4 Sustainability Assessment—Results

This section presents the sustainability assessment and outcomes (results) for each shortlisted option.

11.4.1 Assessment of Option 2: Improve MDWSS Rules and Operation

The assessment of Option 2 against each of the sustainability goals is presented in Table 2.

Table 2 Option 2 Sustainability Assessment

SUSTAINABILITY GOAL	RATING	COMMENT
1. A diverse and resilient economy	Minor positive	Implementation of option will marginally increase regional production.
2. Higher levels of productivity and economic efficiency	Minor positive	Implementation of option will increase level of agricultural production and efficient use of water allocations.
3. Increased trade or exports	Minor positive	Implementation of option will increase level of agricultural production and exports.
4. More competitive industries	No impact	No impact positive or negative expected.
5. Fairer distribution of income	No impact	No impact positive or negative expected.
6. Improved public safety	No impact	No impact positive or negative expected.
7. Social cohesion and inclusion	Uncertain impact	Dependent on implementation method of option may be socially divisive or inclusive.
8. Equity	No impact	No impact positive or negative expected.
9. Preserving healthy landscapes	No impact	No impact positive or negative expected.
10. Reducing the loss of habitat and biodiversity	No impact	No impact positive or negative expected.
11. Increasing the efficient use of energy and water resources	Medium positive	Will increase amount of production without changing allocation.
12. Protecting sites with heritage, indigenous and cultural values	No impact	No impact positive or negative expected.



SUSTAINABILITY GOAL	RATING	COMMENT
13. Enhancing the liveability and amenity of urban centres	No impact	No impact positive or negative expected.

11.4.2 Outcomes for Option 2

Option 2 has three medium positive impacts in relation to increasing productivity and efficiency, increasing exports and increasing the efficiency of energy and water use. Option 2 has one minor positive impact relating to a diverse and resilient economy.

The Option 2 impact on social cohesion and inclusion is considered unknown at this stage.

Option 2 is considered to have no impact on the majority of the sustainability goals assessed.

11.4.3 Assessment of Option 3: Modernise MDWSS and Convert Losses

The assessment of Option 3 against each of the sustainability goals is presented in Table 3.

Table 3 Option 3 Sustainability Assessment

SUSTAINABILITY GOAL	RATING	COMMENT
1. A diverse and resilient economy	Medium positive	Option 3 will add to the overall productivity of the region and may encourage the establishment of further diversification and processing options.
2. Higher levels of productivity and economic efficiency	Medium positive	Implementation of Option 3 will significantly boost production in the existing irrigation area.
3. Increased trade or exports	Medium positive	Implementation of Option 3 will significantly boost production in the existing irrigation area.
4. More competitive industries	Medium positive	Increases in water availability will add to the competitiveness of regional industries.
5. Fairer distribution of income	Uncertain	Dependent on hiring and employment practices of regional agriculturalists.
6. Improved public safety	Minor positive	Implementation of water loss reduction strategies may lead to some covered channels marginally increasing public safety in the irrigation area.
7. Social cohesion and inclusion	Minor positive	Loss reduction program appropriately implemented may add to sense of place and common cause.
8. Equity	Minor positive	Greater volumes of water availability may encourage greater long-term investment and intergenerational benefit.
9. Preserving healthy landscapes	Medium negative	Loss reduction activities will potentially impact on Mareeba wetlands.
10. Reducing the loss of habitat and biodiversity	Medium negative	Loss reduction activities will potentially impact on Mareeba wetlands.
11. Increasing the efficient use of energy and water resources	Major positive	Significant reduction in amount of water lost in irrigation scheme. Water and electricity efficiency gains.



SUSTAINABILITY GOAL	RATING	COMMENT
12. Protecting sites with heritage, indigenous and cultural values	Uncertain	Dependent on sites for additional infrastructure such as balancing storages.
13. Enhancing the liveability and amenity of urban centres	Medium negative	Any resulting additional water from efficiency gains being taken up within the existing MDWSS reduces the availability of this option as a future longer-term option for urban water supply in Cairns.

11.4.4 Outcomes for Option 3

Option 3 has three major positive impacts on sustainability goals related to increased levels of production, export growth and the efficient use of water and energy resources. Option 3 has two medium positive impacts related to a diverse and resilient economy and more competitive industries. Option 3 has two minor positive impacts related to social cohesion and equity.

The impact of Option 3 on income distribution and sites with heritage, indigenous and cultural values was considered uncertain.

Option 3 has three medium negative sustainability goal impacts related to preserving healthy landscapes, biodiversity and the liveability and amenity of urban centres.

11.4.5 Assessment of Option 4: Nullinga Dam for Agricultural Use

The assessment of Option 4 against each of the sustainability goals is presented in Table 4.

Table 4 Option 4 Sustainability Assessment

SUSTAINABILITY GOAL	RATING	COMMENT
1. A diverse and resilient economy	Major positive	Option 4 will potentially deliver a significant boost in agricultural production. The construction phase of the dam will add to economic diversity while additional production may support regional processing.
2. Higher levels of productivity and economic efficiency	Major positive	Option 4 will potentially deliver a significant boost in agricultural production.
3. Increased trade or exports	Major positive	Option 4 will potentially deliver a significant boost in agricultural production including goods for export.
4. More competitive industries	Medium positive	Increases in water availability will add to the competitiveness of regional industries.
5. Fairer distribution of income	Uncertain	Dependent on hiring and employment practices of regional agriculturalists.
6. Improved public safety	Minor negative	Large dam in upper catchment increases public safety risk in event of catastrophic failure. Failure considered unlikely.
7. Social cohesion and inclusion	Uncertain	Significant uncertainty in terms of degree of acceptance of dam locally, regionally, state-wide and nationally.
8. Equity	Medium positive	Greater volumes of water availability may encourage greater long-term investment and intergenerational benefit.
9. Preserving healthy landscapes	Major negative	Dam will inundate a significant area and create downstream impacts on existing aquatic habitats and biodiversity.



SUSTAINABILITY GOAL	RATING	COMMENT
10. Reducing the loss of habitat and biodiversity	Major negative	Dam will inundate a significant area and create downstream impacts on existing habitats and biodiversity.
11. Increasing the efficient use of energy and water resources	No impact	
12. Protecting sites with heritage, indigenous and cultural values	Uncertain	Based on current information significant uncertainty regarding the impact of the option on the goal exists. No indigenous heritage values study has been completed.
13. Enhancing the liveability and amenity of urban centres	No Impact	There is no identified need for Nullinga dam as a potential future option in Cairns water security strategy. However, Nullinga Dam may provide for a future longer term supply option if demand developed above what has been identified to date.

11.4.6 Outcomes for Option 4

Option 4 has three major positive impacts on sustainability goals in relation to a diverse and resilient economy, higher levels of economic productivity and increased trade and exports. Option 4 has three medium positive impacts in terms of more competitive industries, equity and enhancing the liveability of urban centres.

The impact of Option 4 on the distribution of income, social cohesion and inclusion and sites of heritage, indigenous and cultural values were considered uncertain.

Option 4 has one minor negative impact in terms of public safety. Option 4 has two major negative impacts on sustainability goals in relation to preserving healthy landscapes and loss of habitats and biodiversity.

11.5 Conclusion

Table 5 provides a summary of the sustainability assessment conducted on all three options.

Table 5 Summary of the Sustainability Assessment

SUSTAINABILITY IMPACT CONTRIBUTION	OPTION 2 – IMPROVE MDWSS RULES AND OPERATION	OPTION 3 - MODERNISE MDWSS AND CONVERT LOSSES	OPTION 4 – NULLINGA DAM FOR AGRICULTURAL USE
Uncertain Impact	✓	✓✓	✓✓✓
No Impact	✓✓✓✓✓✓✓✓		✓
Minor Positive Impact	✓✓✓	✓✓	
Medium Positive Impact	✓	✓✓✓✓	✓✓✓
Major Positive Impact		✓	✓✓✓
Minor Negative Impact			✓



Medium Negative Impact		✓✓✓	
Major Negative Impact			✓✓

The table above provides a summary of the sustainability assessment conducted on all three options as follows:

- Option 2 has been assessed as having the least impact on sustainability goals which is reasonable given the reform nature of that option.
- Option 3 and Option 4 have very similar impacts on sustainability as both options have a level of uncertainty, positive impacts and negative impacts.
- While Option 4 has stronger positive impacts on sustainability, this is offset by two major negative impacts in relation to preserving healthy landscapes and loss of habitats and biodiversity.
- Option 3 has fewer positive impacts but three medium negative sustainability goal impacts related to preserving healthy landscapes, biodiversity and the liveability and amenity of urban centres.

On balance, the preliminary sustainability assessment has identified that Option 4 has a stronger positive impact on sustainability goals but would benefit from a detailed business case assessment.



CHAPTER 12

SOCIAL IMPACT EVALUATION

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

12	SOCIAL IMPACT EVALUATION.....	2
12.1	Purpose	3
12.2	Social Base Case (Social Baseline)	3
12.3	Stakeholder Engagement Summary	8
12.4	Preliminary Assessment of Social Impacts of Each Option	12
12.5	Option 4: Nullinga Dam for Agricultural Use	20
12.6	Conclusion	24

TABLES

Table 1	Estimated Regional Population by Age.....	4
Table 2	Tablelands Agricultural Region Religious Profile.....	5
Table 3	Level of Schooling Achieved.....	5
Table 4	Non-School Qualifications by Field of Study.....	6
Table 5	Employment by industry – Tablelands Agricultural Region and Queensland 2011.....	7
Table 6	Option 2—Beneficial Material Social Impacts.....	13
Table 7	Option 2—Detrimental Material Social Impacts.....	14
Table 8	Option 2—Social Opportunity and Impact Risk Assessment.....	15
Table 9	Option 3—Beneficial Material Social Impacts.....	16
Table 10	Option 3—Detrimental Material Social Impacts.....	17
Table 11	Option 3—Social Opportunity and Impact Risk Assessment.....	19
Table 12	Beneficial Material Social Impacts of Option 4.....	20
Table 13	Option 4—Detrimental Material Impacts.....	21
Table 14	Option 4—Social Opportunity and Risk Assessment.....	23
Table 15	Summary Table of Material Social Impacts.....	24



12 SOCIAL IMPACT EVALUATION

CHAPTER SUMMARY AND CONCLUSIONS

- The study area for the purpose of the social impact evaluation is the Tablelands Agricultural area, which is defined as the boundaries of the Mareeba and Tablelands local government areas.
- Population growth in the study area is slower than Queensland. The area has an ageing population and a high percentage of Indigenous residents. Levels of education are lower than the average for Queensland and there is a high degree of socio-economic disadvantage. Regional average incomes are lower than the average for Queensland. The unemployment rate for the region was 10.2 per cent in the September quarter of 2016 compared to 6.1 per cent for Queensland.
- Agriculture is the largest employer in the region and is central to the character and identity of the region. Stakeholder engagement revealed strong support for agricultural growth projects. Stakeholders noted additional water supply would enable future agricultural investment and other associated economic opportunities in the region.

Option 2: Improve MDWSS rules and operations

- Option 2 has two low beneficial material social opportunity impacts, three medium beneficial social opportunity impacts and two high beneficial social impact opportunities. Option 2 key beneficial impacts generally relate to additional employment and regional growth.
- Option 2 has six low detrimental social impacts, one medium detrimental social impact and zero high detrimental social impacts. Option 2 detrimental impacts relate to changes to existing business practices and processes.

Option 3: Modernise MDWSS and convert losses

- Option 3 has three low beneficial material social opportunity impacts, three medium beneficial social opportunity impacts and two high beneficial social impact opportunities. Option 3 key beneficial impacts centre on additional employment and regional growth.
- Option 3 has one low detrimental social impact, 11 medium detrimental social impacts and four high detrimental social impacts. Option 3 detrimental impacts focus on impacts from competition for additional water supply, foreign ownership, changes to existing flow regimes for domestic supplies and impacts on the Mareeba wetlands and associated tourism and cultural values.

Option 4: Nullinga Dam for agricultural use

- Option 4 has one low beneficial material social opportunity impact, three medium beneficial social opportunity impacts and six highly beneficial social impact opportunities. Option 4 key beneficial impacts centre on additional employment and regional growth during the construction period and from ongoing agricultural expansion.
- Option 4 has three low detrimental social impacts, 11 medium detrimental social impacts and seven high detrimental social impacts. Option 4 detrimental impacts focus on the impacts on downstream communities from flow alterations, large scale land use change, pressure on existing infrastructure, and land acquisition. Social conflict resulting from a large on-stream dam on the Walsh River may occur given potential impacts on threatened species and likely impacts on community and cultural values associated with the Mitchell River and the Gulf of Carpentaria.



12.1 Purpose

The purpose of this chapter is to present the preliminary social impacts arising from each of the shortlisted options.

All three shortlisted options occur in the Tablelands Agricultural area that is defined by the boundaries of the Mareeba Shire Council and the Tablelands Regional Council (DAFF 2016). Accordingly, the Tablelands Agricultural area is the study area for the purpose of the social impact evaluation.

A regional social profile for the study area is initially presented to establish the operating context for each of the shortlisted options. Following this, a summary of the outcomes of the stakeholder consultation process is presented and the potential social impacts are considered.

12.2 Social Base Case (Social Baseline)

Overview

Population growth in the study area is slower than Queensland. The area has an ageing population and a high percentage of Indigenous residents. Levels of education are lower than the average for Queensland and there is a high degree of socio-economic disadvantage. Regional average incomes are lower than the average for Queensland and unemployment is significantly higher. Agriculture is the largest employer in the region and is central to the character and identity of the region.

This social baseline presents detailed information on the study area.

The area is located in Far North Queensland and covers an area of 65,009 square kilometres.

Agriculture is the dominant land use in the area and the most intensive agricultural activity occurs on the elevated eastern highlands. Mining is a relatively minor component of the economic profile of the study area in comparison. Tourism is a growing activity in the study area based around natural features and food. Major towns in or close to the study area are Mareeba, Ravenshoe, Malanda, Kuranda, Herberton and Atherton. Smaller towns are Chillagoe, Dimbulah, Irvinebank, Julatten, Millaa Millaa, Mt Garnett, Mt Molloy, Mutchilba, Tolga, Walkamin and Yungaburra.

While the study area has been extensively cleared for agriculture, there remain several remnants of rainforest that are protected in national parks. Cairns is the closest large regional centre with extensive social and economic infrastructure such as hospitals and ports.

12.2.1 Population

At 30 June 2015, the estimated resident population of the study area was 46,830 persons.¹

The population of the study area grew at a lower rate than Queensland, with average population growth at 0.9 per cent over the five years to June 2015 and 1.2 per cent over the ten years. This is compared to 1.6 per cent and 2.0 per cent over the five and ten years to June 2015 respectively for Queensland.

By June 2036, the population of the study area is projected to increase to 56,968 persons, an average increase of 0.9 per cent per year.² This is below the average population growth for Queensland as a whole over the same period (at 1.7 per cent per annum).

¹ Queensland Government Statisticians Office 2017

² Queensland Government Statisticians Office 2017



12.2.2 Age

The study area has an older population with a high median age and a high proportion of elderly people. The following table shows the population age distribution and indicates a higher proportion of residents aged 65 years or older (19.8 per cent) in comparison to the rest of Queensland (14.4 per cent).

Table 1 Estimated Regional Population by Age

	0-14		15-24		25-44		45-64		65+	
	Number	per cent	Number	per cent	Number	per cent	Number	per cent	Number	per cent
Mareeba (s)	4,209	19.3	2,401	11.0	5,242	24	6,019	27.6	3,962	18.1
Tablelands	5,167	20.7	2,636	10.5	4,708	18.8	7,166	28.7	5,320	21.3
Region	9,376	20	5,037	10.8	9,950	21.2	13,185	28.2	9,282	19.8
Queensland	943,992	19.8	647,983	13.6	1,327,470	27.8	1,173,195	24.5	686,214	14.4

Source: ABS 3235.0 Population by Age and Sex regions of Australia 2015

The median age of the region in 2015 was 43.6 years compared to the median age for the rest of Queensland of 36.9 years. The median age for the region increased from 40.8 years as at 30 of June 2005 to 43.6 in 2015 compared to an increase in the median age across Queensland from 35.9 years in 2005 to 36.9 years in 2015. The median age of the population within the region is projected to increase to 49.6 years in June 2036 in comparison to the projected median age for Queensland in 2036 of 39.9 years³.

The median age of the population is growing faster than the rest of Queensland and this trend is predicted to continue. In the future, based on trends, there will be an older population with a continued decline in the proportion of younger working people.

12.2.3 Indigenous Population

Based on the 2011 Census of Population and Housing, 10.3 per cent of the regional population identified as Indigenous (with Mareeba having the largest percentage of Indigenous persons with 13.4 per cent) compared to 3.6 per cent for Queensland⁴.

12.2.4 Ethnicity and Language

Based on the 2011 Census of Population and Housing, 14.5 per cent of people in the region were born overseas in comparison to 20.5 per cent for Queensland overall. 32.8 per cent of the population indicated that they spoke a language other than English at home in comparison to 36 per cent for Queensland overall. Information from the Queensland Government Statisticians Office indicates the top non-English language spoken at home to be Italian, with 2.9 per cent of the total regional population speaking Italian at home⁵.

12.2.5 Religion

Table 2 shows the religious profile of the region. 61.4 per cent of the population in the study area indicated that they were affiliated with a Christian religion compared to 64.3 per cent of the Queensland population overall.

³ Queensland Government Statisticians Office 2017

⁴ Queensland Government Statisticians Office 2017

⁵ Queensland Government Statisticians Office 2017



Table 2 Tablelands Agricultural Region Religious Profile

RELIGIOUS AFFILIATION	PERCENTAGE
Catholic	25.0 per cent
No Religion	23.7
Anglican	16.0
Uniting Church	6.1
Presbyterian and Reformed	3.5

Source: ABS 3235.0 Population by Age and Sex regions of Australia 2015

12.2.6 Families and Housing

Within the study area there were 16,237 households. 68.9 per cent of total households were a one family household. The majority of the housing stock (89.4 per cent) is defined as separate houses. The percentage of total occupied private dwellings in the study area that were fully owned was 41.1 per cent⁶.

12.2.7 Department of Social Services Payments

7,137 residents received the age pension. 2,025 received the disability support pension. 2,620 received the Australian Government's Newstart allowance⁷.

12.2.8 Education

Education levels in the study area are lower than for the rest of Queensland. The table below summarises the highest level of schooling achieved.

Table 3 Level of Schooling Achieved

AREA	DID NOT GO TO SCHOOL OR YEAR 8 OR BELOW		YEAR 9 OR 10 OR EQUIVALENT		YEAR 11 OR 12 OR EQUIVALENT		TOTAL number
	number	per cent	number	per cent	number	per cent	
Mareeba (s)	1,850	12.0	4,924	32.0	6,553	42.6 p	15,378
Tablelands	1,813	10.0	6,719	37.0	7,875	43.4	18,155
Total Region	3,663	10.9	11,643	34.7	14,428	43.0	33,533
Queensland	219,102	6.6	977,116	29.4	1,836,995	55.3	3,320,761

Source: ABS Census of Population and Housing 2011

In terms of higher education 9.9 per cent of people aged over 15 held a Bachelor degree or higher compared to 15.9 per cent for the Queensland population. Similarly, 6.3 per cent held an Advanced Diploma or Diploma compared to 7.5 per cent for the Queensland population while 20.7 per cent held a certificate in comparison to 19.9 per cent for Queensland overall (ABS 2011).

⁶ Queensland Government Statisticians Office 2017

⁷ Queensland Government Statisticians Office 2017



Table 4 Non-School Qualifications by Field of Study

FIELD OF STUDY	REGION		QUEENSLAND
	Number	%	%
Natural and Physical Sciences	395	2.2	2.3
Information Technology	132	0.7	2.2
Engineering and Related Technologies	3,178	17.8	16.8
Architecture and Building	1,222	6.8	6.6
Agriculture Environment and Related Studies	750	4.2	2.0
Health	1,561	8.7	9.3
Education	1,497	8.4	7.5
Management and Commerce	1,864	10.4	16.6
Society and Culture	1,348	7.5	9.6
Creative Arts	345	1.9	2.8
Food, Hospitality and Personal Services	966	5.5	5.6
Mixed Field Programs	29	0.2	0.2
Total	17,859	100	100

ABS, Census of Population and Housing, 2011

12.2.9 Socio-economic Index of Areas

Socio-Economic Indexes of Areas is a summary measure of the socio-economic condition of geographic areas across Australia. The Index of Relative Socio-Economic Disadvantage generally focuses on low-income earners, with relatively lower education attainment, high unemployment and dwellings without motor vehicles. 41.5 per cent of the study area population were considered to be in the most disadvantaged quintile compared to 20 per cent of the Queensland population overall. 0.9 per cent of the population were considered to be in the least disadvantaged quintile compared to 20 per cent of the Queensland population overall⁸.

12.2.10 Income

Incomes in the study area were lower than those for Queensland overall. Median annual personal income in the study area in 2011 was \$23,468 compared to \$30,524 for Queensland overall. 40.9 per cent of the population aged 15 years or older earned less than \$20,000 per annum compared to 34.6 per cent for Queensland overall.

Approximately 19.5 per cent of families in the study area were classified as low income compared to 13.0 per cent of families for Queensland overall. Median family income in the region was \$54,440 per year compared to \$75,556 for Queensland overall⁹.

⁸ Queensland Government Statisticians Office 2017

⁹ Queensland Government Statisticians Office 2017



12.2.11 Unemployment

In the September 2016 quarter, there were 2,038 unemployed persons in the study area. The unemployment rate was 10.2 per cent compared to 6.1 per cent for Queensland. 798 or 18.5 per cent of families with children under 15 years had no parent in employment compared to 13.5 per cent for Queensland overall¹⁰.

12.2.12 Employment

The table below indicates that agriculture is the major direct employer in the region. Farmer and farm manager were listed as the top occupational categories in the study area.

Table 5 Employment by industry – Tablelands Agricultural Region and Queensland 2011

INDUSTRY	REGION		QUEENSLAND
	Number	%	%
Agriculture, forestry and fishing	2,257	12.7	2.7
Mining	677	3.8	2.6
Manufacturing	1,030	5.8	8.4
Electricity, gas, water and waste	230	1.3	1.2
Construction	1,558	8.7	9.0
Wholesale trade	471	2.6	3.6
Retail trade	2,044	11.5	10.7
Accommodation and food services	1,097	6.2	7.0
Transport, postal and warehousing	721	4.0	5.3
Information, media and telecommunications	116	0.7	1.2
Financial and insurance services	195	1.1	2.7
Rental, hiring and real-estate services	224	1.3	1.8
Professional, scientific and technical services	696	3.9	6.5
Administrative and support services	463	2.6	3.2
Public administration and safety	1,230	6.9	6.7
Education and training	1,480	8.3	7.9
Health care and social assistance	1,953	11.0	11.9
Arts and recreation services	234	1.3	1.4
Other services	626	3.5	3.9
Total	17,806	100	100

Source: ABS Census of Population and Housing 2011

¹⁰ Queensland Government Statisticians Office 2017



The 2011 ABS Census of Population and Housing reports the top five occupation sub major groups of employment for the study area were:

1. Farmers and Farm Mangers (7.9 per cent)
2. Sales Assistants and Salespersons (6.3 per cent)
3. Carers and Aides (4.7 per cent)
4. Hospitality, Retail and Service Managers (4.5 per cent)
5. Education Professionals (4.4 per cent).

12.3 Stakeholder Engagement Summary

12.3.1 Introduction

Engagement with key stakeholders is central to the preliminary evaluation of water supply options in the region. Key stakeholder ideas, concerns, policies and plans were captured and addressed as part of the development of this PBC.

This section of the report presents the findings of the stakeholder consultation.

In October 2016, the Building Queensland Project Team developed a Stakeholder Engagement Plan to guide the stakeholder engagement process. Building Queensland, the Department of Energy and Water Supply and SunWater provided input into this process.

A Stakeholder Reference Group (SRG) was established and key stakeholders were invited to participate in the SRG, and three meetings occurred. The following organisations participated in the SRG meetings:

- SunWater
- Department of Natural Resources and Mines
- Department of Agriculture and Fisheries
- Department of State Development
- Wet Tropics Management Authority
- Cairns Regional Council
- Mareeba Shire Council
- Tablelands Regional Council
- Advance Cairns
- Regional Development Australia Far North Queensland and Torres Strait
- James Cook University
- Tablelands Futures Corporation
- MSF Sugar Limited
- Mareeba Fruit and Vegetable Growers Association
- Mareeba Chamber of Commerce
- Mareeba Dimbulah Irrigation Area Council
- AgForce



- Stanwell—Barron Hydro
- North Queensland Land Council (NQLC).

The first SRG meeting was held in Mareeba in October 2016 during Phase 1 of the stakeholder engagement process: defining the problem and opportunity. This meeting enabled key stakeholders to understand the purpose of the study, and to discuss the water supply problem and opportunities in the region, and regional needs and benefits.

The second SRG meeting was held in Mareeba in December 2016 during Phase 2 of the stakeholder engagement process: discussing the potential options. This meeting provided an update on the study and sought feedback on a range of potential water supply options.

The third and final SRG meeting was held in Mareeba in March 2017 during Phase 3 of the stakeholder engagement process: proposed shortlisted options. This meeting provided confirmation of the identified service need for the PBC and the options shortlisted to meet the service need. Feedback was sought on these key findings.

12.3.2 Perceptions of the Service Need

Stakeholder feedback relating to the perceived need for additional water supply expressed during the SRG meetings included:

- Clear acceptance of the need for additional water supply to support expected urban growth in Cairns. The need to support urban growth in Mareeba and Atherton was not perceived to be as great.

However, as the study progressed, and it became clear that Cairns does not have an identified need for water from a regional source, such as Nullinga Dam, until the very long term, stakeholders began to question this assumption. At the third SRG meeting, where Building Queensland communicated that, as a result of this identified very long term need, the study is not addressing a water supply problem for Cairns, there was considerable stakeholder discussion.

It is very clear that a number of stakeholders do not accept this PBC conclusion. While these stakeholders accept that water supply in Cairns may not be needed until the very long term, they do not accept that this very long term need is not to be addressed by the study. There is a perception that the 'lead time' required to obtain approvals and then construct a dam warrant the inclusion of this very long term need for urban water as part of the Preliminary Business Case.

- Clear acceptance that there is a regional opportunity for growth in agriculture. The sugar mills, particularly the Tableland Mill operated by MSF Sugar, have indicated a desire to expand. Stakeholders also discussed potential opportunities for:
 - Growth in the production of biofuels
 - Intensified agriculture including bananas, blueberries and avocados, with a doubling of avocado yield discussed
 - A doubling of the cane yield
 - Higher value crop production.
- Acknowledgement that opportunities for agricultural growth are driven by a return on investment. If water is too expensive, growth will not happen. As part of this, there was a clear view that water affordability must be maintained.



- An observation additional water supply provides an opportunity for diversification, including biofuels and cogeneration¹¹
- A perception that there is a clear link between increased water supply and confidence to invest. This could include investment in:
 - Crop expansion
 - Crop diversification
 - Recreation
 - Tourism (particularly water-based tourism if a dam is built)
 - More, and better, use of hydroelectrical generation assets
 - Converting grazing land to cropping
 - New industry (e.g. Fruit and vegetable and other processing and aquaculture)
 - Infrastructure
 - Local government infrastructure and assets
 - Indigenous economic development.
- A perception that improving access to water will improve water sharing, competition for water and water transfers.
- Overall, the majority of stakeholders indicated that additional water supply would lead to more agriculture and tourism, which would lead to a vibrant region and towns.
- Very few negative perceptions were expressed. Those that were expressed related to:
 - Environmental impacts, including a desire for any additional water supply to be reef neutral
 - Cultural heritage impacts
 - Managing mindset that is comfortable with the inefficient use of water.

12.3.3 Perceptions about Shortlisted Options and Benefits

A number of stakeholder expectations and opinions were expressed about the shortlisted options and benefits during the SRG meetings. These perceptions included the following.

- There is need to provide more rigour around the demand projections that will inform sequencing and priorities.
- Water efficiency and trading are already happening so these could be prioritised. Where efficiencies had been achieved, or trading had occurred, these savings had already been absorbed by customers.
- There is a desire to build on-farm dams or water storage. However, there are regulatory barriers that would need to be addressed to make this possible.
- There is a clear stakeholder expectation that the shortlisted options should be considered together, as a system. There are interrelationships between all components within the system, so options should not be considered in isolation. Stakeholders emphasised on-farm efficiencies and operational losses being considered in tandem.

¹¹ Cogeneration in this instance is defined as the burning of waste sugar cane fibre to generate heat and electricity



- Water security brings with it certainty for future investment (e.g. fruit and vegetable and other processing). There is also better regional access to domestic and international markets, and this needs to be capitalised upon for the regional economy.
- There is an expectation that it is possible to better use the available resource, through on-farm efficiency measures and conversion of operational losses.

12.3.4 Perceptions of Potential for Shortlisted Options to Provide Equitable Outcomes

A number of stakeholder expectations and opinions were expressed during the SRG meetings in relation to the ability for the shortlisted options to provide equitable outcomes. These perceptions included the following:

- If there is more water, there is a perception that there will be more equitable competition for water.
- There is an acknowledged difference between the east and west of the Mareeba-Dimbulah Water Supply Scheme (MDWSS). This difference also relates to potential price of water, and the equitable management of customers moving to a new scheme, and potentially paying a higher price for water.
- A perception that existing distribution is at capacity, or will reach capacity in the near future.
- A clear opinion was expressed that equitable outcomes depend on the cost of water. If the cost of water is too high, additional water supply will not benefit anyone. If the price is right, the economy will be stimulated and everyone will benefit from the flow-on effects (e.g. increased tourism, expanded agriculture, local government infrastructure investment, and retail).
- There is also the potential for better use of the existing resource. Currently a quarter of water allocations are lost.
- There is a perception that, if Nullinga Dam or another bulk water storage is built, a market mechanism is needed for irrigators and water customers to be able to transfer their allocations between Tinaroo Falls Dam and the new bulk storage.
- Improved efficiencies of existing channels have the potential to deliver more than 10,000 ML. However, stakeholders expressed a need for clarity about who would fund these improvements works: the user or government, and where the 'new water' created from these improvements could be used in the current system.
- There was a question amongst stakeholders about whether all potential issues are currently known.

12.3.5 Potential Social Licence of Shortlisted Options

Based on stakeholder feedback at the SRG meetings, a number of observations can be made in relation to the potential social licence to operate the shortlisted options. These observations include the following.

- There is broad stakeholder acceptance of the identified drivers for urban growth, and the demand profiles for both urban and agricultural growth. However, the agricultural drivers also need to consider other factors, such as electricity costs, distribution infrastructure, irrigation types and crop types.
- There is broad stakeholder acceptance of Nullinga Dam, or other bulk water sources. However, discussion about the comparative yield of Nullinga Dam and Tinaroo Falls Dam resulted in an observation that Nullinga Dam may not provide the 'silver bullet' solution that some stakeholders were expecting.
- There is also an appreciation that construction of a bulk water source requires a considerable lead time for impact assessment and approvals processes to occur. Stakeholders expect that these lead times will be considered.



- Stakeholders agree that water trading and water efficiency (on-farm and system-wide) measures should be priorities, as they are already well-used tools. There is an expectation that these options be considered as a system rather than in isolation, and that interrelationships between options are considered.
- Stakeholders also expect that for on-farm efficiencies to be achieved that regulatory barriers will be addressed.
- Stakeholders expect that any solution will be reef 'neutral'.

In relation to Option 2:-Improve MDWSS rules and operation, the following observations can be made:

- Stakeholders supported this option, and indicated that it could be implemented fairly and equitably.
- However, there was a perception that modelling is required to determine feasibility and to test the cumulative impact of proposed improvements to the operation of the scheme.

In relation to Option 3: Modernise MDWSS and convert losses, the following observations can be made:

- Stakeholders considered this option to be the most cost effective use of resources.
- However, stakeholders indicated that the take-up of the 15,000 ML water savings captured by this option would be heavily dependent on price. There was a perception that irrigators with higher value crops would move to take-up this water more quickly.
- There was considerable interest in SunWater's funding application to the NWIDF, and the cost assumptions that underpinned it. The outcomes of this round of funding applications will be keenly observed by stakeholders in the region.

In relation to Option 4: Nullinga Dam for agricultural use, the following observations can be made:

- Stakeholders indicated that there is broad support for this option. Some stakeholders qualified this support by indicating that it needed to be economically viable, or that their support was contingent on the water price remaining the same or being affordable.
- Stakeholders acknowledged that more work is required to assess whether this option is feasible, particularly in relation to cost and resultant water pricing, potential demand and resultant size of the dam, management of the new system, and potential opportunities to expand the dam in the future should need arise.
- Some stakeholders question the assumption that the study is not addressing a water supply problem for Cairns, and that this very long term need is not being factored into any analysis of Nullinga Dam.
- Some stakeholders indicated that, regardless of the outcome of the study, measures needed to be put in place now to protect the footprint of the dam.

It is important to note that this stakeholder engagement process was focused on capturing the opinions and feedback of key stakeholders in the study area. Broader community perceptions of shortlisted options have not been explored as part of the PBC, and, as a result, broader 'social licence' observations cannot be drawn at this time.

12.4 Preliminary Assessment of Social Impacts of Each Option

Social impacts are defined as the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally cope as members of society.



The term also includes cultural impacts involving changes to the norms, values and beliefs that guide and rationalise their cognition of themselves and their society. This section identifies material beneficial and detrimental social impacts before undertaking and documenting a social opportunity and impact risk assessment for each shortlisted option.

12.4.1 Option 2: Improve MDWSS Rules and Operation

12.4.1.1 Key Social Impact Issues Associated with Option 2

Beneficial and detrimental social impacts associated with the implementation of Option 2 are presented in Tables 6 and 7. Social impacts that were considered material (sufficiently large that upon realisation could influence the most appropriate project option) were identified through literature reviews, lessons from other projects, stakeholder engagement and expert analysis. These impacts were then grouped into key categories and impact aspects before being subjectively scored against a likelihood and consequence table.

Table 6 Option 2—Beneficial Material Social Impacts

IMPACT CATEGORY	IMPACT ASPECT	BENEFICIAL IMPACTS
Community	Employment	B1. Minor increase in regional employment from enhanced agricultural productivity. Monetised in the Cost Benefit Analysis (CBA)
	Infrastructure	B2. Enhanced usage of existing water delivery infrastructure for agricultural production. Not monetized in the CBA
	Services	No change expected
	Housing	No change expected
	Indigenous	No change expected
Cultural	Business Practices	B3. Improved use of existing resources through changing water business practices
	Land Use	B4. Change in land use to higher value per hectare crops in suitable areas. Monetised in the CBA
	Social Cohesion	No change expected
Health		No change expected
Intergenerational	Equity	B5. Enhanced confidence to invest in long term business operations and succession opportunities
Personal and property rights	Existing allocations	B6. Increase in value and flexibility of existing water allocations
Political Systems	Governance	B7. Engagement in redefining operating rules potentially beneficial to social cohesion and regional productivity
Quality of Life	Sense of Place	No change expected
	Heritage	No change expected
	Liveability	No change expected



Table 7 Option 2—Detrimental Material Social Impacts

IMPACT CATEGORY	IMPACT ASPECT	DETRIMENTAL IMPACTS	POTENTIAL MITIGATION STRATEGIES
Community	Employment	No change expected	
	Infrastructure	D1. Minor additional demands on existing community infrastructure in terms of electricity and transport networks	Inform relevant organisations of proposed program as part of engagement process
	Services	No change expected	
	Housing	No change expected	
	Indigenous	No change expected	
Cultural	Business Practices	D2. Change in existing business practices such as requirements for water ordering	Develop detailed consultation and communication strategy
	Land Use	D3. Potential change in land use from cane to higher value crops will change land use	
	Social Cohesion	D4. Potential community conflict over changing land use and cropping patterns	Develop detailed consultation and communication strategy
Health		No change expected	
Intergenerational	Equity	D5. Loss of opportunity for future water savings	Incorporate changes in future water-planning processes
Personal and property rights	Existing	No change expected	
Political Systems	Social Cohesion	D6. Impacts on cohesion through changing long established water ordering patterns	Develop detailed consultation and communication strategy
	Governance	D7. Increased demands on local governance arrangements to manage scheme operation	Ensure SunWater has adequate resources to deliver option
Quality of Life	Sense of Place	No change expected	
	Heritage	No change expected	
	Liveability	No change expected	



Table 8 Option 2—Social Opportunity and Impact Risk Assessment

SOCIAL OPPORTUNITY AND RISK CATEGORISATION						
		Insignificant	Minor	Moderate	Major	Significant
HIGH	Almost Certain—Very likely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly					
	Likely—Likely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly	D1, D5	D6	B1, B2		
Likelihood of Occurring	Possible—Possible to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly	B6, B7 D2, D3, D4, D7	B3	B4, B5		
	Unlikely—Unlikely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly					
LOW	Rare—Very unlikely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly					
Legend		LOW		OPPORTUNITY/IMPACT/CONSEQUENCE		HIGH
		INCIDENTAL	MINOR	SIGNIFICANT	MAJOR	SEVERE
		Local, small scale easily reversible change on social characteristics or values of the communities of interest or communities can easily adapt or cope with change	Short term recoverable changes to social characteristics and values of the communities of interest or community have substantial capacity to adapt and cope with change	Medium term recoverable changes to social characteristics and values of the communities of interest or community has some capacity to adapt and cope with change	Long-term term recoverable changes to social characteristics and values of the communities of interest or community have limited capacity to adapt and cope with change	Irreversible changes to social characteristics and values of the communities of interest or community has no capacity to adapt and cope with change

Legend

Low Social Impact or Opportunity	Medium Social Impact or Opportunity	High Social Impact or Opportunity
----------------------------------	-------------------------------------	-----------------------------------



12.4.1.2 Option 2—Conclusion

From the social opportunity and impact risk analysis it can be identified that Option 2 has two low beneficial material social opportunity impacts, three medium beneficial social opportunity impacts and two high beneficial social impact opportunities.

Option 2 has six low detrimental social impacts, one medium detrimental social impact and zero high detrimental social impacts.

12.4.2 Option 3: Modernise MDWSS and Convert Losses

12.4.2.1 Key Social Impact Issues Associated with Option 3

Beneficial and detrimental social impacts associated with the implementation of Option 3 are presented in Tables 9 and 10. Social impacts that were considered material (sufficiently large that upon realisation could influence the most appropriate project option) were identified through literature reviews, lessons from other projects, stakeholder engagement and expert analysis. These impacts were then grouped into key categories and impact aspects before being subjectively scored against a likelihood and consequence table.

Table 9 Option 3—Beneficial Material Social Impacts

IMPACT CATEGORY	IMPACT ASPECT	BENEFICIAL IMPACTS
Community	Employment	B8. Medium increase in regional employment from enhanced agricultural productivity and scheme modernisation construction activities. Monetised in the CBA
	Infrastructure	B9. Modernisation of existing water delivery infrastructure for enhanced agricultural production. Monetized in the CBA
	Services	No change expected
	Housing	No change expected
	Indigenous	No change expected
Cultural	Business Practices	B10. Improved use of existing water resources
	Land Use	B11. Change in land use to higher value per hectare crops in suitable areas. Monetised in the CBA
	Social Cohesion	No change expected
Health		No change expected
Intergenerational	Equity	B12. Enhanced confidence to invest in long term business operations and succession opportunities. Opportunities to diversify economy, would support retention of young people due to increased/diversity of employment opportunities
Personal and property rights	Existing allocations	No change expected
Political Systems	Social Cohesion	B13. Equitable allocation of additional water may add to sense of social cohesion
	Governance	No change expected
Quality of Life	Sense of Place	B14. Reinforce importance of agriculture to the study area (character and identity)



IMPACT CATEGORY	IMPACT ASPECT	BENEFICIAL IMPACTS
		B15. Positive impacts in relation to community vitality – increase in employment opportunities help to retain/attract people to the area
	Heritage	No change expected
	Liveability	No change expected

Table 10 Option 3—Detrimental Material Social Impacts

IMPACT CATEGORY	IMPACT ASPECT	DETRIMENTAL IMPACTS	POTENTIAL MITIGATION STRATEGIES
Community	Employment	D8. Potential competition for skilled labour	Undertake workforce skills gap analysis
	Infrastructure	D9. Additional demands on existing infrastructure in terms of electricity supply and transport	Inform relevant organisations of proposed works program and schedule as part of engagement process
	Services	No change expected	
	Housing	No change expected	
	Indigenous	D10. Potential impacts on cultural heritage values in areas of new infrastructure	Undertake cultural heritage survey and incorporate in planning program
Cultural	Business Practices	No change expected	
	Land Use	D11. Changes in land use and expansion of irrigated areas will create potential changes in community structure and composition	Develop detailed consultation and communication strategy
	Social Cohesion	D12. Competition for new water supplies may create social conflict	Develop detailed consultation and communication strategy
D13. Issues regarding the potential sale of new water allocations for existing businesses and local stakeholders		Develop detailed consultation and communication strategy	
Health		No change expected	
Intergenerational	Equity	D14. Loss of potential water savings identified as an option for the augmentation of the long-term water supply requirements for the city of Cairns	Incorporate changes in future water-planning processes.
Personal and property rights	Existing	D15. New infrastructure construction and provision will disrupt existing landholder activities	Develop detailed consultation and communication strategy



IMPACT CATEGORY	IMPACT ASPECT	DETRIMENTAL IMPACTS	POTENTIAL MITIGATION STRATEGIES
		D16. Minor land resumptions required for additional infrastructure	Adequately compensate landholders
		D17. Loss of access to existing volumes of unregulated water removals for downstream riparian rights holders	Develop detailed consultation and communication strategy
Political Systems	Governance	D18. Higher demands on existing SunWater Resources	Ensure SunWater has adequate resources to deliver option
	Governance	D19. Greater demands on governance arrangements in terms of planning upgrades and allocation of additional water supplies.	Ensure regional planning bodies have adequate resources to deliver option
Quality of Life	Sense of Place	D20. Potential impacts on existing water assets such as Mareeba wetlands	Provide sufficient flows for wetland
	Heritage	D21. Changes in visual amenity of existing channel system	Develop detailed consultation and communication strategy
	Liveability	D22. Potential impacts on existing water and tourism assets such as Mareeba wetlands	Provide sufficient flows for wetland
		D23. Short term impacts from construction activities.	Develop detailed consultation and communication strategy



Table 11 Option 3—Social Opportunity and Impact Risk Assessment

SOCIAL OPPORTUNITY AND RISK CATEGORISATION						
		Insignificant	Minor	Moderate	Major	Significant
HIGH	Almost Certain - – Very likely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly		D15	B8, B9		
	Likely - – Likely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly	B14, B15 D8	D9, D18	D13, D16	D17, D20	
Likelihood of Occurring	Possible - – Possible to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly	B13	D12	B10, B11, B12 D10, D11, D14, D19, D21, D22, D23		
	Unlikely - – Unlikely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly					
	Rare - – Very unlikely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly					
LOW						
Legend		LOW OPPORTUNITY/IMPACT/CONSEQUENCE			HIGH	
		INCIDENTAL	MINOR	SIGNIFICANT	MAJOR	SEVERE
		Local, small scale easily reversible change on social characteristics or values of the communities of interest or communities can easily adapt or cope with change	Short term recoverable changes to social characteristics and values of the communities of interest or community have substantial capacity to adapt and cope with change	Medium term recoverable changes to social characteristics and values of the communities of interest or community has some capacity to adapt and cope with change	Long-term term recoverable changes to social characteristics and values of the communities of interest or community have limited capacity to adapt and cope with change	Irreversible changes to social characteristics and values of the communities of interest or community has no capacity to adapt and cope with change

Legend

Low Social Impact or Opportunity	Medium Social Impact or Opportunity	High Social Impact or Opportunity
----------------------------------	-------------------------------------	-----------------------------------



12.4.2.2 Option 3—Conclusion

From the social opportunity and impact risk analysis it can be identified that Option 3 has three low beneficial material social opportunity impact, three medium beneficial social opportunity impacts and two high beneficial social impact opportunities.

Option 3 has one low detrimental social impact, eleven medium detrimental social impacts and four high detrimental social impacts.

12.5 Option 4: Nullinga Dam for Agricultural Use

12.5.1 Key Social Impact Issues Associated with Option 4

Beneficial and detrimental social impacts associated with the implementation of Option 4 are presented in Tables 12 and 13. Social impacts that were considered material (sufficiently large that upon realisation could influence the most appropriate project option) were identified through literature reviews, lessons from other projects, stakeholder engagement and expert analysis. These impacts were then grouped into key categories and impact aspects before being subjectively scored against a likelihood and consequence table.

Table 12 Beneficial Material Social Impacts of Option 4

IMPACT CATEGORY	IMPACT ASPECT	BENEFICIAL IMPACTS
Community	Employment	B16. Large long-term increase in regional employment from increases in agricultural productivity. Monetised in the CBA
	Infrastructure	B17. Construction of new large infrastructure (i.e. Nullinga Dam) and development of large greenfield irrigated agricultural site and supporting infrastructure. Monetized in the CBA
	Services	B18. Development of additional community support services
	Housing	No change expected.
	Indigenous	B19. Opportunities for indigenous business and employment
Cultural	Business Practices	No change expected
	Land Use	B20. Change in land use to higher value per hectare crops in suitable areas. Monetised in the CBA
	Social Cohesion	No change expected
Health		B21. Improved employment prospects and worker number will translate to improved community facilities and health
Intergenerational	Equity	B22. Enhanced confidence to invest in long term business operations, additional processing, industry diversification, lowering of age profile and succession opportunities
Personal and property rights	Existing allocations	No change expected
Political Systems	Governance	B23. Development of new governance and planning support
Quality of Life	Sense of Place	B24. Improved sense of place as a thriving agricultural area based on new infrastructure and agricultural expansion
	Heritage	No change expected
	Liveability	B25. Opportunities for additional recreation areas surrounding dam



Table 13 Option 4—Detrimental Material Impacts

IMPACT CATEGORY	IMPACT ASPECT	DETRIMENTAL IMPACTS	POTENTIAL MITIGATION STRATEGIES
Community	Employment	D24. Competition for skilled labour	Undertake workforce skills gap analysis
	Infrastructure	D25. Significant impacts for existing transport networks and electricity infrastructure at both dam site and new irrigation area	Inform relevant organisations of proposed works program and schedule and engage as part of the planning process
	Services	D26. Additional demands on existing services during construction and operational phases	Inform relevant organisations of proposed works program and schedule as part of engagement process
	Housing	D27. Demand for worker housing during construction phase may impact on regional housing affordability and supply	Undertake housing supply analysis and develop alternative housing arrangements if required
		D28. Long-term impacts on housing availability in area	Undertake housing supply analysis
	Indigenous	D29. Potential loss of areas of cultural significance	Undertake cultural heritage survey and incorporate in planning program
Cultural	Business Practices	D30. Potential significant impacts on downstream communities through changes in flow regimes impacting on important commercial aquatic species	Determine significance of impacts as part of EIS process and develop mitigation strategies
	Land Use	D31. Large scale change in land use from broad acre grazing to intensive agriculture will change community numbers and composition	Develop detailed consultation and communication strategy
	Social Cohesion	D32. Opposition to major dam on Walsh River by local, regional, national and international environmental groups	Develop detailed consultation and communication strategy
		D33. Competition for new water sources and cost of water may drive social conflict	Develop detailed consultation and communication strategy
		D34. Displacement of existing landholders and industry	Develop detailed consultation and communication strategy
		D35. Issues regarding the potential sale of new water allocations for existing businesses and local stakeholders	Develop detailed consultation and communication strategy
		D36. Temporary influx of construction workers impacting on community cohesion	Develop detailed consultation and communication strategy



IMPACT CATEGORY	IMPACT ASPECT	DETRIMENTAL IMPACTS	POTENTIAL MITIGATION STRATEGIES
Intergenerational	Equity	D37. Loss of potential water supply as an option for the augmentation of the long-term water supply requirements for the city of Cairns	Incorporate changes in future water-planning processes
Personal and property rights	Existing	D38. Acquisition of land in dam inundation and buffer area.	Adequately compensate landholders
Political Systems	Governance	D39. Significant impacts on existing governance arrangements and requirements for comprehensive long term planning	Ensure regional planning bodies have adequate resources to deliver option
Quality of Life	Sense of Place	D40. Loss of sense of place in upper Walsh catchment	Develop detailed consultation and communication strategy
	Heritage	D41. Potential impacts on heritage areas from changes in flow regimes and impacts on groundwater tables.	Undertake cultural heritage survey and incorporate in planning program.
		D42. Potential impacts on cultural heritage values in that area identified for the dam	Undertake cultural heritage survey and incorporate in planning program
	Liveability	D43. Lifestyle impacts from dam construction, development of new irrigation area and supporting infrastructure.	Develop detailed consultation and communication strategy
		D44. Temporary impacts during construction on liveability (noise, dust)	Mitigate as part of EIS process



Table 14 Option 4—Social Opportunity and Risk Assessment

SOCIAL OPPORTUNITY AND RISK CATEGORISATION						
		Insignificant	Minor	Moderate	Major	Significant
HIGH	Almost Certain – Very likely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly		D25, D26, D44		B16 D30, D32	
	Likely – Likely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly	B25 D28, D36	D27, D29, D38, D39	D31	B17	
Likelihood of Occurring	Possible – Possible to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly	D40	B23 D24, D42	B18, B19 D33, D43	B20, B121, B22, B24 D34, D35, D37, D41	
	Unlikely – Unlikely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly					
LOW	Rare – Very unlikely to occur or be an opportunity at either a specific stage of the project lifecycle or more broadly					
Legend		LOW OPPORTUNITY/IMPACT/CONSEQUENCE			HIGH	
		INCIDENTAL	MINOR	SIGNIFICANT	MAJOR	SEVERE
		Local, small scale easily reversible change on social characteristics or values of the communities of interest or communities can easily adapt or cope with change	Short term recoverable changes to social characteristics and values of the communities of interest or community have substantial capacity to adapt and cope with change	Medium term recoverable changes to social characteristics and values of the communities of interest or community has some capacity to adapt and cope with change	Long-term term recoverable changes to social characteristics and values of the communities of interest or community have limited capacity to adapt and cope with change	Irreversible changes to social characteristics and values of the communities of interest or community has no capacity to adapt and cope with change
Legend		Low Social Impact or Opportunity	Medium Social Impact or Opportunity	High Social Impact or Opportunity		



12.5.1.1 Option 4—Conclusion

From the social opportunity and impact risk analysis it can be identified that Option 4 has one low beneficial material social opportunity impacts, three medium beneficial social opportunity impacts and six highly beneficial social impact opportunities.

Option 4 has three low detrimental social impacts, eleven medium detrimental social impacts and seven high detrimental social impacts.

12.6 Conclusion

The following table summarises the positive and negative material social impacts for each option.

Table 15 Summary Table of Material Social Impacts

SOCIAL IMPACTS	OPTION 2			OPTION 3			OPTION 4		
	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
Positive Material Social Impacts	2	3	2	3	3	2	1	3	6
Negative Material Social Impacts	6	1	0	1	11	4	3	11	7



CHAPTER 13

ENVIRONMENTAL ASSESSMENT

Nullinga Dam and Other Options Preliminary Business Case

CONTENTS

13	ENVIRONMENTAL ASSESSMENT	2
13.1	Purpose	3
13.2	Establishing the Environmental Context – Base Case	3
13.3	Preliminary Environmental Assessment of Option 2: Improve MDWSS Rules and Operation	11
13.4	Preliminary Environmental Assessment of Option 3: Modernise MDWSS and Convert Losses	15
13.5	Preliminary Environmental Assessment of Option 4: Nullinga Dam for Agricultural Use	18
13.6	Conclusion	22

TABLES

Table 1	Climate of Key Tableland Towns	10
---------	--------------------------------------	----

FIGURES

Figure 1:	Flora	8
Figure 2:	Fauna	9



13 ENVIRONMENTAL ASSESSMENT

CHAPTER SUMMARY AND CONCLUSIONS

Base Case

- The preliminary environmental assessment is focused on the Tablelands Agricultural Area, defined as the boundaries of the Mareeba Shire Council and Tablelands Regional Council local government areas.
- The majority of the MDWSS area has been cleared for grazing and intensive agriculture. The area is noted for its productive soils and high rainfall.
- Surface water quality is moderate with elevated levels of nutrients and pesticides associated with irrigated agriculture identified. Areas of elevated groundwater and high salinity risk have been also been identified.
- Areas within the broader study area and the existing MDWSS are identified as containing non-remnant vegetation. A number of threatened ecological communities and flora and fauna species are mapped as occurring within the study area and may be impacted by the shortlisted options.

Option 2: Improve MDWSS rules and operation

- The key environmental issues associated with Option 2 relate to the potential for the increased operational performance of the scheme to result in a (marginal) expansion of land under irrigation.
- Key environmental issues associated with the marginal expansion of land under irrigation include:
 - Changes to surface water and groundwater level and quality due to minor increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
 - Clearing of vegetation to facilitate new irrigation areas. Land surrounding the existing irrigation area is mapped as regulated vegetation and has the potential to contain threatened ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Clearing in these areas could trigger State and Commonwealth approvals.

Option 3: Modernise MDWSS and convert losses

- The key environmental issues associated with Option 3 relate to the potential for the creation of new water allocations and the associated expansion of land under irrigation.
- Key environmental issues associated with Option 3, and increased irrigation, are the same as those for Option 2 but on a larger scale.

Option 4: Nullinga Dam for agricultural use

- The construction of Nullinga Dam would result in not only construction of a new impoundment on the Walsh River, but may also involve the development of a new irrigation area, noting that much of the unirrigated cropping land adjacent to the Walsh River would fall within the existing MDWSS area (as far west as the end of the Dimbulah area).
- To the extent that Option 4 results in increased irrigation within an existing irrigation area, key environmental issues associated with Option 4 relate to the potential for the creation of new water allocations and the associated increase in irrigation (in Area 10 of the MDWSS).



- Key environmental issues associated with increased irrigation are the same as those for Options 2 and 3 but again on a larger scale. Potential environmental issues associated with Option 4 (both the dam and increased irrigation) include:
 - Potential approval triggers at both State and Commonwealth level, resulting in a more complex and longer approvals process than would be required for Option 2 and 3.
 - Construction of the dam would require acquisition of land across a range of tenure types.
 - Modification to the Walsh River and the potential creation of a new irrigation area (or land use change on a greater scale than for Option 2 and 3) have the potential to impact water quality and flows downstream of the dam with consequential impacts on species composition.
 - Clearing of regulated vegetation will be required for both the dam inundation area and in parts of any new irrigation development. There are areas of land adjacent to the Walsh River (extending as far as the end of the Dimbulah area) that have been previously cleared and which are currently used for grazing and/or cropping
 - It is likely that essential habitat for threatened species listed at both the State and Commonwealth level will be impacted by the development.
 - Offsets for vegetation clearing under the *Environmental Offsets Act 2014* (Qld) may be required.
 - Clearing of threatened ecological communities (TEC) and threatened species listed under the EPBC Act is likely to trigger an EPBC Act referral to the Commonwealth Department for the Environment and Energy. If the project were declared to be a controlled action, offsets for vegetation clearing would be required.
 - Change in land use both at the dam site and in the new and existing irrigation areas will result in a change in visual amenity for the development areas.
 - Aboriginal cultural heritage has the potential to be disturbed as a result of the project. As the project is likely to trigger an environmental impact statement (EIS), an approved Cultural Heritage Management Plan will be required.

13.1 Purpose

The purpose of this chapter is to present the preliminary findings of environmental impacts arising from each of the short-listed options. The first part of this chapter provides a regional environmental profile to establish the operating context for each of the shortlisted options. Following this is the environmental assessment of the shortlisted options, including the potential environmental impacts.

13.2 Establishing the Environmental Context – Base Case

All three shortlisted options under examination will occur in the Tablelands Agricultural Area. Mareeba Shire Council and the Tablelands Regional Council local government areas define the boundary of the Tablelands Agricultural Area. Therefore, this environmental context setting includes information about each local government area.

There are a number of national parks within the region including Hann Tableland National Park, Barron Gorge National Park and Danbulla National Park. Additionally, approximately 25.5 per cent of the local government area for the Tablelands Regional Council also falls within the Wet Tropics World Heritage Area.



Major water resources in the area include the Barron River which flows to an estuary north of Cairns and the Walsh River which flows towards the Gulf of Carpentaria.

This environmental context setting provides information on the existing environment of planning and land use, topography, geology and soils, water quality, hydrology, flora and fauna, climate, noise and vibration, landscape and amenity and cultural heritage.

13.2.1 Planning and Land Use

The Tablelands Agricultural Area has a total area of 65,009 square kilometres. The local government area of Mareeba Shire Council makes up the majority of this area, with a total area of approximately 53,611 square kilometres.

Queensland Land Use Mapping identifies the majority of the region is used for grazing. Irrigated cropping areas are concentrated around the Walsh River, Barron River and Emerald Creek, which is the area of the existing MDWSS. There is also a small area of irrigation within the Upper Mitchell River sub-catchment.

The majority of the region is zoned rural under both relevant planning schemes; this includes the areas of the MDWSS.

13.2.2 Topography, Geology and Soils

The Barron Basin is a topographically variable area, ranging from approximately 800 metres above sea-level in the upper Barron Basin to approximately 400 metres around Mareeba and less than 100 metres toward the coast. Similar to the topography, the geology of the area varies throughout the basin. Parent materials are generally metamorphic and granite in the higher elevations of the upper Barron River catchment and the middle catchment around Mareeba and Kuranda. Basalt flows occur around the Atherton area and Mareeba, while alluvium underlies the coastal plain.

Soil type varies markedly from Atherton in the south to the Mareeba area in the north. Typically soil on the southern tablelands is red, structured, high-clay soil with an acid-neutral pH; it is well drained, has good fertility and is derived from basalt. In contrast, soil in the Mareeba-Dimbulah area is sandy loam to sandy clay loam over a red, structured, coarse sandy clay soil with a slightly acid pH; it is well drained, is derived from granite and has inherent low fertility.

Soils within the MDWSS vary from deep red and yellow friable basalt soils to the south-east of the scheme area to well drained deep red earths and red duplex soils on the upper slopes and mottled yellow duplex soils with deep pale sands and grey duplex soils on the lower slopes in the western scheme area. There are two large distinct alluvial areas found to the north and west of Mareeba. These areas are comprised primarily of grey cracking clays with minor areas of solodics. These alluvial areas are recognised as being a high risk area for salinization.

The geology of the Chillagoe district, to the west of the Barron Basin, is located along the western periphery of the Palaeozoic Tasman Geosyncline on the borders of the Precambrian basement. After being folded, the Palaeozoic sediments were intruded by Upper Permian granites and covered by concomitant volcanics. Chillagoe lies within a belt of limestone approximately 5 kilometres wide and 45 kilometres long, extending from south of Chillagoe and north-west to the Walsh River and beyond. The Chillagoe Karst Region contains the best examples of tropical limestone bluffs and towers in Australia. Soils within the Mitchell River catchment are generally poor quality, with better quality soils associated with floodplains and adjacent to rivers.

In 2002, DNRM identified that soil and crop suitability investigations indicated that potentially there are more than 50,000 hectares (ha) of soil suitable for irrigated cropping within the area, including the current



cropped area of 21,000 hectares. This suggests an additional 29,000 hectares is suitable for irrigation. However, the best lands served by the existing canals and pipelines have already been developed.

13.2.3 Water Quality

13.1.1.1 Surface Water

The 2014-15 Healthy Waterways report gave an overall water quality grade for the Barron Basin as moderate. These assessments use aquatic ecosystem guidelines for protection of freshwater systems and not load reduction targets for the marine environment. The score for Total Suspended Solids (TSS) indicated that the annual medians of TSS did not comply with the guideline values. Nutrients also scored moderate, meaning that nutrient values either equalled or were less than the guideline value. The Barron Basin is not monitored for contaminants and therefore no grade was provided for this parameter. Stakeholders within the MDWSS have however raised concerns in relation to the potential for heavy metals in sediments from historic mining activities in the upper catchment.

The Barron River and Trinity Inlet Water Quality Improvement Plan identified sediment and nutrient loads within the Barron River and Trinity Inlet. The plan includes both point sources (such as sewage treatment plants and urban development sites) and diffuse sources (such as natural forests in protected areas, sugarcane, grazing, plantation forestry, banana and mixed cropping horticulture; urban development zones). The plan identifies that the estimated annual pollutant loads delivered to receiving waters (including Tinaroo Falls Dam) was as follows:

- 1,600 tonnes of total nitrogen per year
- 250 tonnes of total phosphorus per year
- 78,000 tonnes of total suspended sediment per year.

Generally, the modelled average annual pollutant sources increased through the catchment, with the majority of pollutants originating in the lower sub-catchments. However, modelling carried out as part of the plan identified that a major source of elevated nitrogen (including nitrate, ammonia and particulate nitrogen) loss in the catchment is from urban sources (mainly in the lower catchment) and from cropping areas (located mainly in the upper and middle catchments). Elevated phosphorus loss in the catchment was from horticulture cropping areas and sewage treatment plants.

Grazing in the middle and lower catchments and cropping areas were identified as major sources of sediment loss in the catchment. Mud loggers rank the Barron River as the largest exporter of fine sediment per unit of catchment area in north Queensland.

Sources of herbicides detected in the catchment waterways were associated with land uses such as plantation horticulture and sugarcane cropping, with some contribution from urban areas. A wide range of other pesticide residues (e.g. ametryn, hexazinone, 2,4-D, MEMC) are also found in the Barron River. It should be noted that there have been some reductions in farm runoff, attributed to improved fertilizer and land management practices and the conversion of sewage treatment plants to tertiary treatment.

Environmental values, management goals and water quality objectives for the Barron Basin are set out in the *Barron River Basin Environmental Values and Water Quality Objectives Basin No. 110*. This document is made under the provisions of the *Environmental Protection (Water) Policy 2009*. Mapping identifies the MDWSS within the upland fresh water area. The MDWSS is not located within an area mapped as a high ecological value, slightly disturbed or moderately disturbed area. As such, the MDWSS is not required to ensure the water quality objectives are met; however, the water quality objectives provide a guide for management of water releases in the area.



Limited water quality is available for the upper Walsh and Mitchell catchments. The majority of watercourses in this area are ephemeral and changes in flow can impact water quality parameters. From the water quality data that is available, reduced water quality is generally associated with areas within the MDWSS, with these areas having high nutrient concentrations. High concentrations of phosphorus in some watercourses have been attributed to sewage treatment plants. Abandoned metal mines are scattered throughout the upper catchment and have been shown to be discharging metals and other contaminants, contaminating local stream waters and streambed sediments.

There are not currently any environmental values or water quality objectives established for surface water or groundwater within the Walsh and Mitchell catchments.

13.1.1.2 Groundwater

Within the Atherton Subartesian Area, water supplies from the Atherton Basalt are typically very good quality. Groundwater electrical conductivity ranges from 45 μScm^{-1} to 350 μScm^{-1} . However, there is limited data indicating that brackish/saline groundwater may be discharging to drainage features which may influence downstream water quality in the Barron River.

Groundwater monitoring bores within the MDWSS have shown trends of rising groundwater levels. Groundwater quality in Cattle Creek, Leadingham Creek and Biboohra has an impact on the surface water quality of the upper Walsh and Mitchell catchments. Groundwater within the Cattle Creek catchment has been rising and has the potential to result in increased salt concentrations in surface water. There are zones of significant salinity hazard located in the Biboohra area. Leadingham Creek is not considered to have a significant salinity hazard.

13.2.4 Hydrology

The Tablelands Agricultural Area comprises the water planning areas of Barron, Mitchell, Gulf and Wet Tropics catchments. Options 2 and 3 will primarily impact the catchment of the Barron Basin, while Option 4 will primarily have impact on the Walsh and Mitchell River catchment. The Barron River is the major watercourse within the basin. Major tributaries in the basin include Leslie Creek, Scrubby Creek, Rocky Creek, Tinaroo Creek, Emerald Creek, Granite Creek, Clohesy Creek, Flaggy Creek and Freshwater Creek.

Major impoundments within the Barron Basin include the Tinaroo Falls Dam on the Barron River and Copperlode Dam on Freshwater Creek (to the east of the MDWSS). The Barron River catchment downstream of the Tinaroo Falls Dam is a highly modified catchment.

There are three supplemented watercourses in the Walsh River catchment: the Walsh River, Murphy's Creek and Eureka Creek. In the Mitchell River system, the only supplemented watercourse is Two Mile Creek. The Walsh River extends upstream and downstream of the supplemented section of the MDWSS. Flow-related impacts both upstream and downstream of the supplemented sections are currently minor.

13.2.5 Flora and Fauna

Large areas of the existing MDWSS area are mapped as containing non-remnant vegetation. However, small pockets of remnant vegetation occur within the existing developed area and surrounding the existing developed area. Mapped regional ecosystems within the MDWSS are largely not of concern or, of concern to regional ecosystems. There are areas of endangered regional ecosystems to the north, east and south-west of Lake Tinaroo. These areas of remnant vegetation are mapped as regulated vegetation, category B.

Four threatened ecological communities (TEC) listed under the EPBC Act have the potential to occur within the Tablelands Agricultural Area. These include:



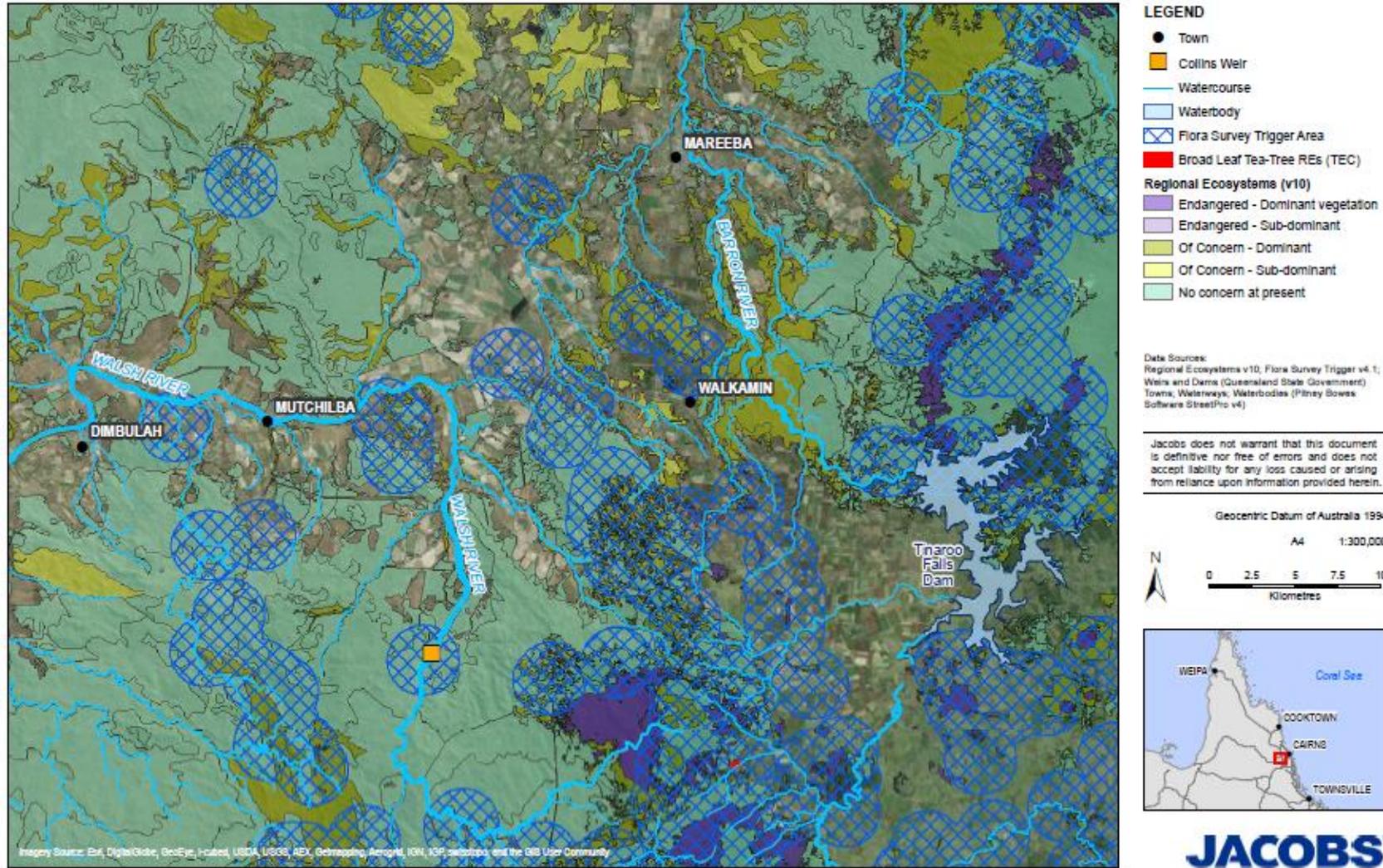
- Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland – listed as endangered
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia – listed as critically endangered
- Mabi Forest (Complex Notophyll Vine Forest 5b) – listed as critically endangered
- The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin – listed as endangered

Regional ecosystem mapping indicates that one TEC, broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland, occurs to the south-west of the proposed Nullinga Dam site. Clearing within areas of TEC has potential to trigger assessment under the EPBC Act. If clearing will or is likely to have a significant impact on a TEC, referral and assessment of the clearing under the EPBC Act will be required.

A number of flora and fauna species protected under State and Commonwealth legislation also have the potential to occur within the study area, with essential habitat and high-risk flora areas mapped within the study area as follows (refer to Figures 1 and 2).



FIGURE 1: FLORA

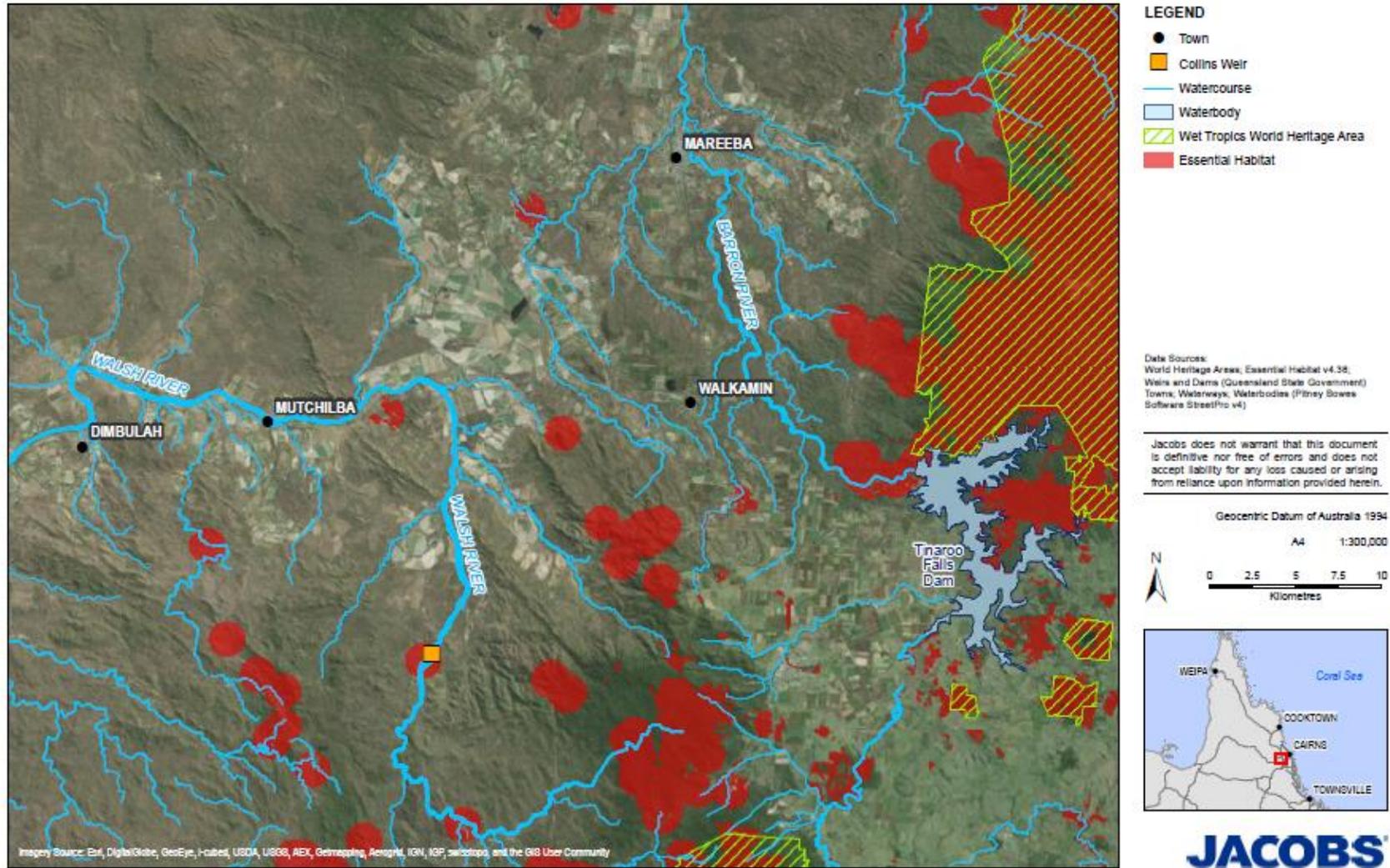


NULLINGA DAM

C:\Users\SMonro\Documents\Temp\Projects\170221_NullingaDam_IH110400_RP\owlett\Spatial\ArcGIS\Figures\IH110400_NullingaDam_Figure1_Flora.mxd Produced: 27/02/2017



FIGURE 2: FAUNA



NULLINGA DAM

C:\Users\SMonro\Documents\Temp\Projects\170221_NullingaDam_IH110400_RP\owleth\spata\ArcGIS\Figures\IH110400_NullingaDam_Figure2_Fauna.mxd Produced: 9/03/2017



Subject to the location of potential irrigation development, approvals under State and Commonwealth legislation may also be required. These approvals would be dependent on the location of each individual proposal.

The Walsh and Mitchell catchments have high natural diversity of freshwater fish. The significance of the upper Walsh and Mitchell Rivers within a regional context is the high diversity of fishes found in the rivers and the contribution they make to the overall fish diversity of the region. Much of the fish fauna of the upper Walsh and Mitchell Rivers is evolutionarily and biogeographically distinct from that occurring in the easterly-flowing streams.

Groundwater dependent ecosystems (GDEs) are known to occur within the Barron Basin. The GDEs include:

- A cave and karstic ecosystem to the east of Mareeba
- Non-riverine wetlands considered to be GDEs located to the south of Yungaburra and along the coast near Yorkeys Knob
- Seventy-one regional ecosystems considered to be GDEs are located throughout the Barron Basin, but generally concentrated along the Mitchell River, Walsh River, and extending north of the Walsh River towards the Hann Tableland National Park. These regional ecosystems are generally associated with *Corymbia* and *Eucalyptus* species.

13.2.6 Climate

The climate of the area is predominantly humid subtropical with most rain falling in the summer. Wide variations in climate occur across the Tablelands Agricultural Area with changes in altitude and proximity to the Great Dividing Range being the major impacting factors.

Elevated areas in the east and south are generally wetter and cooler, whereas western and northern regions are hotter and drier. Average temperatures range from 18.2°C to 30.6°C and the average rainfall across the region is 1,090 millimetres each year. Table 1 summarises the climate aspects of key towns in the Tablelands.

Table 1 Climate of Key Tableland Towns

LOCALITY	ALTITUDE (M)	AVERAGE ANNUAL RAINFALL (MM)	AVERAGE TEMPERATURE RANGE (°C)	
			JANUARY	JULY
Kuranda	336	2,002	24-31	17-26
Mareeba	400	918	21-31	11-25
Dimbulah	407	783	22-34	11-27
Atherton	752	1,420	18-29	10-22
Malanda	738	1,565	17-28	5-22
Ravenshoe	930	842	16-31	3-23

Source DAF 2016

13.2.7 Noise and Vibration

Within the study area there are a range of land uses that generate noise. Noise sources are generally from agricultural uses and traffic. Within areas more remote from permanent man-made noise sources, the only ongoing noise present would be wind blowing over vegetation and noises from insects, birds and other local wildlife.



13.2.8 Landscape and Visual Amenity

The landscape within the Tableland Agricultural Area ranges from flat plains and river valleys, undulating hills and steep ranges. The general character is that of rural agricultural and grazing area. There are several towns, including Mareeba, Walkamin, Mutchilba and Dimbulah.

13.2.9 Cultural Heritage

No Commonwealth heritage properties are located within the study area. There are several State and local heritage places throughout the Tablelands Region.

There is potential for Indigenous cultural heritage to be associated with the following landscape features:

- Mature and/or remnant vegetation
- Rock outcrops
- Elevated plateaus
- Hills and mounds
- Water sources such as creeks, rivers, billabongs, lakes and springs.

13.3 Preliminary Environmental Assessment of Option 2: Improve MDWSS Rules and Operation

13.3.1 Environmental Issues Associated with Option 2

The key environmental issues associated with Option 2 relate to the potential for the increased operational performance of the scheme to result in a marginal expansion of land under irrigation. Key environmental issues associated with expansion of land under irrigation include:

- Changes to surface water and groundwater level and quality due to minor increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
- Clearing of vegetation to facilitate new irrigation areas. Land surrounding the existing irrigation area is mapped as regulated vegetation and has the potential to contain TEC listed under the EPBC Act. Clearing in these areas could trigger State and Commonwealth approvals.

13.3.2 Legislation and Permit Requirements

To enable Option 2 minimal legislative changes are required. Option 2 would require a review and amendment of the existing Barron Resource Operations Plan (ROP) and Resource Operations Licence (ROL). The recent introduction of a new water planning framework under the *Water Act 2000* (Qld) (Water Act) (because of the *Water Reform and Other Legislation Amendment Act 2014*) requires new documents to replace the existing Water Plans and ROLs. These changes aim to deliver a water planning process that is more flexible and more efficient. This change in water planning framework may provide the opportunity to implement Option 2 as part of this process.

The new planning framework includes the following documents:

- *Water Regulation 2016*—replaces the *Water Regulation 2002* and takes a greater role in supporting the water planning process.
- Water plans—will replace water resource plans and will assess the size and nature of the resource to ensure that water is allocated within sustainable limits.



- Water entitlement notice—will replace the schedules in the ROPs and will be used to convert, grant, amend as well as refuse and cancel or repeal (in certain situations) entitlements.
- Water management protocols—will include operational matters such as water sharing and trading rules applicable to specific water management areas in a water plan area.
- ROLs and distribution operations licences—will detail the roles and responsibilities of scheme operators (supplemented water) to achieve the outcomes of the associated water plan.
- Operations manual—will include the day to day operation rules for the associated scheme and is approved by the chief executive.

The fact that the water resources plans and ROLs are changing means that there is a potential opportunity for the implementation of Option 2 with relatively low additional cost associated. The timeframe for implementation of the new planning framework for the Barron Water Plan area is unknown at this time, but depending on the priority of Barron catchment, this may delay the introduction of Option 2.

13.3.3 Planning and Land Use

A change to the availability and/or security of water for irrigation has the potential to change land use in the area of water availability. Within the rural zone, a change to, or intensification of, irrigated cropping (excluding mushroom farming and forestry for wood production) is self-assessable development under both the Mareeba Shire Council and the Tablelands Regional Council's planning schemes.

Expansion and or intensification of cropping within the rural zone because of Option 2 are consistent with the intent of the planning and land use within the area of the MDWSS.

13.3.4 Property Impacts

Option 2 provides an opportunity to increase water use through the existing irrigation system. Any additional infrastructure required to use the water would be associated with on-farm infrastructure and would be the responsibility of the individual land owner. No additional land would be required to implement this option. Property impacts are therefore negligible.

13.3.5 Water Quality Impacts

13.1.1.3 Surface Water

Intensification of production due to increased water availability may have a resultant effect of increased runoff and increased nutrients and pesticides entering the Barron, Walsh and Mitchell Rivers. This has the potential to further impact the existing water quality of the Barron, Walsh and Mitchell Rivers, as well as potential subsequent water quality impacts to the Great Barrier Reef and the Gulf of Carpentaria.

13.1.1.4 Groundwater

Groundwater monitoring bores within the MDWSS have shown trends of rising groundwater levels. Bores near the confluence of Leadingham Creek and the Walsh River have shown rising groundwater levels, with some bores rising approximately 3 metres between the mid 1990's to 2011-12. Bores along Callte Creek have also shown rising groundwater levels, with some bores rising between 1 metre and 4 metres over a similar period. Rising groundwater levels in bores can be an indicator of increasing salinity, which can result in lost agricultural production. Increased agricultural development has the potential to continue this trend and potentially increase salinity issues in the area.

Increased irrigation may also result in an increase in fertiliser and pesticides associated with crop management. Leaching of fertiliser and pesticides has the potential to impact groundwater quality. *Barron*



River Basin Environmental Values and Water Quality Objectives Basin No. 110 cover groundwater resources of the MDWSS. Under this document, where groundwater is in good condition, the existing water quality is to be maintained consistent with relevant water quality objectives.

13.3.6 Topography, Geology and Soils

Increasing water use through the existing irrigation system may provide some opportunity to expand irrigation into areas not currently irrigated. Increasing irrigation within the MDWSS has the potential to increase the risk of salinisation, particularly in the alluvial areas to the north and west of Mareeba. Increasing agricultural production within the MDWSS also has the potential to increase sediment loss, particularly within areas of sodic soils.

13.3.7 Hydrology

Changes implemented as part of Option 2 may result in hydrological changes in the Barron River catchment. The catchment is already highly modified and no additional dams or weirs are proposed to be constructed as a result of implementation of Option 2. However, changes to the transmission and operational allowances may result in hydrological changes. Further investigation into the potential impact on environmental flow objectives and water allocation security objectives will be required and assessment as to the associated environmental impacts of any hydrological change.

13.3.8 Flora and Fauna

Option 2 essentially requires amendments to existing statutory documents to increase operational performance of the scheme. While Option 2 itself does not require any on-ground works, it may result in increased water availability and may trigger individual land owners to expand irrigation areas. This expansion in irrigation areas has the potential to impact flora and fauna, however the extent of impact will be dependent upon the specific location of any expansion activities.

Expansion into areas mapped as regulated vegetation will trigger approval to clear native vegetation. Clearing for high-value agriculture is a relevant purpose under the *Vegetation Management Act 1999* (Qld) so it is possible to submit a development application to clear native vegetation that would be assessed against the relevant code.

Clearing within areas of TEC has the potential to trigger assessment under the EPBC Act. If clearing will have or is likely to have a significant impact on the TEC, referral and assessment of the clearing under the EPBC Act will be required.

A number of flora and fauna species protected under State and Commonwealth legislation also have the potential to occur within the MDWSS area. Depending on the location of potential irrigation development, approvals under State and Commonwealth legislation may also be required. These approvals would be dependent on the location of each individual proposal.

As previously described, Option 2 does not necessarily require any on-ground works. Therefore, the extent of impact to flora and fauna will be dependent upon the specific location of any expansion activities.

Groundwater dependent ecosystems (GDEs) are known to occur within the Barron Basin. The GDEs include:

- A cave and karstic ecosystem to the east of Mareeba
- Non-riverine wetlands considered to be GDEs located to the south of Yungaburra and along the coast near Yorkeys Knob
- Seventy-one regional ecosystems considered to be GDEs are located throughout the Barron Basin, but generally concentrated along the Mitchell River, Walsh River, and extending north of the Walsh River



towards the Hann Tableland National Park. These regional ecosystems are generally associated with *Corymbia* and *Eucalyptus* species.

Changes to groundwater, such as quality and depth, have the potential to impact GDEs. Increased take of groundwater or changes to groundwater quality with expansion of irrigation in the Barron Basin has the potential to impact these GDEs. Management measures can be established to minimise expansion of irrigation, including establishing minimum set back distances for groundwater pumping from known GDEs and establish minimum groundwater depth triggers and pumping rates in prescribed areas which relate to the GDE water requirements.

13.3.9 Climate and Air Quality

Option 2 has the potential to increase the irrigated area within the Barron Basin. Increasing the cropped area within the Barron Basin would potentially increase the exposed surfaces and result in an increase in dust generated in the area. The potential decrease in air quality due to dust emissions is not considered to be significant.

Seasonal variations currently influence the availability and take of water within the MDWSS. The implementation of Option 2 will not change the seasonal variation in water availability of the system, but may change the water use practices that may change the take of water in the system.

13.3.10 Climate Change and Emissions

Climate change has the potential to change the timing, frequency, magnitude and duration of stream-flows as well as reduce groundwater levels. Potential impacts may include an increase in frequency and severity of droughts. Increased agricultural activities may result in additional land clearing and increased use of fossil fuels which can contribute to carbon dioxide emissions.

13.3.11 Noise and Vibration

Option 2 includes a review of the ROP and ROL to increase operational performance of the existing scheme. Implementation of Option 2 will not directly result in changes to noise and vibration. Increased irrigation and associated agricultural machinery movements have the potential to increase noise and vibration. However, the area is already being used for irrigation purposes and the extent of potential increase in irrigation area is unlikely to result in significant to sensitive receivers such as residential dwellings or schools from noise and vibration.

13.3.12 Landscape and Visual Amenity

The MDWSS area is an existing irrigation area and the visual amenity is consistent with agricultural use. The implementation of Option 2 has the potential to increase the irrigation area. This expansion in irrigation area would be consistent with the existing use in the surrounding area and is unlikely to result in a change to visual amenity.

13.3.13 Cultural Heritage

The implementation of Option 2 is unlikely to impact State and local heritage places in the Barron Basin, as the majority of these sites are located within towns.

Aboriginal cultural heritage has the potential to be disturbed through the development of new irrigation areas. The *Aboriginal Cultural Heritage Act 2003* (Qld) requires that all persons must exercise due diligence and reasonable precaution before undertaking an activity that may harm Aboriginal cultural heritage. The *Aboriginal Cultural Heritage Act 2003 Duty of Care Guidelines* provides guidance in measures to ensure that activities are managed to avoid or minimise harm to Aboriginal cultural heritage. Any activities that may



cause ground disturbance that are associated with implementation of Option 2 will need to comply with the guidelines.

13.3.14 Waste Management

Option 2 includes a review of the ROP and ROL to increase operational performance of scheme. Implementation of Option 2 will not directly generate waste that will require management.

13.4 Preliminary Environmental Assessment of Option 3: Modernise MDWSS and Convert Losses

13.4.1 Key Environmental Issues Associated with Option 3

The key environmental issues associated with Option 3 relate to the potential for the creation of new water allocations and the associated increase in irrigation. Key environmental issues associated with increased irrigation are the same as those for Option 2 and are as follows:

- Changes to surface water and groundwater quality and groundwater levels due to increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
- Clearing of vegetation to facilitate new areas under irrigation. Land surrounding the existing areas of irrigation is mapped as regulated vegetation and has the potential to contain TEC. Clearing in these areas could trigger State and Commonwealth approvals.

13.4.2 Legislation and Permit Requirements

No changes to legislation would be required to implement Option 3. There may be a requirement to obtain development approvals for operational works under either relevant planning schemes or the *Sustainable Planning Act 2009* (Qld)¹, or equivalent planning legislation. Works will need to be assessed against the planning scheme and Sustainable Planning Act to confirm if works trigger a development application.

13.4.3 Planning and Land Use

Planning and land use issues and requirements are the same as Option 2. Expansion and/or intensification of cropping within the rural zone as a result of Option 3 are consistent with the intent of the planning and land use within the area of the MDWSS.

13.4.4 Property Impacts

Planning and land use issues and requirements are the same as Option 2. Option 3 has the potential to provide additional water allocations through improvement in existing SunWater infrastructure. Any additional on-farm infrastructure required to use the water would be the responsibility of the individual land owner. Some additional small areas of land would be required to implement this option for facilities such as balancing storages. Property impacts are therefore considered low.

13.4.5 Water Quality

Issues and impacts associated water quality are considered to be the same as Option 2. Intensification of production due to increased water availability may have a resultant effect of increased runoff and increased nutrients and pesticides entering the Barron, Walsh and Mitchell Rivers. This has the potential to further impact the existing water quality of the Barron River, leading to potential subsequent water quality impacts in the Great Barrier Reef and the Gulf of Carpentaria. Increased agricultural development may impact on

¹ The *Planning Act 2016* will come into force in Queensland on 3 July 2017 and will supersede the *Sustainable Planning Act 2009*



groundwater levels and groundwater quality in the area. Leaching of fertiliser and pesticides has the potential to impact groundwater quality.

13.4.6 Topography, Geology and Soils

Issues and impacts associated with topography, geology and soils are considered to be the same as Option 2. Increasing the availability of water through converting bulk transmission and distribution losses may provide some opportunity to expand irrigation into areas not currently irrigated. Increasing irrigation within the MDWSS has the potential to increase the risk of salinisation, particularly in the alluvial areas to the north and west of Mareeba. Increasing agricultural production within the MDWSS also has the potential to increase sediment loss, particularly within areas of sodic soils.

13.4.7 Hydrology

Changes implemented as part of Option 3 are unlikely to result in hydrological changes in the Barron, Walsh and Mitchell River catchments. The catchment is already highly modified and no additional dams or weirs are proposed to be constructed as a result of implementation of Option 3.

13.4.8 Flora and Fauna

Option 3 involves improving existing infrastructure to reduce transmission and distribution losses. Implementation of Option 3 may require on-ground works to be carried out. These works would be restricted to existing areas of disturbance/infrastructure within the MDWSS. The MDWSS is largely located in areas mapped as non-remnant vegetation. However, small pockets of remnant vegetation do exist within the MDWSS area.

Similar to Option 2, implementation of Option 3 may create new water allocations that could facilitate expansion of the irrigation area. Regulated remnant vegetation is mapped in the area surrounding the existing irrigation area. Clearing of remnant vegetation for MDWSS infrastructure or for the expansion of irrigation area has the potential to impact flora and fauna.

As described in Section 14.2.5, mapped regional ecosystems within the MDWSS and surrounding area are largely not of concern or of concern to regional ecosystems. There are areas of endangered regional ecosystems to the north, east and south-west of Lake Tinaroo. Four TECs also have the potential to occur within the Tablelands Agricultural Area.

Clearing within areas mapped as regulated vegetation will trigger approval to clear native vegetation. Clearing for high-value agriculture is a relevant purpose under the *Vegetation Management Act 1999* (Qld) so it is possible to submit a development application to clear native vegetation which would be assessed against the relevant code.

Clearing within areas of TEC has the potential to trigger assessment under the EPBC Act. If clearing will have or is likely to have a significant impact on the TEC, referral and assessment of the clearing under the EPBC Act will be required.

A number of flora and fauna species protected under State and Commonwealth legislation also have the potential to occur within the MDWSS area. Depending on the location of the proposed works, approvals under State and Commonwealth legislation may also be required. Permit and approval requirements in relation to flora and fauna would be dependent on the location of the proposed works or irrigation development.

Changes to groundwater, such as quality and depth, as a result of Option 3 have the potential to impact GDEs known to occur within the Barron Basin. Increased take of groundwater or changes to groundwater



quality associated with intensification of use and/or expansion of irrigation in the Barron Basin has the potential to impact these GDEs. Management measures can be established to minimise expansion of irrigation, including establishing minimum set back distances for groundwater pumping from known GDEs and establish minimum groundwater depth triggers and pumping rates in prescribed areas which relate to the GDE water requirements.

As with Option 2, Option 3 has the potential to impact wetlands within and around the MDWSS through changes to flow regime and potential changes in water quality. Delivery of environmental flows to sustain wetlands could be implemented to minimise potential impacts.

13.4.9 Climate and Air Quality

Option 3 may create new water allocations, which could potentially increase the irrigated area within the Barron Basin. Increasing the cropped area within the Barron Basin would potentially increase the exposed surfaces and result in an increase in dust generated in the area. The potential decrease in air quality due to dust emissions is not considered to be significant.

Seasonal variations currently influence the availability and take of water within the MDWSS. The implementation of Option 3 will not change the seasonal variation in water availability of the system, but may change the water use practices that in turn may change the take of water in the system.

13.4.10 Climate Change and Emissions

Climate change has the potential to change the timing, frequency, magnitude and duration of stream-flows as well as reduce groundwater levels. Potential impacts may include an increase in frequency and severity of droughts. Increased agricultural activities may result in additional land clearing and increased use of fossil fuels which can contribute to carbon dioxide emissions.

13.4.11 Noise and Vibration

Option 3 involves improving existing infrastructure to reduce transmission and distribution losses. Noise and vibration may potentially increase during construction of infrastructure improvements; however, the works are proposed within an existing agricultural area and is unlikely to be significantly different to the existing noise and vibration associated with agricultural activities. Increased irrigation and associated agricultural machinery movements also have the potential to increase noise and vibration. As previously stated, the area is already being used for irrigation purposes and the extent of potential increase in irrigation area is unlikely to result in significant impacts to noise and vibration.

13.4.12 Landscape and Visual Amenity

The MDWSS area is an existing irrigation area and the visual amenity is consistent with agricultural use. The implementation of Option 3 has the potential to increase the irrigation area. This expansion in irrigation area would be consistent with the existing use in the surrounding area and is unlikely to result in a change to visual amenity.

13.4.13 Cultural Heritage

As detailed in Section 14.3.13, no Commonwealth heritage properties are located within the MDWSS and State and local heritage places are generally located within towns and are unlikely to be impacted by the implementation of Option 3.

Aboriginal cultural heritage has the potential to be disturbed during construction of infrastructure, as well as development of any new irrigation areas. The *Aboriginal Cultural Heritage Act 2003* Duty of Care Guidelines provides guidance in measures to ensure that activities are managed to avoid or minimise harm to Aboriginal



cultural heritage. Any activities that may cause ground disturbance that are associated with implementation of Option 3 will need to comply with the guidelines.

13.4.14 Waste Management

Option 3 involves improving existing infrastructure to reduce transmission and distribution losses to MP water. Waste potentially generated during construction includes domestic and industrial hazardous and non-hazardous wastes. Implementation of waste management practices during construction can manage potential impacts associated with waste generation.

13.5 Preliminary Environmental Assessment of Option 4: Nullinga Dam for Agricultural Use

13.5.1 Key Environmental Issues Associated with Option 4

The construction of Nullinga Dam would result in not only construction of a new impoundment on the Walsh River, but may also involve the development of a new irrigation area and an increase in the area of land within Area 10 of the MDWSS under irrigation. Key environmental issues associated with Option 4 include:

- Potential approval triggers at both State and Commonwealth level, resulting in a more complex and longer approval process to Option 2 and 3.
- Construction of the dam would require acquisition of land across a range of tenure types.
- Modification to the Walsh River and an increase in the area of land under irrigation (both in potential new irrigation and existing MDWSS) has the potential to impact water quality and flow downstream of the dam.
- Modification to the Walsh River will result in changes to the hydrological environment, both upstream and downstream of the dam, which may impact aquatic fauna.
- The dam wall will create a potential barrier to aquatic fauna which may impact species seasonal migration, spawning and preferred habitat and food resources.
- Clearing of regulated vegetation will be required for both the dam and new irrigation areas. Clearing of TEC and threatened species listed under the EPBC Act is likely to trigger an EPBC Act referral to the Commonwealth Department for Environment and Energy. Should the dam trigger an EIS at the State and/or Commonwealth level, offsets for vegetation clearing will be required.
- It is likely that essential habitat for threatened species listed at both the State and Commonwealth level will be impacted by the development.
- Change in land use both at the dam site and in the new irrigation will result in a change in visual amenity for the development areas.
- Aboriginal cultural heritage has the potential to be disturbed as a result of the project. As the project is likely to trigger an EIS, an approved Cultural Heritage Management Plan will be required.

13.5.2 Legislation and Permit Requirements

Due to the likely impact to matters of national environmental significance (MNES), Option 4 is likely to trigger the requirement for approval under the EPBC Act. At the State level, it is likely that the dam would meet the criteria for a significant project under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act). Declaration of the project as a state significant project is likely to trigger the need for an EIS.



To minimise duplication of the assessment process, an assessment bilateral agreement between the State and Commonwealth is in place. To take advantage of this process, coordination of the initial referral of the project to the State and Commonwealth will be required.

Several additional approvals are likely to be required. Approvals under the following legislation are likely to be triggered:

- Native Title Act 1993 (C'th)
- SP Act (Qld) (or the *Planning Act 2016* when it comes into force in July 2017)
- Environmental Protection Act 1994 (Qld)
- Water Act 2000 (Qld)
- Vegetation Management Act 1999 (Qld)
- Nature Conservation Act 1992 (Qld).

As with Option 2, Option 4 will also require changes to the ROP. Section 14.3.2 details the changes to the water planning framework. However, Option 4 is likely to require substantial change to the existing water planning and is likely to take longer to incorporate Option 4 into the necessary water planning documents.

13.5.3 Planning and Land Use

The construction of the Nullinga Dam and compatibility with existing and future land use would be assessed as part of the EIS. The dam would result in a loss of agricultural land and resultant change in land use within the inundation area of the dam.

The Nullinga Dam would provide the opportunity to expand irrigated cropping into new areas of the MDWSS and potentially new irrigation areas outside of the MDWSS. Within the rural zone, a change to irrigated cropping (excluding forestry for wood production) is self-assessable development under the Mareeba Shire Council planning scheme. Expansion of cropping within the rural zone because of Option 4 is consistent with the intent of the planning and land use within the rural zone.

13.5.4 Property Impacts

Land within the footprint of the proposed inundation and buffer areas for Nullinga Dam will require acquisition to enable the development to proceed. Land tenure around the proposed dam site is a mix of freehold, lease hold land, reserves and State land. Under the SDPWO Act, the Coordinator-General has the power to resume or compulsorily acquire land on which large-scale infrastructure projects are to be built.

13.5.5 Water Quality

13.1.1.5 Surface Water

The implementation of Option 4 has the potential to result in a change to water quality within the Walsh and Mitchell river catchments. Reduced downstream flows due to the dam have the potential to greatly increase the impacts of runoff and nutrients on the Walsh River.

13.1.1.6 Groundwater

Groundwater pressure has the potential to change as a result of the dam. Change in groundwater pressure can increase groundwater levels in the vicinity of the dam. Further investigation into the potential hydrogeological change as a result of change in groundwater pressure would be further investigated as part of an EIS.



Implementation of Option 4 may result in a change in land use from rain-fed cropping and grazing to irrigated cropping. As was the case for Options 2 and 3, irrigation may result in an increase in fertiliser and pesticides applications associated with cropping.

13.5.6 Topography, Geology and Soils

The Nullinga Dam will result in inundation of agricultural and grazing land. The dam will permanently alienate this agricultural land from productive agricultural use. Change in land use due to irrigation has the potential to increase the risk of salinisation and may also result in erosion due to an increase in exposed surfaces. Development of the Nullinga Dam and associated irrigation area also has the potential to impact the Chillagoe-Mungana Caves due to changes in water quality and quantity of water.

13.5.7 Hydrology

Development of the Nullinga Dam is likely to result in significant flow-related impacts to the Walsh River. Changes to the low flow regime have the potential to impact flora and fauna, as well as existing downstream users and commercial industries in the Gulf of Carpentaria. Management of the low flow regime through environmental releases from Nullinga Dam may potentially reduce the impact to flora and fauna. The dam will also result in a change to flood regime, resulting in reduced floodplain process and flood-tolerance of the riverine ecosystem.

Reduction in high flows reduces the competitive advantage of flood-tolerant or dependent species. The dam will also impact sediment transport. The dam will act as a sink for sediment upstream and will reduce the sediment load downstream of the dam. This has the potential to cause erosion downstream. There is also potential of a slight reduction in sediment transport in the Mitchell River catchment, increasing the potential for weed encroachment and associated implications to instream biota.

13.5.8 Flora and Fauna

The implementation of Option 4 has potential for significant impacts to flora and fauna. Impacts will vary depending of the project stage, with impacts during construction generally short-term, with long-term impacts associated with dam operation. Potential short-term impacts during construction and impoundment filling include:

- Loss of riparian zone along the Walsh River and tributaries of Catherine, Pandanus and Middle creeks.
- Loss of terrestrial habitat due to construction of the dam wall, access roads and water supply infrastructure.
- Barrier to fish and turtle passage due to the dam wall, potentially dividing populations and disrupting migration and lifecycle stages of migratory or highly mobile species.
- Change in aquatic habitat due to alteration to flow and water quality.
- Increase in invasive and pest species through creation of conditions conducive to the introduction and maintenance of populations of pest species such as tilapia (*Tilapia mariae*), hymenachne (*Hymenachne amplexicaulis*) and gambusia (*Gambusia affinis*).
- Flooding of flora and fauna communities due to inundation by dam waters.

Potential long-term impacts associated with the dam operation include:

- Changes to downstream morphology of riverbed and banks that has the potential to change the in-stream habitat and provide habitat favourable to invasive flora and fauna.



- Impact on benthic substrates and their dependent macroinvertebrate communities due to changes in sediment loads.
- Change to flood regime, resulting in reduced floodplain process and flood-tolerance of the riverine ecosystem and reduction in the competitive advantage of flood-tolerant or dependent species.
- Long term alteration below impoundment area impacting the abundance and diversity of fauna populations.
- Long term opportunities for pest species through the creation of conditions favourable for establishment and survival.
- Loss of terrestrial habitat due to clearing associated with establishment of new irrigation area.

13.5.9 Climate and Air Quality

Option 4 will result in development of a new irrigation area within the Walsh River and Mitchell River catchments. Increasing the cropped area would potentially increase the exposed surfaces and result in an increase in dust generated in the area. The potential decrease in air quality due to dust emissions is not considered to be significant.

13.5.10 Climate Change and Emissions

Climate change has the potential to change the timing, frequency, magnitude and duration of stream-flows as well as reduce groundwater levels. Potential impacts may include an increase in frequency and severity of droughts. Increased agricultural activities will result in additional land clearing and increased use of fossil fuels which can contribute to carbon dioxide emissions.

13.5.11 Noise and Vibration

Option 4 involves the construction and operation of the Nullinga Dam. Noise and vibration is likely to increase during construction of the dam. Potential impact of construction related noise and vibration at sensitive receptors will be required to be assessed as part of the EIS process. It is unlikely that noise and vibration associated with operation of the dam will have a significant impact to sensitive receptors.

13.5.12 Landscape and Visual Amenity

With the exception of the existing MDWSS area on the Walsh River, the landscape is dominated by grazing and natural areas. The development of the dam and associated irrigation area will change the visual amenity of these areas. In relation to the new irrigation area, visual amenity impact may be limited as the development is within an existing agricultural area and sensitive receptors may not be sensitive to the change in visual amenity. The dam will result in a significant change in visual amenity of the area.

13.5.13 Cultural Heritage

In the area of the Nullinga Dam site through to Chillagoe there are no Commonwealth heritage properties. State heritage places within the area are upstream of the proposed dam site and to the north west of Dimbulah. It is unlikely that the implementation of Option 4 will impact these sites. Local heritage places are located within towns and are unlikely to be impacted by the implementation of Option 4.

As it is highly likely that Option 4 will trigger the requirement for an EIS, the Aboriginal Cultural Heritage Act requires that a cultural heritage management plan (CHMP) is developed and approved for the project. The CHMP is an agreement between the proponent and the Traditional Owners and details how land use activities can be managed to avoid or minimise harm to Aboriginal cultural heritage.



13.5.14 Waste Management

Option 4 involves construction of a new dam. During construction of the dam, waste potentially generated includes domestic and industrial hazardous and non-hazardous wastes. Waste disposal will be required to keep the construction area tidy and safe, but also to prevent land and water contamination. Implementation of waste management practices during construction can manage potential impacts associated with waste generation.

13.6 Conclusion

The legislative and permitting requirements to implement Options 2 or 3 are significantly less than those required for Option 4.

The implementation of Option 2 would require amendment of existing water resource planning documents. Recent legislative changes have resulted in the introduction of a new water-planning framework. This means that there is a potential for Option 2 to be implemented with relatively low additional cost.

Option 3 requires limited permitting requirements, simply development approvals for operational works under either relevant planning schemes, the SPA, or equivalent planning legislation.

Option 4 is likely to meet the requirements to be declared a controlled action under the EPBC Act and meet the criteria for a significant project under the SDPWO Act. This would trigger the need for an EIS to be approved prior to construction of the dam. The EIS process is a more complex and longer approval process than that required for implementation of Option 2 or 3.

All three options have the potential to increase the area of land under irrigation, with Option 4 providing the largest potential for increased irrigation. Environmental impacts associated with increased irrigation are likely to reflect the scale of impact, but may include:

- Reduction in habitat as a result of vegetation clearing.
- Changes in surface water and groundwater level and quality due to increases in farm inputs.
- Changes to the hydrological regime resulting in potential impacts to aquatic flora and fauna.

In addition to increased irrigation area, Option 4 includes the construction of Nullinga Dam. This will result in inundation of land currently used for agricultural purposes and a number of environmental impacts. The potential environmental impacts associated with the dam include:

- Loss of riparian zone and terrestrial habitat and changes in aquatic habitat due to inundation, alteration to flow and/or water quality.
- Barrier to the movement of aquatic fauna due to the dam wall.
- Changes to downstream morphology of riverbed and banks which has the potential to change the in-stream habitat and provide habitat favorable to invasive flora and fauna.
- Impact on benthic substrates and their dependent macroinvertebrate communities due to changes in sediment loads.
- Change to flood regime, resulting in reduced floodplain process and flood-tolerance of the riverine ecosystem and reduction in the competitive advantage of flood-tolerant or dependent species.
- Impact to cultural heritage within the inundation area.



CHAPTER 14

ECONOMIC ANALYSIS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

14	ECONOMIC ANALYSIS	3
14.1	Purpose	4
14.2	Establishing the Economic Base Case (Economic Baseline)	5
14.3	Demand for Water Based on Unirrigated Cropping Land	17
14.4	Economic Benefits—Method and Assumptions	19
14.5	Economic Costs	23
14.6	Timing of Economic Costs and Benefits—Assumptions	26
14.7	Option 2: Improve MDWSS Rules and Operation	29
14.8	Option 3: Modernise MDWSS and Convert Losses	32
14.9	Option 4: Nullinga Dam for Agricultural Use	35

TABLES

Table 1	Employment by Industry—Tablelands Agricultural Region and Queensland 2011	6
Table 2	Employment for Agriculture, Forestry and Fishing Industry—Tablelands Agricultural Region.....	7
Table 3	Total Area, Gross Revenue and Revenue per Hectare by Commodity 2014-15	8
Table 4	GVP or Gross Revenue per Hectare by Commodity 2014–15	10
Table 5	Different Commodities Relating to GVP per Hectare for Tablelands and MDWSS Agriculture 2015	12
Table 6	Changes in Hectares of Agricultural Production 2011 to 2015	13
Table 7	Areas of Cropping Land in Area 10 (Section of MDWSS near Nullinga Dam)	18
Table 8	Areas of Unirrigated Cropping Land in Area 10 and Potential Demand for Water	18
Table 9	IVA—Three Main Agricultural Categories in the Atherton Tablelands	20
Table 10	Comparison of GVP per Hectare in MDWSS—Options 2 and 3	21
Table 11	Comparison of GVP per Hectare in MDWSS—Option 4	21
Table 12	Opportunity Cost—Option 2 and 3.....	22
Table 13	Opportunity Cost—Option 4	23
Table 14	Irrigation Equipment Cost—Option 2 and 3.....	24
Table 15	Irrigation Equipment Cost—Option 4.....	24
Table 16	On-Farm Crop Establishment Costs—Option 2 and 3	25
Table 17	On-Farm Crop Establishment Costs—Option 4.....	25
Table 18	Timing of Economic Costs and Benefits in Economic Model—Option 4	26
Table 19	Timing of Water Uptake and Indicative Cumulative Economic Benefit.....	27
Table 20	Direct and Indirect Jobs from Agriculture in the Tablelands.....	27
Table 22	Additional Employment Associated with Option 2 Productivity Scenarios	30
Table 23	Economic Net Present Value—Sensitivity Analysis.....	31
Table 24	Economic Benefit Cost Ratios—Sensitivity Analysis	31
Table 25	Economic Net Present Value—Sensitivity Analysis.....	31
Table 26	Economic Benefit Cost Ratios—Sensitivity Analysis	31
Table 27	New Water Created by Option 2	31



Table 28	Additional Hectares of Production—Option 3	33
Table 29	Option 3 Capex, On-Farm Investment and Benefit Estimation—Medium Scenario.....	33
Table 30	Additional Employment Associated with Option 3 Productivity Scenarios	34
Table 31	Economic Net Present Value—Sensitivity Analysis.....	34
Table 32	Economic Benefit Cost Ratios—Sensitivity Analysis	34
Table 33	Economic Net Present Value—Sensitivity Analysis.....	34
Table 34	Economic Benefit Cost Ratios—Sensitivity Analysis	35
Table 35	New Water Use Created by Option 3	35
Table 36	Additional Hectares of Production—Option 4	36
Table 37	Option 4 Capex, On-Farm Investment and Benefit Realisation Schedule (\$2017)	36
Table 38	Option 4 Capex Profile (\$2017).....	36
Table 39	Option 4 On-Farm Investment and Benefit Estimation – Medium Scenario.....	37
Table 40	Additional Employment Associated with Option 4 Productivity Scenarios	38
Table 41	Economic Net Present Values—Sensitivity Analysis	38
Table 42	Economic Benefit Cost Ratios—Discount Rates Sensitivity Analysis.....	38
Table 43	Economic Net Present Value—Sensitivity Analysis.....	38
Table 44	Economic Benefit Cost Ratios—On-farm Benefits Sensitivity Analysis.....	38
Table 45	New Water Use Created by Option 4	39

FIGURES

Figure 1	GVP Tablelands Agricultural Region \$ (DAF 2015).....	8
Figure 2	Gross Value of Crop Production per Hectare in the Tablelands (DAF 2015).....	10
Figure 3	Gross Demand Forecast Scenarios (MJA 2017)	16
Figure 4	Queensland Land Use Mapping of SunWater Management Area 10.....	17
Figure 5	2016 Permanent Water Trades in the MDWSS.....	28



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).

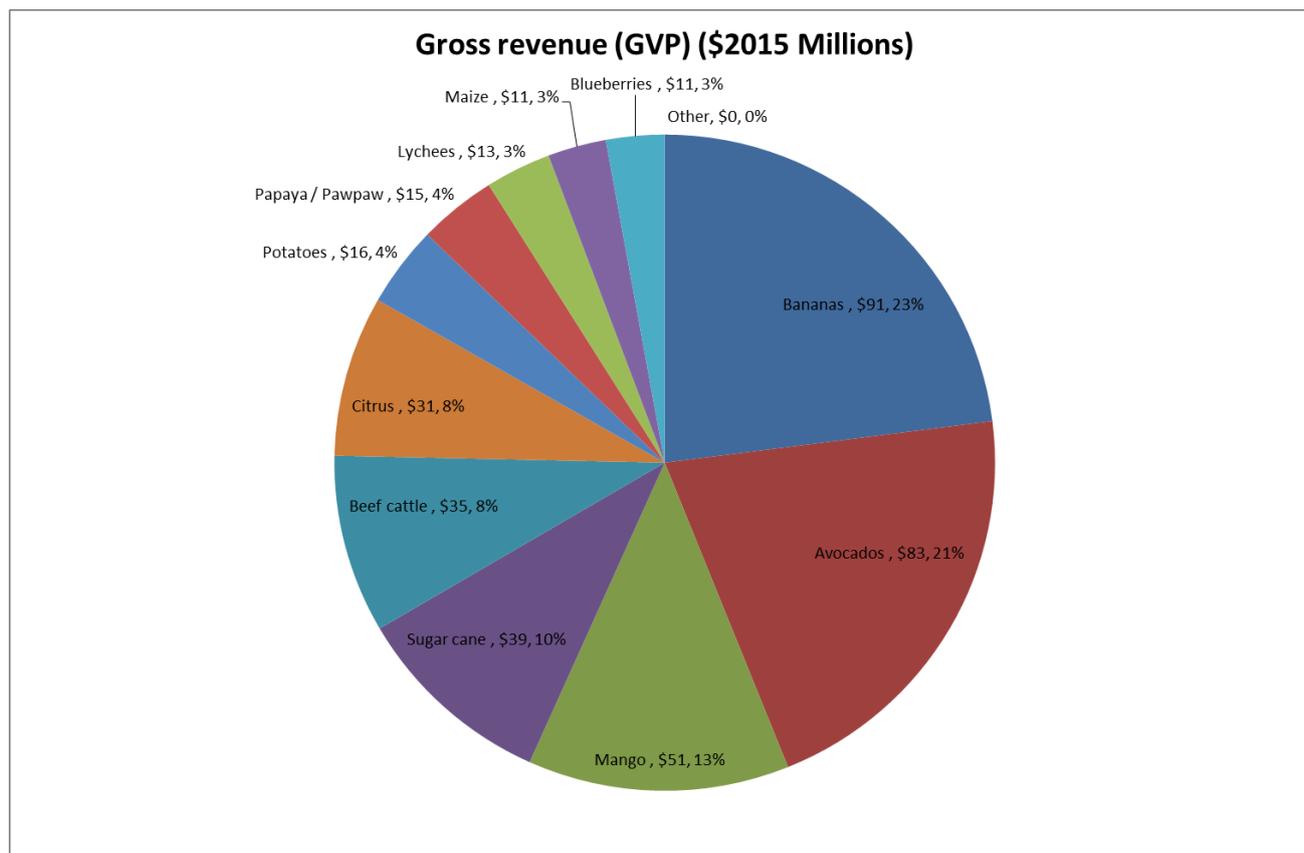
14.2.2 Profile of Agricultural Production

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



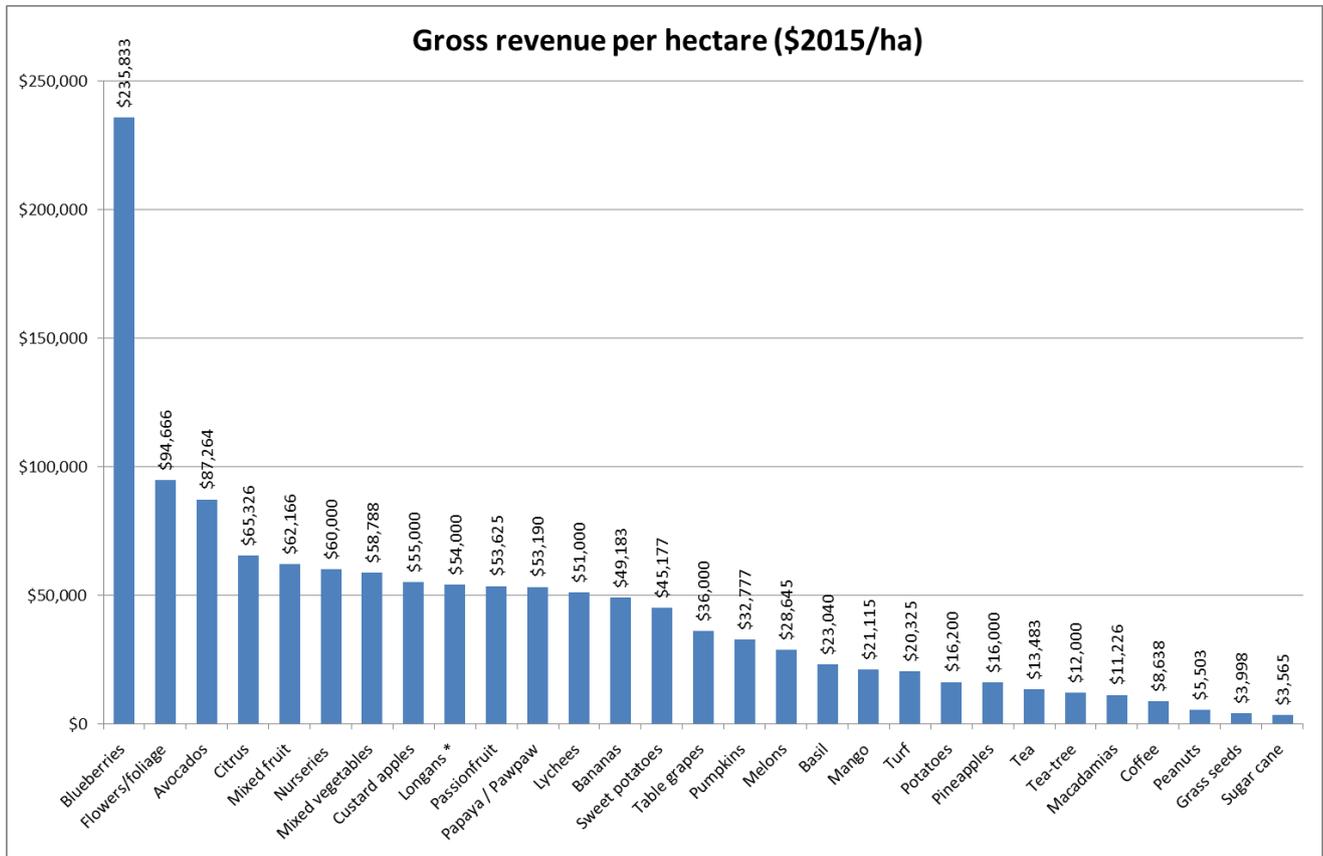
COMMODITY	AREA 2015 (HA)	GROSS REVENUE (\$2015 MILLIONS)	SHARE OF TOTAL GVP	GVP/HA (\$2015/HA)
Pumpkins	270	8.9	1.9%	32,777
Longans* (like lychees)	125	6.8	1.4%	54,000
Nurseries	100	6.0	1.3%	60,000
Tea	445	6.0	1.3%	13,483
Sweet potatoes	123	5.6	1.2%	45,177
Peanuts	874	4.8	1.0%	5,503
Grass seeds	1,195	4.8	1.0%	3,998
Hay	3,020	3.7	0.8%	1,240
Flowers/foilage	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/foilage	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/foilage	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 value 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.

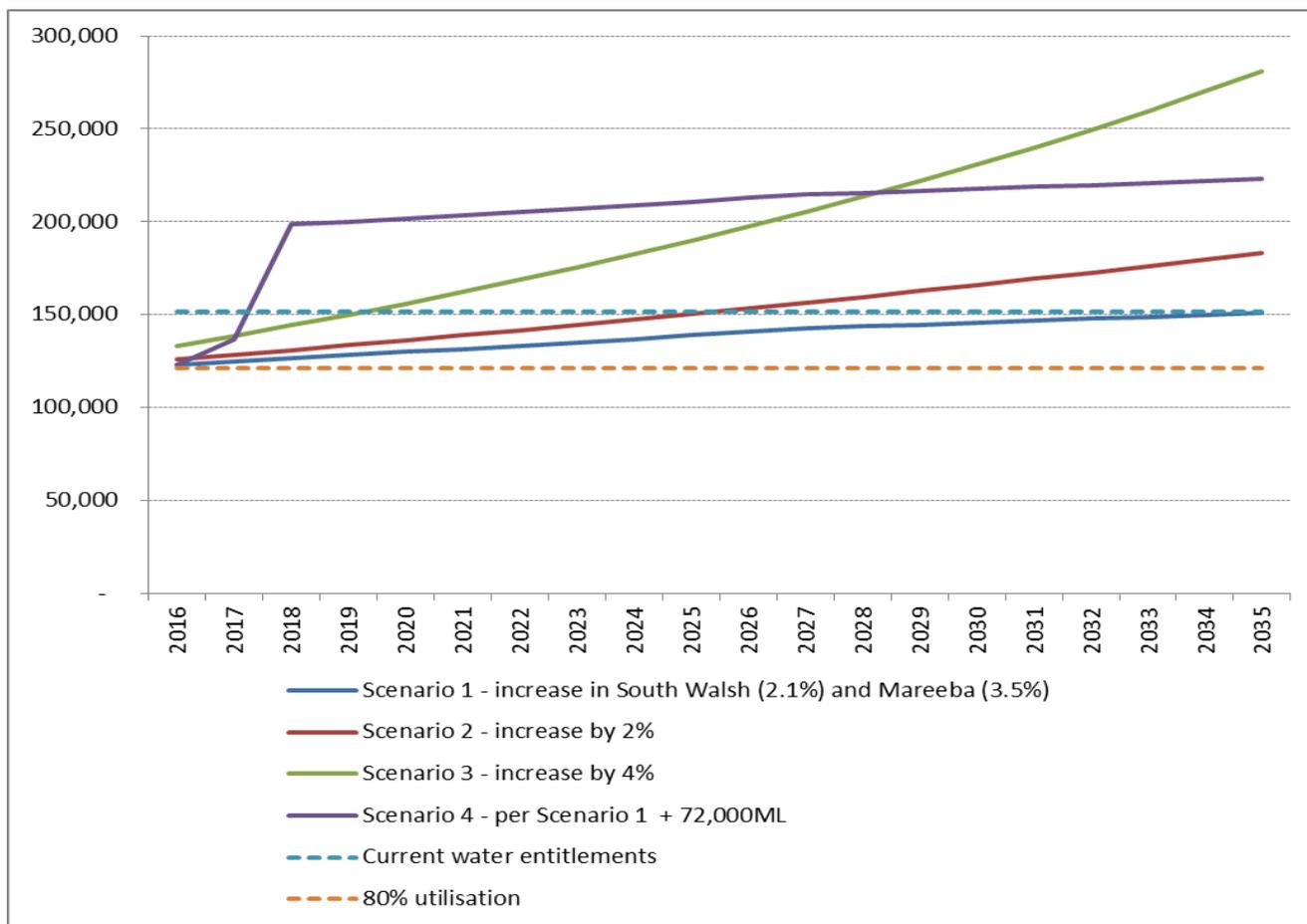
MJA modelled four demand scenarios:

- 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.

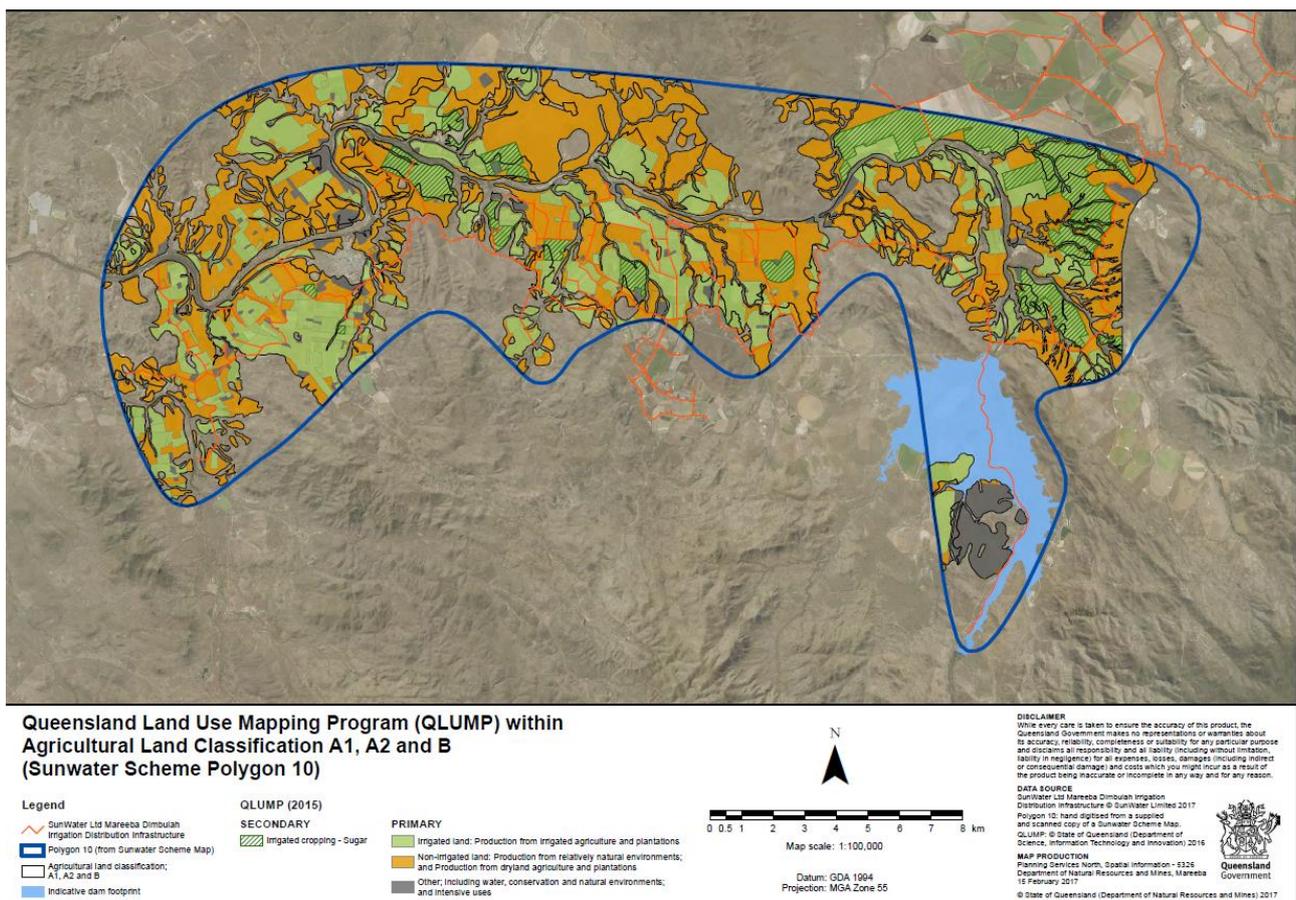
The first two bullet points (above) suggest that a new water supply (Options 3 and 4) and other related measures (Option 2) would address some of the barriers to agricultural production in Northern Queensland.

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. DNRM 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 cent² 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.

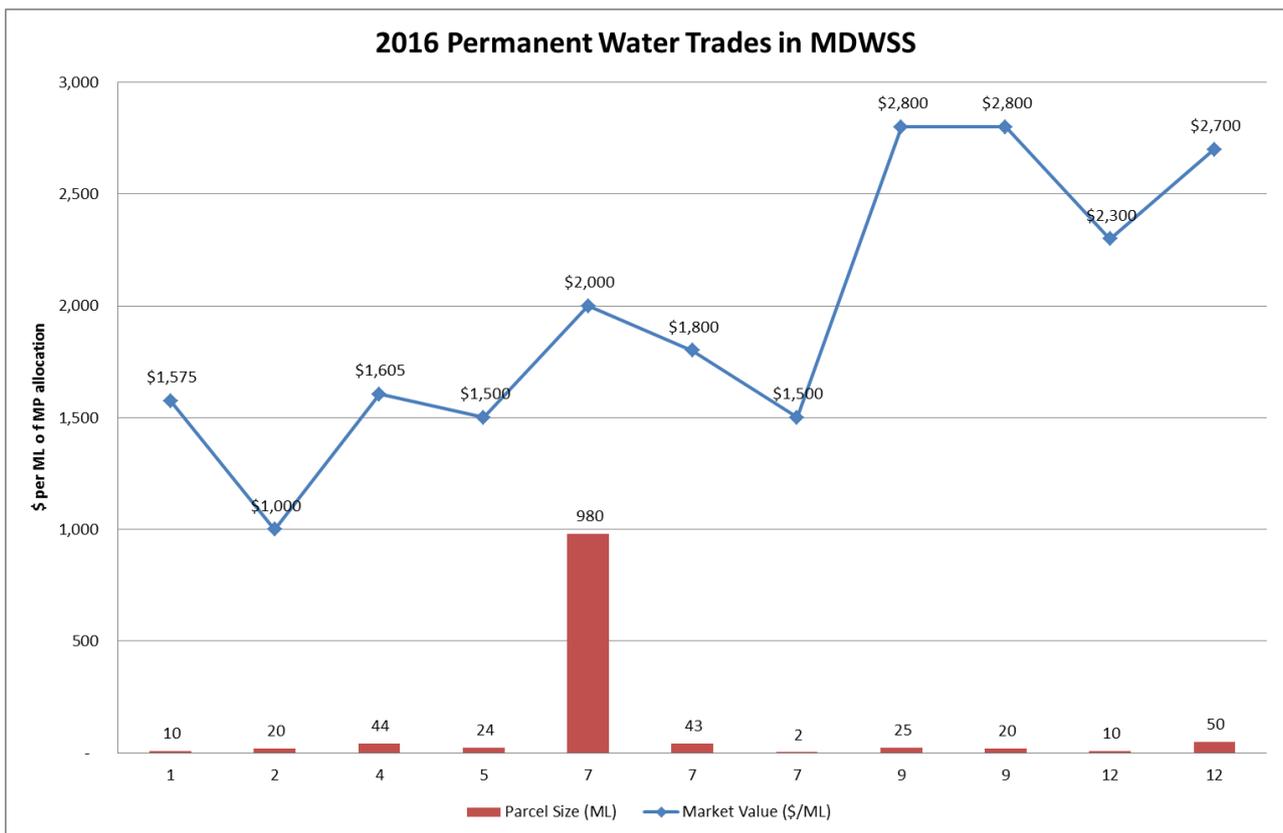
14.6.2 Value of Irrigation Water

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 than 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.



CHAPTER 15

FINANCIAL AND COMMERCIAL ANALYSIS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

15	FINANCIAL AND COMMERCIAL ANALYSIS	3
15.1	Purpose	4
15.2	Approach	4
15.3	Financial Net Present Value (FNPV)	7
15.4	Risk Unadjusted Financial NPVs—Summary	19
15.5	Risk-adjusted Financial NPVs—Method	21
15.6	Application of Risk Findings	23
15.7	Risk-adjusted NPVs	23

TABLES

Table 1	Considerations and Sensitivities with Shortlisted Options	5
Table 2	Customer Willingness to Pay.....	7
Table 3	Summary of Assumed Cost of Debt	10
Table 4	Key Assumptions—Financial Year	10
Table 5	Key Assumptions—Asset Lifespan	11
Table 6	Key Assumptions—Cost Escalation	11
Table 7	Key Assumptions—Annual Water Charges Escalation.....	11
Table 8	Assumed Yields for Options	12
Table 9	Capital Costs—Option 3	13
Table 10	Capital Costs—Option 4	13
Table 11	Estimated Operating Costs (Government)—Option 2.....	13
Table 12	Estimated Ongoing Opex—Option 3	14
Table 13	Estimated Ongoing Opex—Option 4	15
Table 14	SunWater Existing Tariffs	17
Table 15	Types of Revenues for Assessing Option 2.....	17
Table 16	Types of Revenues for Assessing Option 3.....	18
Table 17	Estimated Impacts on Annual Charges—Option 3.....	18
Table 18	Types of Revenues for Assessing Option 4.....	18
Table 19	Estimated Annual Water Charges—Option 4.....	19
Table 20	Summary of Financial NPVs for Options (Not Adjusted for Risk)	19
Table 21	Capex Funding and Annual Charges (Not Adjusted for Risk)—Option 3	19
Table 22	Capex Funding and Annual Charges (Not Adjusted for Risk)—Option 4	20
Table 24	Quantitative Guidelines for Capex and Opex Consequences for Option 4.....	21
Table 25	Risk Categories for Options 2 to 4	22
Table 26	Risk-adjusted NPV Outputs for Option 3	24
Table 27	Risk Adjustments for Option 3	25
Table 28	Risk-adjusted NPV Outputs for Option 4	25
Table 29	Risk adjustments to Option 4.....	27
Table 30	Financial Risk-adjusted NPVs.....	27
Table 31	Cost Estimate for Option 3 (8,300 ML).....	29



Table 32	Capital Cost Estimation for Option 3	29
Table 33	Central Capex for a Small Yielding Nullinga Dam	30
Table 34	Alternative Central Capex for a Small Yielding Nullinga Dam.....	30

FIGURES

Figure 1	Process Used for Identifying Risks	23
Figure 2	Monte Carlo Revenue Output for Option 3.....	24
Figure 3	Monte Carlo Totex Output for Option 3.....	24
Figure 4	Monte Carlo Revenue Output for Option 4.....	25
Figure 5	Monte Carlo Totex Output for Option 4.....	26
Figure 6	Monte Carlo Total Capex Output for Option 4.....	26
Figure 7	Financial NPV (Net Revenue) for Option 3	32
Figure 8	Financial NPV (Net Revenue) for Option 4	32



15 FINANCIAL AND COMMERCIAL ANALYSIS

CHAPTER SUMMARY AND CONCLUSIONS

- This chapter sets out financial implications of the shortlisted options.

Option 1: Do minimum (base case)

- This is business as usual and outlines the base line. All financial analysis has been developed as incremental changes to the Base Case. For example, changes in capital and operating costs for Options 3 and 4 are net of changes to the Base Case.

Option 2: Improve MDWSS rules and operation

- This option has no capital costs (capex) as it is reform only. An annual \$0.5 million operating costs (opex) budget for two years (total \$1 million) is estimated, comprised of government wages and consultant costs.

Option 3: Modernise MDWSS and convert losses

- The risk adjusted capex estimate for this option depends on the cost of works and assumed medium priority (MP) water allocations to be converted from loss allocations.
- At \$2,500 per ML upfront contribution for MP water allocations, customers may provide a significant portion of capital funding, depending on the yield and capital costs of the works. Certainty on the capex and yield estimates is subject to further detailed assessment.
- Estimated annual charges are within the expected range consistent with the MDWSS charges in relation to water services and it is expected annual charges will recover ongoing opex.

Option 4: Nullinga Dam for agricultural use

- The central case risk adjusted capex estimate for this option developed for the PBC is \$323 million.
- At \$2,500 per ML for MP water allocations, customers may provide contributions of 33 to 58 per cent of the capital funding requirements, depending on the capex assumptions and water sales. This leaves a substantial portion of the capital costs which would be required to fund the balance.
- Estimated annual water charges depend on the funding model applied.

Financial Net Present Value

- The Financial Net Present Value (FNPV) of the shortlisted options presented in this chapter is based on assumptions in relation to the pre-sale of new water allocations prior to water availability (creating certainty over demand/recovery of costs from customers; and the transfer of risk from the proponent to the customer) and the application of Australian Government funding. If an alternative model was used the result would be different. However, a FNPV of zero does not mean the cost and revenue of an option is zero e.g. the risk adjusted gross whole of life present value cost for Option 3 is \$55.7 million and for Option 4 is \$431.2 million.



15.1 Purpose

The purpose of this chapter is to document the financial implications and budgetary impacts by presenting cash flows for each shortlisted option. The analysis incorporates risks associated with the cash flows for each option to explain and quantify financial inputs to decision-making.

15.2 Approach

In summary, this assessment has taken the following approach for each of the shortlisted options:

1. Identified revenues and costs (both capital and operating costs) and modelled over the evaluation period of 30 years.
2. Assumptions have been set out and nominal discount rates have been applied to nominal cash flows.
3. Generated a summary table of the revenues and costs in Present Value (PV) terms with commentary allowing a comparison of the options.
4. Customer capital funding has been considered, as well as potential government funding for analysis purposes, to show the impact of different funding models.
5. A Financial Net Present Value (FNPV) has been calculated, with a risk-adjusted discount rate, and SunWater costs estimates and debt costs provided by the NWILF.
6. FNPVs have been presented based on raw costs and revenues without risk adjustments.
7. FNPVs have been presented based on risk-adjusted revenues and costs to a P50 level of confidence.

15.2.1 Demand Forecasting Approach

A key input to the financial analysis is a robust demand forecast. Demand forecasting for commercial water infrastructure requires consideration of demand for allocations and demand for water use.

The key component of water demand in the context of this PBC is demand for new water allocations. It is critical for water infrastructure projects (e.g. Option 3 and 4) to assess the water users' (e.g. irrigators) willingness to pay for permanent water allocations.

In terms of annual cash flows, water supply and demand for water use are not as critical. Generally, around 90 per cent of costs are fixed and recovered via fixed charges, regardless of water use. Variable (delivery) costs are matched by water use charges reflecting those variable costs (generally around 10 per cent). Combined, this means that regardless of water availability or water use, the annual capital and operating costs are equal to revenue. The only exception is where there may be customer default (non-payment of bills) which is a very low risk historically in SunWater schemes.



15.2.2 Considerations and Sensitivities

Table 1 shows considerations and sensitivities which affect the aspects of each option.

Table 1 Considerations and Sensitivities with Shortlisted Options

SENSITIVITY		ANALYSIS
OPTION 2 – IMPROVE MDWSS SCHEME AND OPERATION		
1.	Requirement for government grant or concessional loan funding	Option 2 requires no grant or concessional loan funding.
2.	Establishment costs	One-off operating costs have been identified for Option 2, comprised of government wages and consultant costs.
3.	Ongoing management costs for system operators	An incremental increase in MDWSS staff is not expected as a result of the Option 2 reform process, as there will be no increase in water allocations and no change to infrastructure. If increased staff were required, these costs are expected to be fully recovered through water tariffs.
4.	Costs to irrigators to engage in a more sophisticated scheme	<p>It is expected education will be delivered to irrigators are part of the reform process. This may include:</p> <ul style="list-style-type: none"> ▪ Describe peak flow entitlements for customer ▪ Train customers in peak flow entitlement trading ▪ Describe carryover modelling to customers ▪ Describe water ordering options for customers. <p>It is assumed government or SunWater will deliver this education and there will be no cost to irrigators.</p>
5.	Affordability	Costs associated with Option 2 will need to be considered within existing departmental and SunWater budgets.
6.	Potential impact of LMA	Many of the proposed reforms are bulk operational matters and are likely to remain with SunWater. However, it is recommended that any implementation of Option 2 involve ongoing consultation with the interim Local Management Arrangements (LMA) Board for the Mareeba-Dimbulah Distribution System to ensure that there is limited potential for any impacts on any separation payment.
OPTION 3 – MODERNISE MDWSS AND CONVERT LOSSES		
7.	Requirement for government grant or concessional loan funding	Option 3 may require grant or concessional loan funding depending on the capital costs. This requires further detailed assessment.
8.	Commercially neutral FNPV based on the assumption of \$2,500 allocation sale price	This issue is addressed in Table 2 below.
9.	Accuracy of loss reduction and cost estimates	The accuracy of loss reduction estimates has been addressed by using a number of variables in the yield analysis. The issue of capital cost estimates has been addressed by using a number of variables in the cost analysis.



SENSITIVITY	ANALYSIS
OPTION 4 - NULLINGA DAM FOR AGRICULTURAL USE	
10. Water sales	A customer funding model where contracts are pre-sold using deposits and binding contracts will provide certainty over the number and price of pre-sold allocations. In comparison, not pre-selling water allocations will mean water sales will depend on market appetite and have less certainty.
11. Capital costs	The low to high capital costs include a range of detailed sensitivities. It is assumed that charges for the new scheme will be set after the capital costs have been realised.
12. Timing of take up	A customer funding model with pre-sold water allocations will mean the take up of allocations will immediately follow the availability of water. Customers will not be able to delay entering into contracts until they are ready to receive water. In comparison, not pre-selling water allocations will create a risk for water take-up, as it will be dependent upon water sales being made following water availability.
13. Affordability to water users	This issue is addressed in the affordability chapter.
14. Discount rate of 4%	<p>The NWILF loans have a term of 15 years (half of the 30-year assessment period).</p> <p>SunWater’s bulk and distribution prices are recalibrated periodically to account for changes in conditions, including the cost of debt and the cost of equity. The current period is 7 years, due to a two-year extension. However, typically annual charges will be updated to accommodate changes in costs every five years.</p> <p>The FNPV over the life of the asset will still be neutral if the annual discount rates are chained into an annual discount factor. The NPV will also be neutral if a geometric average of the annual discount factors is used.</p> <p>There may be some changes in the cost of debt and equity during the pricing period. The discount rate is likely to rise from the current low, reducing charges below full cost recovery (NPV neutral). However, there will likely be instances where the discount rate falls during the pricing period increasing charges above full cost recovery. This has been the case in the current pricing period, where actual costs of capital have fallen while prices have been set using higher capital costs.</p> <p>The impact of an increasing discount rate is an increase in water charges. However, increasing capital costs generally indicates improving economic conditions, typically resulting in a higher capacity to pay for water allocations by customers.</p>



15.2.3 Assessment of Customer Willingness to Pay

The table below shows the range of customer willingness to pay using four different methods. \$2,500 is within the range of all of these estimates and has been used in the benchmark for allocation prices.

Table 2 Customer Willingness to Pay

METHOD	LOW (\$)	CENTRAL (\$)	HIGH (\$)
2015 and 2016 maximum permanent water trading	2,000	2,400	2,800
SunWater estimate	2,000	2,600	2,800
MJA Demand Report	2,000	2,500	3,000
Jacobs consultation	2,000	2,500	3,000

15.3 Financial Net Present Value (FNPV)

This section presents the unadjusted FNPV as the output of the PBC's financial model, which projects cash-flows (revenues and costs) from each of the three shortlisted options over a 30-year time horizon. Options 3 and 4 are the main focus of this chapter, as Option 2 is a reform process and does not require a detailed financial analysis.

The financial model (which provides inputs into the economic model) includes revenues generated by the project, capital costs, operating costs and residual values (in the last year of the NPV analysis). Net cash-flow balances have been calculated in each year and discounted at an appropriate nominal discount rate.

A FNPV has been produced for Options 3 and 4. The FNPV reflects the modelled net financial impact to the Queensland Government through SunWater as a government-owned corporation (the assumed proponent for the purposes of the analysis), in present dollars from an internal financing perspective.

The unadjusted FNPV does not take into account the risk profiles of the cash flows. This should be taken into account when considering the FNPVs.

15.3.1 Pricing Method

The National Water Initiative (NWI) advances the principles of:

- User pays infrastructure – the users who directly use the benefit of the infrastructure are charged for its use
- Cost reflective prices – the charges users pay reflect the infrastructure's costs, including:
 - Operating and maintenance expenditure
 - Capital expenditure.

Historically, SunWater does not usually recover all the costs of past capital expenditure through its prices. QCA estimated prices for SunWater's irrigation users in 2012 reflecting:

- Operating and maintenance costs, including interest on loans (fixed and variable)
- Renewals annuity, which collects funds for future capital costs (fixed)¹.

¹ [http://www.qca.org.au/getattachment/5fad8dc9-2101-4097-bdc8-d90d25fbfbbb/SunWater-Irrigation-Price-Review-2012-17-Volum-\(1\).aspx](http://www.qca.org.au/getattachment/5fad8dc9-2101-4097-bdc8-d90d25fbfbbb/SunWater-Irrigation-Price-Review-2012-17-Volum-(1).aspx), p. xxxii



This approach is known as lower bound pricing. SunWater's lower bound pricing for irrigators reflects the past funding decisions of governments. These past governments may have intended on fully recovering capital costs through economic benefits rather than charges to direct users. A new piece of infrastructure using the lower bound prices method would have a negative FNPV.

Upper bound pricing reflects all the costs related to the construction of new infrastructure, including the cost of capital. New infrastructure, using the upper bound pricing approach, would have a neutral FNPV.

Upper bound prices have been used in the financial analysis in this PBC. Upper bound pricing may be implemented through modifying SunWater's lower bound pricing, by adding a rate of return (Weighted Average Cost of Capital (WACC) multiplied by the Regulatory Asset Base (RAB)).

The RAB is a measure of a regulated utility's assets on which it is allowed to earn a return. The generally adopted measure of a RAB for regulated utilities in Australia is the Depreciated Optimised Replacement Cost (DORC). With this method depreciation of assets is removed from the RAB annually. SunWater's current preference is the Optimised Replacement Cost (ORC), which does not feature depreciation.

Upper bound pricing is implemented using a building block approach. Most regulated urban water utilities use this approach. The upper bound building blocks include:

- Operating and maintenance expenditure (fixed and variable)
- Return of capital, or depreciation, which recovers the principal of the capital expenditure (fixed)
- Return on capital, which recovers the cost of raising the funds for capital expenditure (fixed).

Under this approach, prices are based on recovering past capital expenditure, rather than a forecast of future capital expenditure, such as SunWater's ORC and renewals annuity approach.

15.3.2 Approach

NWI pricing principles have been adopted in this analysis, as well as the regulatory economics building blocks approach to develop annual charges using:

- Return on capital (WACC multiplied by the RAB)
- Return of capital (depreciation as a proxy for a SunWater renewals annuity)
- Operating expenditure (opex) including estimates of labour, insurance and other opex items.

Temporary trading water market data from SunWater and anecdotal permanent trading data from representatives from large irrigators has been considered to establish willingness to pay. On this basis it is assumed that MP allocations are likely to trade in the range \$2,000 to \$3000 per ML with a central scenario assumption of \$2,500 per ML.

For each option, where data is available, the model developed for this analysis sets out:

- Costs – capex and opex over a 30-year time horizon for each option in nominal terms
- Demand in ML per annum
- Upfront payments by customers for water allocations (e.g. \$2,500 per ML as above)
- Annual charges (\$ per ML) and revenue in nominal terms (\$ per annum)
- A nominal WACC has been applied using the QCA's 2012 view of SunWater's regulated irrigation WACC
- Escalation rates used to achieve nominal cash flows are set out in the model and summarised below.



15.3.3 Discount Rate

The cost of capital will be influenced by parameters relevant to the proponent. Some key WACC inputs are constant in the analysis while others are varied to generate a range of WACCs for sensitivity analysis.

1. Constant parameters
 - a. Market risk premium (6.5 per cent)
 - b. Risk free rate (2.3 per cent)
2. Variable parameters
 - a. Equity beta—the equity beta is varied between SunWater’s QCA regulated equity beta (0.55) and its unregulated equity beta (0.74).
 - b. Cost of debt:
 - i. National Water Infrastructure Loan Facility cost of debt (2.22 per cent)
 - ii. Queensland Government entity estimated cost of debt (3.0 per cent).

15.3.4 National Water Infrastructure Loan Facility

To enable an understanding of different funding options, use of the Australian Government NWILF has been considered in the analysis. The NWILF provides access to up to \$2 billion of concessional loans for governments to co-fund the construction of water infrastructure. Access to loans is restricted to state and territory governments and subject to eligibility criteria, including that these governments and project partners can demonstrate that the proposed water infrastructure is economically viable and water resources are managed in accordance with the principles of the National Water Initiative.

15.3.4.1 Funding Contributions

Australian Government funding is contingent on the following conditions:

1. Non-Commonwealth parties, such as proponents and customers, must provide cash contributions of at least 51 per cent of total capital costs.
2. Commonwealth contributions for water infrastructure from all sources will not exceed 49 per cent.
3. Non-Commonwealth cash contributions may be sourced from proponents and private investors/customers.
4. In-kind contributions cannot form part of the non-Commonwealth contribution.

15.3.4.2 Features of National Water Infrastructure Loan Facility

Loans from the NWILF have the following features:

1. The minimum loan from the NWILF is \$50 million. There is no upper limit, however, funding is subject to availability.
2. Loan funding is available from 2017 to 2026 but must be fully repaid within 15 years of the loan being taken (latest possible repayment year is 2040–41).
3. Loans can be structured as a:
 - a. Maximum of up to five years for the construction period, where repayments can be interest-only.
 - b. Further maximum of up to 10 years to repay the loan principal and additional interest.



- c. A variable interest rate, based on an average of the daily 10-year Commonwealth bond rate over a specified six month period and the cost of administering water loans, will apply. The interest rate will be reviewed every six months in accordance with the Loan Agreement.

15.3.4.3 Summary – Assumed Cost of Debt

On 23 February 2017, DAWR advised that the current interest rate is 2.22 per cent. The sensitivity analysis assumes a low rate of 2 per cent and a high rate of 3 per cent. Assuming the above range of parameters, the WACCs applied for the commercial analysis section of the financial model, which are not commercial in confidence (commercial in confidence input includes market risk premium, equity beta, risk free cost of debt, and proponent’s cost of equity and debt), are outlined in Table 3. The financial analysis applies a nominal WACC of 4.0 per cent.

Table 3 Summary of Assumed Cost of Debt

INPUT TO WACC FOR PRICING PURPOSES	ADOPTED WACC INPUTS	LOW WACC	CENTRAL WACC	HIGH WACC
Capital structure				
Level of risk capital provided (equity)	51%	51%	51%	51%
Level of borrowings (debt)	49%	49%	49%	49%
WACC for pricing purposes	4.0%	3.9%	4.0%	5.1%

Notes: # Sourced from QCA 2012, QCA 2016 and SunWater 2017. ^ Sourced from NWI Loan Facility (February 2017).

15.3.5 Other Assumptions

Key assumptions excluding WACC, capex and opex are as follows. These are common to all shortlisted options.

Table 4 Key Assumptions—Financial Year

	YEARS
Financial year that costs and prices are presented in:	2016-17
Written as	2017


Table 5 Key Assumptions—Asset Lifespan

COST ITEM	NULLINGA DAM - ASSET LIVES (YEARS)	DISTRIBUTION INFRASTRUCTURE - ASSET LIVES (YEARS)
Dams and weirs	100	100
Pipelines	60	60
Mechanical	25	25
Electrical	15	15
Weighted average life (for depreciation)	97	61

Table 6 Key Assumptions—Cost Escalation

COST ESCALATION	LOW	CENTRAL	HIGH	SOURCE
Past capex (up to 2017)	2.50%	3.00%	3.50%	3%, the geometric average of the above index from June 2007 to June 2014 before the fall in the growth of the index resulting from the end of the mining boom, reflecting historically high prices. A range of +/- 0.5% has been used.
Future capex (2017 onwards)	1.80%	2.00%	2.50%	1.80%, the 8-year geometric average from December 2008 to December 2016 captures the recent fall in the growth of the index. The lower bound of the RBA inflation band has been used as the midpoint and 2.5% as the high inflation point.
Fixed opex	2.00%	2.50%	3.00%	The RBA inflation target range of 2-3%, with the midpoint of 2.5%
Variable opex (e.g. electricity)	2.00%	2.50%	3.00%	The RBA inflation target range of 2-3%, with the midpoint of 2.5%

Table 7 Key Assumptions—Annual Water Charges Escalation

ANNUAL WATER CHARGES ESCALATION	LOW	CENTRAL	HIGH	SOURCE
Fixed	2.00%	2.50%	3.00%	The RBA inflation target range of 2-3%, with the midpoint of 2.5%
Variable	2.00%	2.50%	3.00%	The RBA inflation target range of 2-3%, with the midpoint of 2.5%

The Australian Department of Infrastructure and Regional Development is currently developing Cost Estimation Guidance, which includes a note on escalation to develop outturn costs. This guidance is being developed for the Department's note on Administration and Land Transport Infrastructure Projects and is currently in a consultation phase.



15.3.5.1 National Water Initiatives Pricing Principles—Capital Contributions by Government

The National Water Initiative (NWI) pricing principles state that government grants (and any other contributions including from customers) should be excluded from the regulated asset base (RAB) for pricing i.e. prices should not include a return on or of this capital.

However, the cost of the grant could be recovered from customers if there was clear intent that charges be set to recover the full costs i.e. if the contributor intended there should be a return on this from customers this contribution should then be included in the RAB.

It has been assumed that capital contributions from customers and capital grants from government would be excluded from the RAB for pricing purposes.

15.3.6 Water Allocations

15.3.6.1 Option 1

Option 1 involves the continuing use of the existing yield in the MDWSS. The MDWSS has a total of 192,149 ML of HP and MP water allocations. However, distribution losses account for 45,000 ML, reducing HP and MP allocations available for use to 147,149 ML.

15.3.6.2 Options 2, 3 and 4

For the purposes of analysis, the following yields have been assumed for Options 2 to 4. Option 2 involves better use of existing allocations and produces no new yield.

Table 8 Assumed Yields for Options

YIELD (MP ML)	LOW	CENTRAL	HIGH
Option 2	N/A	N/A	N/A
Option 3	8,300	12,900	15,000
Option 4	55,398	55,398	55,398

Source: SunWater

15.3.7 Capital Costs

15.3.7.1 Option 1

Option 1 includes the current renewal and replacement capex of the MDWSS. SunWater’s forecast for 2017 is:

- \$0.5 million of bulk capex (non-routine expenditure in SunWater’s Network Service Plan)
- \$1.1 million of distribution capex
- \$1.6 million of MDWSS total capex.

15.3.7.2 Option 2

Option 2 involves reforms and requires no incremental capex relative to Option 1.

15.3.7.3 Option 3

The assumed capex for Option 3 in the model is as follows.



Table 9 Capital Costs—Option 3

SCENARIO	TOTAL MP ALLOCATIONS TO BE CONVERTED FROM LOSSES	CAPEX (\$2017 MILLION)
Low	8,300	29.71
Central	12,900	39.36
High	15,000	50.84

Source: SunWater 2017 and Jacobs

15.3.7.4 Option 4

The assumed capex for Option 4 in the financial model is as follows.

Table 10 Capital Costs—Option 4

ASSUMED CAPEX IN BUSINESS CASE - SMALL YIELD	INDEXED CAPEX (\$2017 MILLION)	CHANGE FROM CENTRAL CAPEX
Low	227	30%
Central	323	0%
High	397	23%

Source: Jacobs modified risk adjustment and contingency adjustment (2017).

15.3.8 Initial One-off Operating Costs (Start-up Opex)

15.3.8.1 Option 1

The MDWSS is already operational and requires no one-off operating costs.

15.3.8.2 Option 2

The following costs are assumed to be incurred annually for two years for Option 2.

Table 11 Estimated Operating Costs (Government)—Option 2

OPTION 2 - SALARIES	ANNUAL FULL-TIME EQUIVALENTS (FTES) FOR THE PROJECT	ANNUAL COST OF FTE FOR THE PROJECT (\$)
DNRM	1.4	140,000
SunWater	1.4	140,000
DEWS	0.3	30,000
Building Queensland	0.2	20,000
Premiers	0.1	10,000
Treasury	0.1	10,000
Sub-total	3.5	350,000

In addition, there is an allowance for external advice of \$150,000 per year for two years. The total budget is \$500,000 annually or \$1 million establishment opex over a two-year program.



15.3.8.3 Option 3

There will be no one-off operating costs for Option 3 because all operating costs during construction will be capitalised.

15.3.8.4 Option 4

There will be no one-off operating costs for Option 4 because all operating costs during construction will be capitalised.

15.3.9 Ongoing Costs (Ongoing Opex)

15.3.9.1 Option 1

Opex costs for Option 1 is the opex for the MDWSS. SunWater’s forecast for 2017 is:

- \$1.2 million of bulk opex (routine expenditure in SunWater’s Network Service Plan)
- \$5.0 million of distribution opex
- \$6.1 million of total MDWSS opex.

15.3.9.2 Option 2

Incremental ongoing costs are not applicable once Option 2 reforms are established. Option 2 creates no new water allocations and requires no capex or fixed opex. Variable MDWSS operating costs resulting from increased water use will be recovered from all customers via the QCA price setting process or equivalent (e.g. if LMA proceeds and is not regulated).

15.3.9.3 Option 3

Based on preliminary advice from SunWater (2017), the estimated ongoing opex for Option 3 is as follows.

Table 12 Estimated Ongoing Opex—Option 3

SCENARIO	INDEXED OPEX (\$2017 MILLION PA)
Low	0.56
Central	0.65
High	0.75

The ongoing opex for Option 3 is comprised of the following:

- For opex 50 per cent of the meter depreciation budget has been removed as SunWater’s capex planning makes allowance for customer meter replacement.
- While there will be potential efficiency gains to scheme operation (and unspecified cost savings are possible), the estimate of opex has been developed in consultation with SunWater at a high level.

The central case for the total annual opex is \$0.65 million and it has been assumed this occurs every year from completion of works and, prior to that, increases in constant increments as works are completed over a three-year period.

The costs are indicative only (i.e. plus or minus 50 per cent in accuracy) which is considered suitable for the PBC stage. However, further options assessment, preliminary engineering design and costing work would be needed in any subsequent further assessment of Option 3.



15.3.9.4 Option 4

Based on the previous estimate of opex for the mixed use urban and agricultural dam, it has been estimated that the ongoing opex for Option 4 would be as follows.

Table 13 Estimated Ongoing Opex—Option 4

CATEGORY	LOW (\$M)	CENTRAL (\$M)	HIGH (\$M)
Maintenance	1.5	2.1	2.6
Labour	0.1	0.2	0.3
Insurance	0.2	0.2	0.2
Contingency	0.4	0.5	1.5
Fixed opex (\$ pa)	2.2	2.9	4.6
Variable opex (\$ pa)	0.6	0.6	0.9
Total opex (\$ pa)	2.8	3.6	5.4

15.3.10 Residual Values

Residual values ensure all options (which have different lifetimes) fit within the 30-year time horizon analysis for both the economic and financial/commercial analysis.

In this analysis, residual values are applied to increase the value of revenues (or benefits) at the end of the 30-year assessment term, to match the expected remaining life of each asset type.

The residual value will be applied as a lump sum revenue (or benefit) in Year 30. Straight line depreciation will be used to determine the residual value of each asset type.

15.3.11 Value Capture

The opportunity for value capture has been considered in the analysis.

The approach used recognises that value capture involves extracting funding contributions from those that derive a benefit (other than users) from infrastructure. Most commonly, value-capture mechanisms are targeted at capturing a portion of the uplift in land values attributable to infrastructure investment.

It is noted that appropriately designed value-capture mechanisms can assist in funding infrastructure projects and, in some circumstances, have efficiency and equity advantages relative to government contributions.

The value-capture assessment followed the following steps.

15.3.11.1 Identify Benefits and Beneficiaries

Value uplift may consist of:

- Increased land values
- Environment and safety improvements
- Improved access to other infrastructure
- Economic development and population growth.

Benefits of Options 2 to 4 will include:

- Increased land values for farmers



- Environment and safety improvements (Option 3 due to modernisation)
- Economic development and population growth.

The benefits of the shortlisted options include increased direct and indirect employment, and increased direct and indirect payments to capital (or profit increases) experienced by agricultural and supporting businesses.

As the direct benefits, safety improvements and land value increases accrue to customers, value creation pertains to the indirect jobs and indirect (off-farm) profit, other increases in land value, environmental improvements (if any) and economic development.

The strongest of these – economic development and property value increases – will be captured via taxation laws and the real-estate market.

15.3.11.2 Estimate Value Uplift

Value capture funding methods refer to private sector contribution to the cost of public sector infrastructure based on the value uplift that the infrastructure provides to the community.

The value uplift in the area relates primarily to increased value of production and conversion of unirrigated cropping land to irrigation. This value will be captured in the property market and generally be captured by farmers (customers) through funding construction for Option 3 and Option 4.

15.3.11.3 Identify Relevant Value-Capture Mechanisms

Value capture methods are typically used in conjunction with other financing mechanisms (e.g. PPP, Project Finance, Grants, etc.) to help fund infrastructure projects. The Australian Water Association (2016) prepared a presentation of the application of value capture to the Australian Water Industry including:

- Increase supply to expand irrigation – these are covered by water prices (not value capture)
- Water storages reducing urban water treatment costs downstream – this may be worth consultation with Mareeba Shire Council.

In summary, value capture is unlikely to apply to the shortlisted options.

15.3.11.4 Evaluate Mechanisms

Where value uplift is identified, the evaluation of mechanisms that could be employed to capture that uplift must be guided by the following established principles:

- Efficiency (economic and taxation efficiency)
- Equity and fairness (horizontal equity)
- Materiality and sustainability (stability and reliability).

Stakeholder consultation and support would be critical to successful use of value-capture mechanisms.

A theoretical option is a funding method that applies to sharing the benefits of increased land values and densities that are driven by infrastructure projects. A tax, levy or charge is applied over a specified period of time for properties, people or communities that specifically benefit from the infrastructure.

This would be challenging to implement in the Tablelands region, as it is complex, may be viewed as an additional tax and would undermine community support for additional water supply, meeting with strong stakeholder opposition. The prevailing view is that government should invest in regional economic development and not increase taxes.



15.3.11.5 Conclusion

Beyond customers funding capex and opex of Options 3 and 4, a viable opportunity cannot be seen to capture additional funds from the private sector's indirect beneficiaries, beyond the current income and corporation tax regimes, and (via the property market) through status quo stamp duties payable to the Queensland Government.

15.3.12 Revenues

15.3.12.1 Option 1

SunWater collects revenues to recover the costs of owning and running the MDWSS bulk and distribution systems. The QCA determines the maximum tariffs SunWater can charge irrigation users for holding and using each megalitre allocation of scheme water.

SunWater's tariffs are separated into parts reflecting the costs they are developed to recover. The following table shows SunWater's existing tariff components for 2017.

Table 14 SunWater Existing Tariffs

TARIFF	MEASUREMENT	RANGE OF TARIFFS (\$2017/ML)	ASSOCIATED COST TO RECOVER
Part A	\$/ML of bulk allocation	14.73	Fixed costs of bulk, including capital costs
Part B	\$/ML of bulk water use	0.55	Bulk costs which vary with water use
Part C	\$/ML of distribution allocation	10.21-36.61	Fixed costs of distribution, including capital costs
Part D	\$/ML of distribution water use	4.39-80.67	Distribution costs which vary with water use

The following tables show the types of revenues identified for assessing the shortlisted options.

15.3.12.2 Option 2

Table 15 Types of Revenues for Assessing Option 2

REVENUE	MEASUREMENT	SOURCE	COMMENT
Fixed water charges	\$/ML of nominal allocation	NWI pricing principles Demand forecast	MDWSS charges will continue to be applied
Variable water charges	\$/ML of water use	NWI pricing principles Demand forecast	MDWSS charges will continue to be applied
Value capture	To be investigated	To be investigated	Not applicable

Changes in opex will be reflected in future irrigation prices, which are outside the scope of this PBC.



15.3.12.3 Option 3

Table 16 Types of Revenues for Assessing Option 3

REVENUE	MEASUREMENT	SOURCE	COMMENT
One off sale of water allocations	\$/ML of new water allocation	Water market data	At \$2,500 per ML upfront contribution for MP water allocations, customers may provide a significant portion of capital funding depending on the capex applied.
Fixed water charges	\$/ML of nominal allocation	NWI pricing principles Demand forecast	Fixed costs will be recovered via fixed Part A and Part C annual charges regardless of supply and demand
Variable water charges	\$/ML of water use	NWI pricing principles Demand forecast	Costs that vary with water use will be 100 per cent recovered via Part B and Part D charges applied to metered water use regardless of supply and demand.
Value capture	To be investigated	To be investigated	Not applicable

Changes in capital costs and opex will be reflected in future irrigation prices, which are outside the scope of this PBC. However, the annual charges for incremental users have been estimated in the table below. The annual charges absent any government funding, with all capital costs paid by customers, will be the same as the annual charges with government grant funding. This is because capital costs are not proposed to be recovered through annual charges with customer funded capex and with government grant funded capex.

Table 17 Estimated Impacts on Annual Charges—Option 3

MP ANNUAL WATER CHARGE	LOW COST (\$2017/ML PER ANNUM)	CENTRAL COST (\$2017/ML PER ANNUM)	HIGH COST (\$2017/ML PER ANNUM)
Government contribution is <i>low interest loan</i>	63	94	154
Government contribution is a <i>capital grant</i>	63	89	118
No government contribution	63	89	118

15.3.12.4 Option 4

Table 18 Types of Revenues for Assessing Option 4

REVENUE	MEASUREMENT	SOURCE	COMMENT
One off sale of water allocations	\$/ML of new water allocation	Water market data	Option 4 may be 33-58 per cent funded by customers at \$2,500/ML, depending on capex and water sales.
Fixed water charges	\$/ML of nominal allocation	NWI pricing principles Demand forecast	Bulk costs will be recovered via fixed Part A annual charges regardless of supply and demand.



Variable water charges	\$/ML of water use	NWI pricing principles Demand forecast	Costs that vary with water use will be 100 per cent recovered via Part B charges applied to metered water use regardless of supply and demand.
Value capture	To be investigated	To be investigated	Not applicable

Nullinga Dam capital costs and opex will be reflected in future irrigation annual water charges. It is recommended that new annual charges be set separately to the MDWSS to reflect the costs of the new scheme.

Charges for Nullinga Dam water will likely be different to MDWSS and have been estimated as follows. Again, annual charges absent any government funding, with all capital costs paid by customers, will be the same as the annual charges with government grant funding because capital costs are not proposed to be recovered through annual charges with customer funded capex and with government grant funded capex.

Table 19 Estimated Annual Water Charges—Option 4

MP ANNUAL WATER CHARGE	LOW COST (\$2017/ML PER ANNUM)	CENTRAL COST (\$2017/ML PER ANNUM)	HIGH COST (\$2017/ML PER ANNUM)
Government contribution is <i>low interest loan</i>	121	226	310
Government contribution is a <i>capital grant</i>	48	79	106
No government contribution	48	79	106

15.4 Risk Unadjusted Financial NPVs—Summary

This section provides a summary of the financial outputs without risk adjustments.

15.4.1 Financial NPVs (Not Adjusted for Risk)

Table 20 Summary of Financial NPVs for Options (Not Adjusted for Risk)

FINANCIAL (RISK UNADJUSTED) NPVS (\$2017 MILLIONS)	LOW	CENTRAL	HIGH
WACC	3.9%	4.0%	5.1%
Option 2 (\$million, 2017 prices)	N/A	N/A	N/A
Option 3 (\$million, 2017 prices)	0.0	0.0	0.0
Option 4 (\$million, 2017 prices)	2.3	0.0	-23.0

15.4.2 Commercial—Capex Funding and Annual Charges (Not Adjusted for Risk)

15.4.2.1 Option 3

Table 21 Capex Funding and Annual Charges (Not Adjusted for Risk)—Option 3

ITEM	LOW COST	CENTRAL COST	HIGH COST
CAPEX FUNDING			



Capex (\$million, 2017 prices)	30	39	51
Capex per new MP allocation (\$2017/ML)	3,579	3,058	3,389
Price of MP allocation paid by customers (one-off permanent trade) - customer capital contribution (2017 dollars/ML)	2,500	2,500	2,500
Portion of capex funded by customers (%)	70	82	74
Capex funding shortfall (%)	30	18	26
ANNUAL CHARGES			
MP annual water charge (2017 dollars/ML pa) * - Government contribution is low interest loan	63	94	154
MP annual water charge (2017 dollars/ML pa) * - Government contribution is a capital grant	63	89	118
MP annual water charge (2017 dollars/ML pa) * - No government contribution	63	89	118

* Note: Charges for Option 3 are likely to be those scheme charges recommended by the QCA and approved by the Queensland Government.

15.4.2.2 Option 4

Table 22 Capex Funding and Annual Charges (Not Adjusted for Risk)—Option 4

ITEM	LOW COST	CENTRAL COST	HIGH COST
CAPEX FUNDING			
Capex (\$million, 2017 prices)	227	323	397
Capex per new MP allocation 2017 dollars /ML)	4,309	6,123	7,531
Price of MP allocation paid by customers (one-off permanent trade) - customer capital contribution 2017 dollars /ML)	2,500	2,500	2,500
Portion of capex funded by customers (%)	58	41	33
Capex funding shortfall (%)	42	59	67
ANNUAL CHARGES			
MP annual water charge (2017 dollars/ML pa)* - Government contribution is <i>low interest loan</i>	121	226	310
MP annual water charge (2017 dollars/ML pa)* - Government contribution is <i>capital grant</i>	48	79	106
MP annual water charge (2017 dollars/ML pa)* - No government contribution	48	79	106

* Note: Charges for Option 4 are likely to be those scheme charges recommended by the QCA and approved by the Queensland Government.

15.4.3 Conclusions

1. Based on the financial outputs without risk adjustments the conclusions for Option 3 include that:
 - a. At \$2,500 per ML for MP water allocations customers will provide capital contributions of 82 per cent of capex under the central case



- b. Estimated annual charges fall within the expected range consistent with MDWSS charges, except with high capex and loan government funding.
2. Based on the financial outputs without risk adjustments the conclusions for Option 4 include that:
- a. At \$2,500 per ML for MP water allocations, customers will provide capital contributions of 41 per cent under the central case
 - b. Estimated annual water charges range from \$48 to \$310 per ML depending on the funding model applied.

15.5 Risk-adjusted Financial NPVs—Method

15.5.1 Modified DEWS Risk Matrix

The DEWS risk matrix was applied for risk adjustments. A modification was made to quantify the definition of consequence in dollar terms for Option 3 and 4. The Option 3 and Option 4 quantitative (dollar term) guidelines for capex and opex consequence are as follows.

Table 23 Quantitative Guidelines for Capex and Opex Consequences for Option 3

CONSEQUENCE – OPTION 3	CAPITAL (\$)	RECURRENT (\$)	TIME
Catastrophic	11,808,231	237,600	12 months +
Major	7,872,154	158,400	6 – 12 months
Moderate	3,936,077	79,200	3 – 6 months
Minor	1,968,039	39,600	1 – 3 months
Insignificant	984,019	19,800	Less than 1 month

Table 24 Quantitative Guidelines for Capex and Opex Consequences for Option 4

CONSEQUENCE – OPTION 4	CAPITAL (\$ MILLION)	RECURRENT (\$ MILLION)	TIME
Catastrophic	68,104,557	650,506	12 months +
Major	45,403,038	433,671	6 – 12 months
Moderate	22,701,519	216,835	3 – 6 months
Minor	11,350,759	108,418	1 – 3 months
Insignificant	5,675,380	54,209	Less than 1 month

Using this and the risk framework (provided by DEWS), the financial and economic costs were risk adjusted.

15.5.2 Risk categories for each option

The risk categories for Options 2 to 4 were considered in workshops and analysis with key stakeholders and are summarised in the following table.



Table 25 Risk Categories for Options 2 to 4

RISK CATEGORIES	RISK CATEGORIES
Social/stakeholder risk	Water sales contractual risk (or auction risks)
Environmental risk	Default risk for annual charges (Part A)
Demand assessment risk	Site risk
Design risk (e.g. peak flows)	Construction risk
Capital cost risk	Operating risk - intended operations and maintenance costs
Operating cost risk	Operating risk - Supply and distribution contract risk
Funding risk (water allocation pricing risk)	Health and safety risk
Annual charges/ongoing revenue risk	Native Title and Cultural Heritage risk

15.5.3 Risk Allocation via Delivery Model

Internal and key stakeholder delivery model workshops considered a range of delivery and procurement options for Option 4. Discussion relevant to the financial analysis is presented below.

1. **Design and Construct (D&C)**—A D&C approach is preferred because preliminary designs are prepared in advance, with specifications on performance. This allows the successful D&C contractor to innovate and prepare a detailed design that meets these performance specifications, enhancing value for money and profitability.

At times, this approach requires proponents to have an in-house design engineering team with strong design capability. This is likely to be the most appropriate model, particularly in a competitive market.

In a less competitive market, this approach can, in limited circumstances, initially deliver a design and construction price that does not represent value for money (or a sufficiently low capex). However, in most cases (even when the market is highly competitive) this delivery model does yield bids that represent value for money.

Occasionally the winning cost can still be too high. To mitigate this risk consider advising the winning contractor that their bid exceeded the budget, and then work with them to bring the capex down to a level that allows the project to proceed.

2. **Early Contractor Involvement (ECI)**—ECI can ensure a higher quality of bid/design by paying contractors to invest in designing and estimating the bid upfront and limiting the number of contractors (typically to three) who are eligible or are in a strong position to win the construction role. This delivery model would minimise the cost of design and construction in a market that has insufficient work.

This delivery model may be recommended in certain circumstances (e.g. where the proponent does not have an in-house design engineering team with strong design capability).

3. **Construct only**—Experience indicates that the risk with this approach is that it costs the proponent a premium for each change in their design. The proponent will also pay for any latent conditions (e.g. unexpected/unidentified geotechnical conditions). For conditions not accounted for in the design provided to the contractor, the risk and cost is with the proponent (and the cost is in practice determined by the contractor), often resulting in costs exceeding budget. By contrast the D&C model transfers this risk to the contractor via a fixed price.



The choice of model informed the assessment of the extent to which the State retains or transfers risks considered.

15.6 Application of Risk Findings

Identified risks were applied to the financial and economic model using the following process.

Figure 1 Process Used for Identifying Risks



15.7 Risk-adjusted NPVs

15.7.1 Option 1

Option 1 was not considered suitable for risk adjustments for the purposes of this PBC. SunWater’s capex and opex for the MDWSS is developed using operating experience of the expected risks of operating and maintaining the scheme. These costs are business as usual.

15.7.2 Option 2

Option 2 is not considered suitable for a risk adjusted financial NPV calculation as it is a reform process requiring a portion of government wages and some external consultancy costs. This option is subject to government reform risk analysis.

Option 2 does not consist of incremental capex or fixed opex costs relative to Option 1. Variable opex for Option 2 will be the same as variable opex for Option1, and has been developed by SunWater using operational experience of the expected risks of operating and maintaining the MDWSS.

15.7.3 Option 3—NPVs (Risk-adjusted) Outputs

The high-level detail for Option 3 is as follows for a WACC of 4.0 per cent.



Table 26 Risk-adjusted NPV Outputs for Option 3

KEY OUTPUTS	\$ (2017 PRICES)	\$ MILLION (2017 PRICES)
NPV of revenue	55,240,637	55.24
NPV of residual value	420,062	0.42
PV of revenue - Option 3	55,660,699	55.66
NPV of capex	39,665,731	39.67
NPV of opex	15,994,968	15.99
PV of totex (capex + opex) – Option 3	55,660,699	55.66
FNPV – Option 3	0	0.00

Figures 2 and 3 show the Monte Carlo output for Option 3 present value (PV) of revenue and costs.

Figure 2 Monte Carlo Revenue Output for Option 3

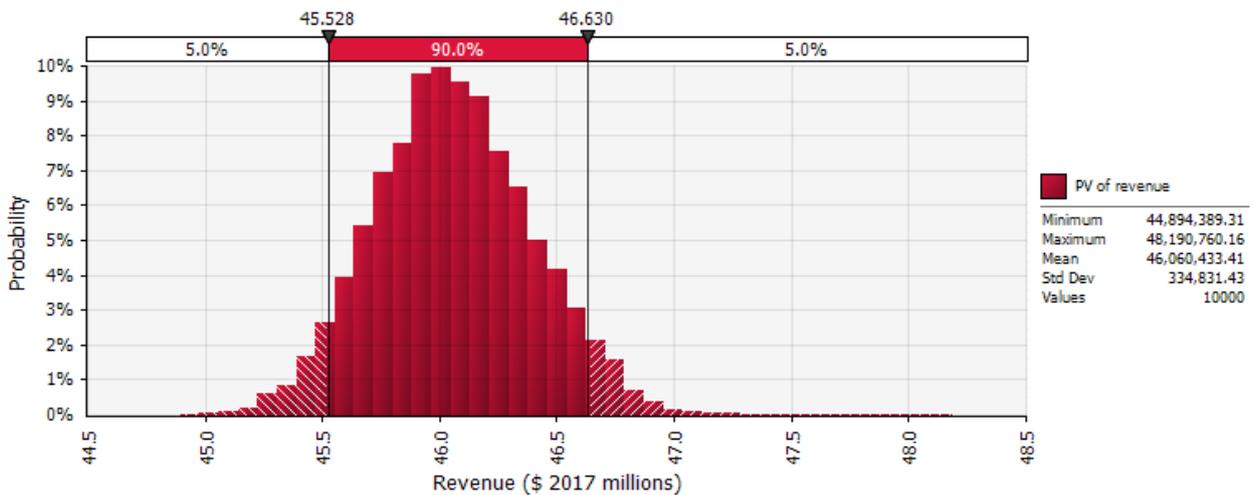


Figure 3 Monte Carlo Totex Output for Option 3

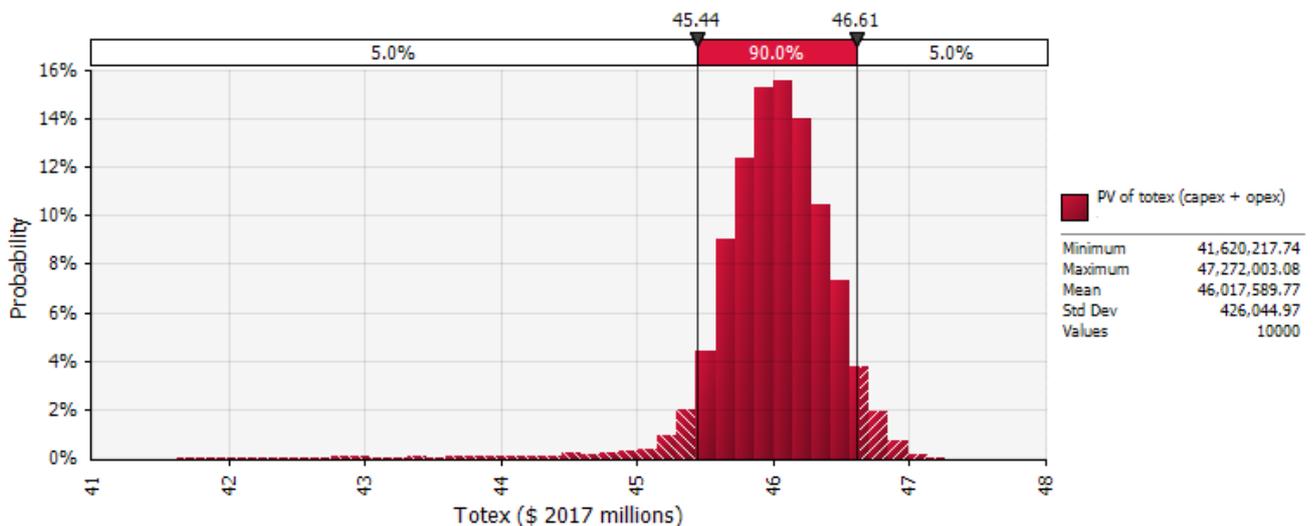




Table 27 shows the risk adjustments to Option 3.

Table 27 Risk Adjustments for Option 3

RISK ADJUSTMENT	\$(2017 PRICES)	\$ MILLION (2017 PRICES)
NPV of revenue	22,943,778	22.94
NPV of residual value	420,062	0.42
PV of revenue – Option 3	23,363,840	23.36
NPV of capex	20,840,174	20.84
NPV of opex	2,523,666	2.52
PV of totex (capex + opex) – Option 3	23,363,840	23.36
FNPV – Option 3	0	0.00

15.7.4 Option 4—NPVs (Risk-adjusted) Outputs

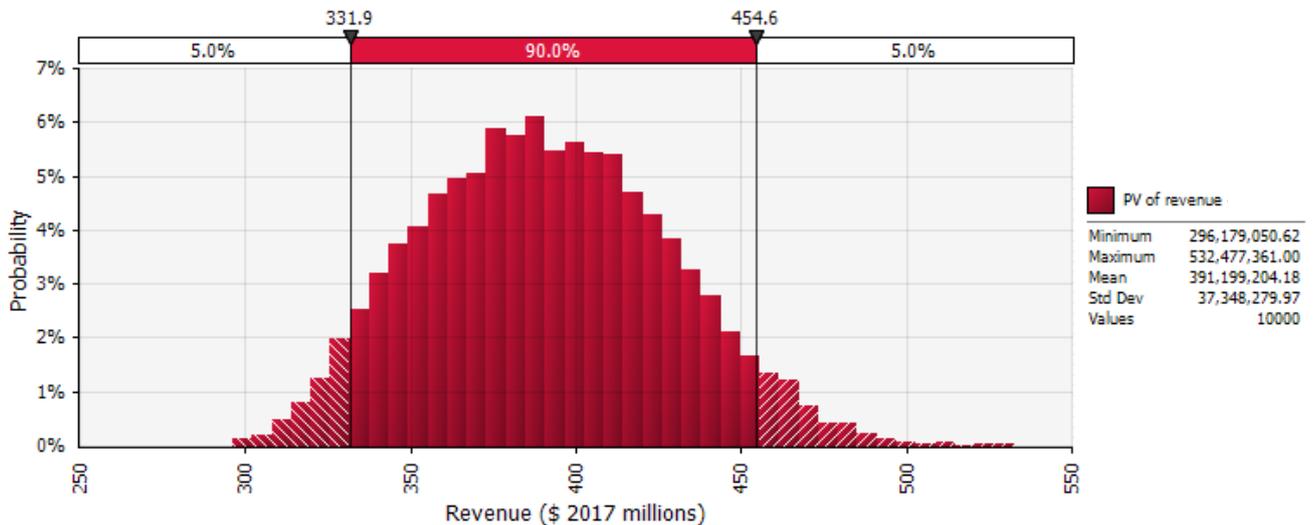
The high-level detail for Option 4 is as follows for a WACC of 4.0 per cent.

Table 28 Risk-adjusted NPV Outputs for Option 4

KEY OUTPUTS	\$(2017 PRICES)	\$ MILLION (2017 PRICES)
NPV of revenue	338,553,081	338.55
NPV of residual value	44,926,260	44.93
PV of revenue – Option 4	383,479,341	383.48
NPV of capex	322,564,297	322.56
NPV of opex	108,632,930	108.63
PV of totex (capex + opex) – Option 4	431,197,228	431.20
FNPV – Option 4	-47,717,887	-47.72

Figures 4 to 6 show the Monte Carlo output for Option 4 present value (PV) of revenue, capex and totex (capex and opex).

Figure 4 Monte Carlo Revenue Output for Option 4





The PV totex (Figure 5) has a long right tail because of the numerous catastrophic risks that were included in its risk assessment, being mindful of precedents such as the Paradise Dam spillway replacement.

Figure 5 Monte Carlo Totex Output for Option 4

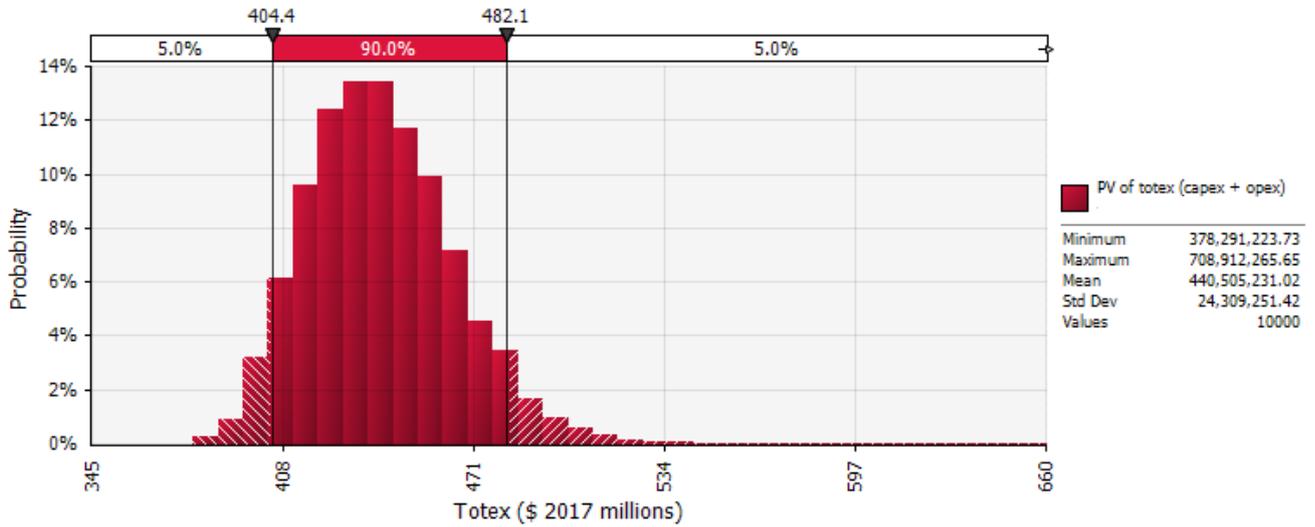


Figure 6 Monte Carlo Total Capex Output for Option 4

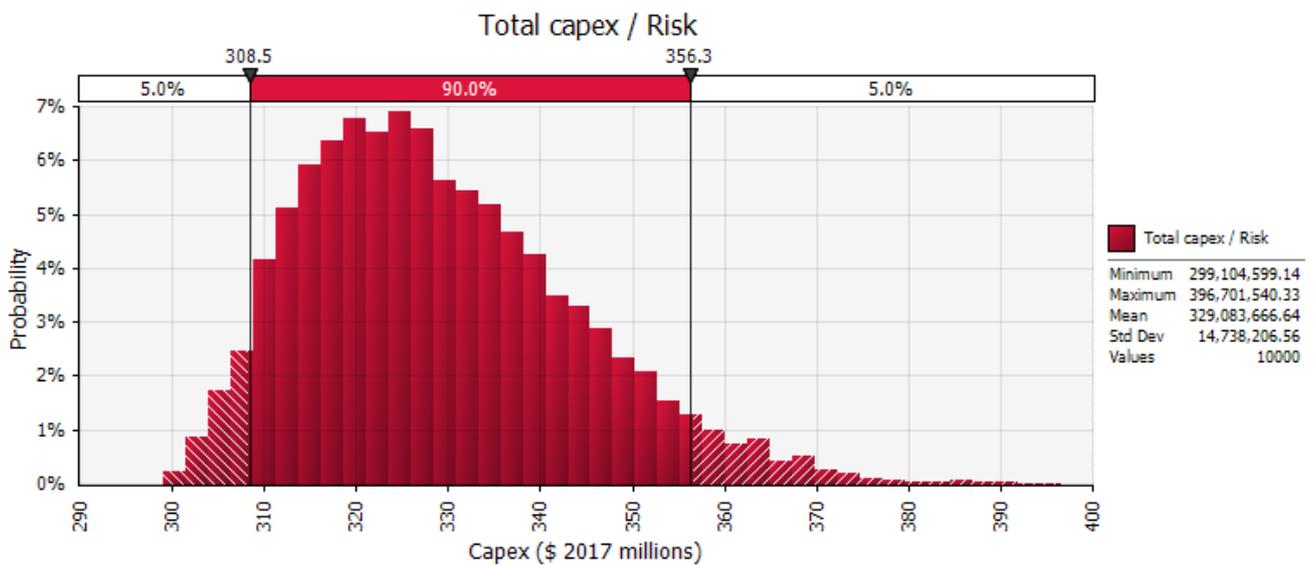




Table 29 shows the risk adjustments to Option 4.

Table 29 Risk adjustments to Option 4

RISK ADJUSTMENT	\$ (2017 PRICES)	\$ MILLION (2017 PRICES)
NPV of revenue	30,565,996	30.57
NPV of residual value	-15,407,176	-15.41
PV of revenue - Option 4	15,158,820	15.16
NPV of capex	62,692,099	62.69
NPV of opex	184,608	0.18
PV of totex (capex + opex) - Option 4	62,876,707	62.88
FNPV - Option 4	-47,717,887	-47.72

15.7.5 Analysis Summary

This section provides a summary of key outputs.

Table 30 Financial Risk-adjusted NPVs

FINANCIAL (RISK ADJUSTED) NPVS (\$ MILLION (2017 PRICES))	UNADJUSTED NPV	RISK ADJUSTMENT	RISK ADJUSTED NPV
Option 2 (\$2017 million)	N/A	N/A	N/A
Option 3 (\$million – 2017 prices)	0	-0	-0
Option 4 (\$ million – 2017 prices)	0	-48	-48

The financial risk adjusted NPVs have the following features:

- Option 3 – No change from unadjusted risk – risk adjusted NPV is zero
- Option 4 – Negative \$48 million change from unadjusted risk – risk adjusted NPV is minus \$48 million.

This has occurred because the capital and operating costs are covered by customer capital contributions and government funding (water allocation pricing and government support) and annual water charges.

If the government funding is a low interest loan, as has been assumed for the risk unadjusted Option 4, customers pay the full capital cost of the option over time via annual charges. That is, annual charges are modelled to recover all principal and interest payments for the loan, plus ongoing operations and maintenance costs.

As shown in the risk adjusted outputs for Option 3 and Option 4, the FNPV of zero or close to zero does not mean the costs and revenues of the options are zero. Indeed, this PBC has determined a risk adjusted gross whole of life PV cost for Option 3 is \$55.7 million and for Option 4 is \$431.2 million.

Prices and revenues have been developed to match these expected whole of life costs, including the expected cost of risk. Although prices are not rigid, prices will not be able to perfectly match changes from expected costs. This is reflected in the distribution of the FNPV. The ability of prices to change to match changes from expected costs is greater for Option 3 than for Option 4, where the possible risks of Option 3 have smaller monetary consequences. Prices are expected to generally be adjusted to account for cost changes.



For analysis purposes, a level of State grant funding was introduced for the risk adjustment of Option 4. This results in a negative financial NPV for the State, as these costs are not recovered through annual charges as with low interest loan funding.

15.7.6 Limitation

Modelling does not yet incorporate the limited (15 year) life of the NWILF low interest loan. The interest rate will need to increase from Year 16 in subsequent analysis. This will not impact NPVs but may increase annual charges for Option 4.

15.7.7 Summary by Option

15.7.7.1 Option 2

Option 2 has zero incremental financial costs (although in the economic assessment, public service wages are included as the opex cost - there are no capex items for Option 2). Moreover, there are no revenues directly linked to Option 2 as it is a reform process designed to increase confidence in the use of existing MDWSS water allocations, for which the annual charging regime should not alter. Accordingly, financial NPVs have not been generated for this option.

15.7.7.2 Option 3

With risk adjustment, Option 3 maintains at least a zero risk adjusted NPV. However, the risk register for Option 3 highlights the need for further option consideration (design and costings) to be conducted. With a willingness to pay of between \$2,000 per ML and \$3,000 per ML, customers can potentially fund a significant portion of the capex required for this option. Ongoing MDWSS annual charges will recover opex and any future capital costs.

15.7.7.3 Option 4

The unadjusted Option 4 also generates a zero NPV. This is because NWI Pricing Principles have been used to develop prices. NWI Pricing Principles emphasise a neutral (\$0.00) NPV over the life of the water asset. Charges are based on actual capital costs, which include a revealed contingency and risk adjustment above forecast costs.

However, this conclusion is based on an important assumption that charges are developed using pre-sold volumes, creating certainty over demand. This means risk is transferred from the proponent to customers. The risk adjusted NPV has a \$62.9 million contingency and risk adjustment for both capex and opex. If an alternative model was used, then the result would be different.

However, with risk adjustment, for analysis purposes an assumption has been made of a level of State grant funding, which leads to a -\$48 million NPV for the State. This is because under the NWI Pricing Principles grant funding is not recovered through prices. If there is no grant funding, or all grant funding is from Australian Government funds, it is expected the risk adjusted NPV will remain zero for the State.

15.7.8 Option 3 Risk-adjusted Capex Story

A risk adjusted cost estimate was developed for an expected yield of 8,300 ML.



Table 31 Cost Estimate for Option 3 (8,300 ML)

ESTIMATE FOR 8,300ML (NO AMENDMENTS)	DOLLARS (\$2017)	PORTION OF BASE ESTIMATE
Part 1		
Preliminaries and General	3,000,839	18%
Part 2 - Construction Works		
Pipeline system	1,407,769	8%
Automation and balancing storages	11,363,241	66%
Sub-total	12,771,010	75%
Construction Value (Parts 1 + 2)	15,771,849	92%
Part 3		
Principal's Costs	1,352,336	8%
Base estimate (Parts 1 + 2 + 3)	17,124,185	100%
Contingency and Risk	3,424,837	20%
Total (incl. base and contingency)	20,549,022	120%

A linear relationship was used to convert the capex estimate to an Option 3 with an expected yield of 15,000 ML. In making the conversion, consideration was given to the reduction of the expected yield from 10,375 ML to 8,300 ML. These two yields were scaled to 15,000 ML.

A contingency and risk allowance of 20 per cent, similar to that used for Option 4, is considered for the purposes of analysis in the PBC.

Table 32 shows the capex estimate for Option 3 prepared for the PBC.

Table 32 Capital Cost Estimation for Option 3

CONVERSION TO WHOLE PROJECT	LOW	CENTRAL	HIGH – SUNWATER ESTIMATE
Base Estimate	7,124,185	8,234,926	19,345,667
Contingency	20%	33%	45%
Contingency (\$2017)	3,424,837	5,964,659	8,786,834
Total capex (incl. contingency) - Partial Project (Yield 8,300 ML)	20,549,022	24,199,585	28,132,501
Ratios	145%	163%	181%
Total capex (incl. contingency) - Whole Project (15,000ML Yield)	29,709,429	39,360,771	50,841,869

15.7.9 Option 4 Risk-adjusted Capex Story

The risk adjusted capex for Option 4 is based on a previously developed capex estimate for Nullinga Dam. However, as a result of the risk workshop processes in the development of this PBC and advice from stakeholders with recent experience estimating and constructing dams, a lower risk adjustment and lower contingency has been proposed.

In summary, in 2017 dollars, the central capex for the small yielding Nullinga Dam (bulk only capex) is outlined in the following table.


Table 33 Central Capex for a Small Yielding Nullinga Dam

ITEM	CAPITAL COST (\$ MILLION – 2017 PRICES)	CAPEX PER ML (\$PER ML – 2017 PRICES)
Raw capex ^	259.9	4,692
Risk adjustment	20.4	368
30% contingency	77.9	1,406
Total capex	358.2	6,466

Note ^ includes an alliance fee of \$26.1 million in 2017 dollars, which will not apply under a D&C (or ECI) delivery model.

In summary, in 2017 dollars, the central capex for small yielding Nullinga Dam (bulk only capex) is:

- Raw capex of \$259.8 million (includes an alliance fee of \$26.1 million in 2017 dollars, which would not apply under a different delivery model such as a D&C (or ECI))
- Risk adjustment of \$20.4 million (including a number of material items ascribed an 80 per cent probability of occurring, which appears to reflect the pre-GFC environment)
- 30 per cent contingency of \$77.9 million (this is compared to a contingency of up to 20 per cent, developed under commercial conditions, which some stakeholders have used recently to deliver irrigation schemes and gain funding approval for further schemes)
- Total capex of \$358.2 million for Option 4: Nullinga Dam (approximately 55,000 ML MP yield).

In summary, the amended version of the central capex for small Nullinga Dam (bulk only capex), which drives the Option 4 financial modelling in this PBC is provided in the table below.

Table 34 Alternative Central Capex for a Small Yielding Nullinga Dam

ITEM	CAPITAL COST (\$MILLION – 2017 PRICES)	CAPEX PER ML (\$PER ML – 2017 PRICES)
Raw capex	259.9	4,725
Risk adjustment	10.7	195
20% contingency for unknown design items and latent conditions (e.g. geotechnical and other risks)	52.0	945
Total capex	322.6	5,865

In summary, in 2017 dollars, the alternative version of the central capex for small yielding Nullinga Dam (bulk only capex) is:

- Raw capex of \$260 million (including an alliance fee of \$26 million in 2017 dollars)
- Risk adjustment of \$11 million
- Contingency of 20 per cent (applied to raw capex) for unknown/latent risks (e.g. if at construction it is discovered that the early geotechnical surveys did not reveal the full extent of the geotechnical challenges faced by the construction entity) of \$52 million
- Total capex of \$323 million.



While the capex estimate was appropriate for the time and purposes it was developed, it is considered for the purposes of analysis that there was benefit in giving consideration to updating the risk and contingency components to reflect 2016-17 market conditions. There have been changes in the market since that time. For example, the cost estimates were developed during the height of the mining boom in 2007, prior to the Global Financial Crisis (GFC). Since that time, construction market conditions have altered. It was therefore considered suitable for the purposes of analysis to reduce some of the previously developed risk adjustments – although many were retained.

Moreover, for the purposes of analysis, the 30 per cent contingency was interrogated in light of recent experience nationally constructing dams and irrigation schemes, in Tasmania and Western Australia, which has demonstrated that a contingency of 10 to 20 per cent for unknown risks at this PBC design stage may be appropriate. The lower required contingency is driven by the design and construct business model, where contractors are incentivised to find efficiencies and savings in the initial design model during tendering and during the construction of the dam. This incentive is not present in an alliance model.

The risk and contingency allowance ranges from a low of 12 per cent to a high of 53 per cent.

As a sense check, the risk and contingency adjusted dam costs have been benchmarked against the costs of a dam of similar roller compacted concrete design to the proposed Nullinga Dam. Meander Dam, built in Tasmania through design and construct delivery model, has a capacity of 85,000m³, 3.89 times less than the proposed Nullinga Dam design capacity.

The post construction realised cost benchmark of Meander Dam (which includes an additional contingency on top of the realised cost) is 13 per cent lower than the unadjusted base costs, and 30 per cent lower than the risk adjusted capex. The benchmark of the Meander Dam shows the cost efficiencies that may be delivered by a design and construct delivery model.

Total capex results in an estimated capital cost of \$5,865 per ML of MP allocations to a P50 confidence level.

15.7.9.1 Limitation

The risk assessment for Option 4 was considered appropriate for a PBC but would warrant review by a dam engineer in any further assessment.

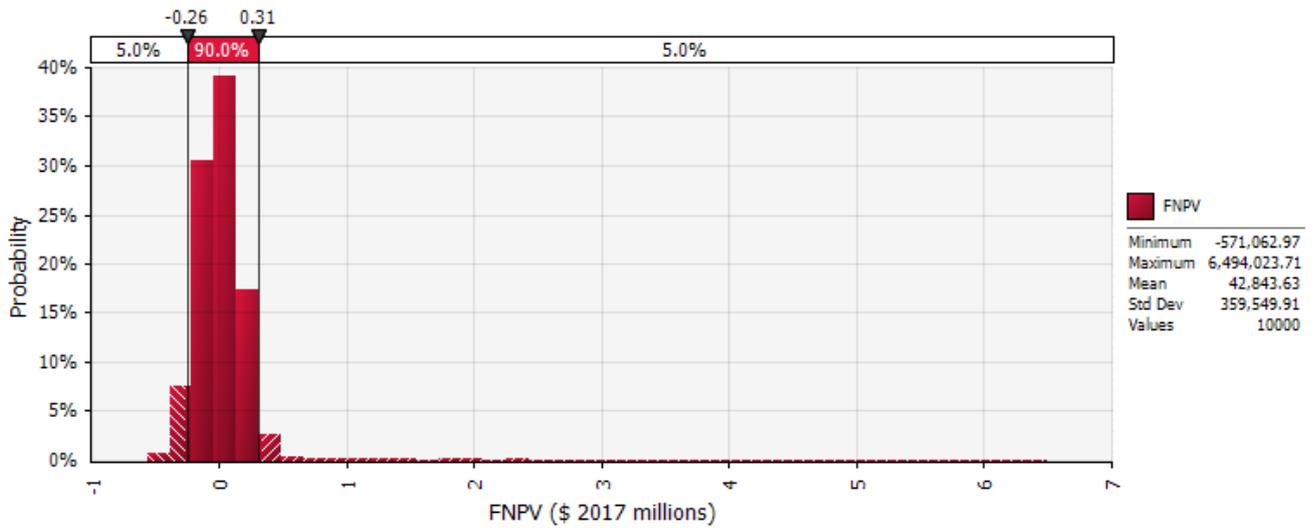
Further assessment of delivery models for Option 4 may also result in the removal of the \$26 million alliance fee from the raw cost estimate on the basis that an alliance fee would not be payable under a different delivery model. This cost remains in the raw capex estimate for the PBC.

15.7.10 Monte Carlo Output for Option 3 Financial NPV

Figure 7 presents Option 3 financial NPV (net revenue).



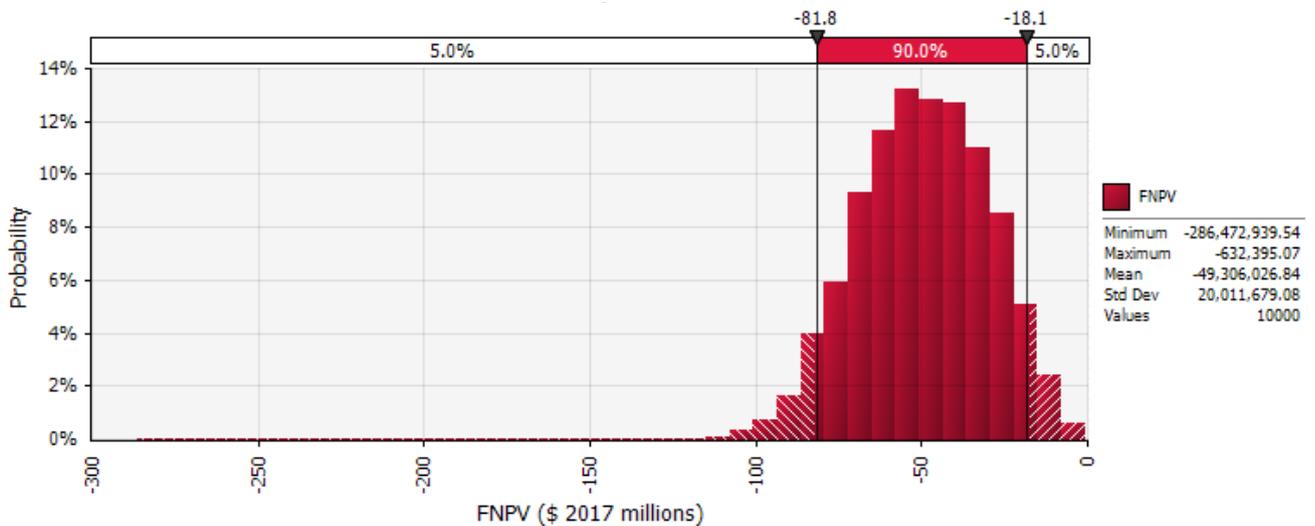
Figure 7 Financial NPV (Net Revenue) for Option 3



15.7.11 Monte Carlo Output for Option 4 Financial NPV

Figure 8 presents Option 4’s financial NPV (net revenue).

Figure 8 Financial NPV (Net Revenue) for Option 4



15.7.12 Conclusions

Initial findings include that the financial and commercial analysis for Options 3 and 4 generally generates NPVs of zero on the basis of assumptions in relation to the recovery of costs from customers and the application of Australian Government funding, except for the risk adjusted Option 4 where some State government grant funding for the purposes of analysis.

The risk adjusted FNPV of zero does not mean the project has a gross cost of zero. Option 3 has a whole of life PV cost of \$55.7 million and Option 4 has a whole of life PV cost of \$431.2 million.



The prices and revenues for Option 3 and Option 4 have been developed using the NWI pricing principles and using the expected yield and capital costs of each project on the basis of available information.

While there is a degree of funding risk for opex, particularly for Option 4, the standard water supply contracts in Queensland require payment of 90 per cent or more of operating costs as fixed charge in advance of each quarter of the water year. Variable costs are paid based on metered water use, but if there is zero water use, these costs are not incurred. Annual charging and supply contracting arrangements mitigate opex recovery risk substantially.

Moreover, under the NWI pricing principles, opex costs are fully recovered from customers. However, there are a number of catastrophic risks associated with a dam which result in costs difficult to translate into prices without unsustainable bill shock. An example of such a catastrophic risk is the failure of the slipway, requiring the rebuilding of the dam and a potential doubling of prices to recover losses.

This effect is shown not in the expected FNPV, which remains zero net of funding, but the distribution of the FNPV around zero. This effect is shown in Figure 8 above.



CHAPTER 16

DELIVERY MODEL ANALYSIS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

16	DELIVERY MODEL ANALYSIS	2
16.1	Purpose	2
16.2	Delivery Model Categories	2
16.3	Assessment Process	3
16.4	Delivery Model Assessment	3
16.5	Assessment of Traditional Delivery Models	6
16.6	Value for Money Assessment	12
16.7	Preliminary Market Sounding	13
16.8	Outcomes of the Preliminary Delivery Model Assessment	15
16.9	Recommendation	16

TABLES

Table 1	Constraints and Opportunities.....	3
Table 2	Overview of Large Dams and Delivery Models in Tasmania.....	5
Table 3	Cost and Quality Criteria—Weightings.....	5
Table 4	Summary of Allocation of Responsibilities to Government and the Private Sector.....	6
Table 5	Competitive Alliance Delivery Model Assessment.....	7
Table 6	Early Contractor Involvement Delivery Model Assessment	7
Table 7	Managing Contractor Delivery Model Assessment.....	8
Table 8	Construction Only Delivery Model Assessment	9
Table 9	Design and Construct Delivery Model Assessment	10
Table 10	Design, Construct Maintain Delivery Model Assessment.....	11
Table 11	PPP Delivery Model Assessment.....	12
Table 12	Qualitative Value for Money Assessment	12
Table 13	Delivery Model Summary of Scores.....	15



16 DELIVERY MODEL ANALYSIS

CHAPTER SUMMARY AND CONCLUSIONS

- Delivery model analysis was only undertaken on Option 4: Nullinga Dam for agricultural use, as Option 2: Improve MDWSS rules and operation is proposed to be carried out by government and SunWater as a reform process, and Option 3: Modernise MDWSS and convert losses is proposed to be carried out by SunWater internally as a number of smaller projects.
- Potentially disaggregating Option 4 into smaller packages was determined not to be a significant consideration for a project of this size at the PBC stage.
- Value for Money objectives were weighted as 55 per cent for quality and 45 per cent for cost.
- The delivery model assessment concluded that the Early Contractor Involvement (ECI) delivery model provided the highest contribution (84.5) to the evaluation criteria closely followed by Design and Construct (81).
- The qualitative Value for Money assessment identified that there is no commercially viable non-traditional (PPP) delivery model for Option 4 given that design, operation and potentially also maintenance of a new dam is likely to be delivered by SunWater.
- Market Sounding identified that industry participants would be interested in Option 4 and would be open to participating in an Early Contractor Involvement process.
- Market Sounding indicated that a single package Design and Construct model was preferred and a PPP delivery model was not suitable for Option 4.
- After considering the outcomes of the preliminary delivery model assessment and market sounding, key stakeholders and advisors formed the view that the preferred model from Option 4 was Design and Construct or Early Contractor Involvement (or potentially Early Tenderer Involvement [ETI]).

16.1 Purpose

The purpose of this chapter is to conduct a preliminary assessment on a range of delivery models, identify a preferred traditional delivery model and then compare it to non-traditional delivery models to understand how the State can achieve the most value for money (VfM), through cost and quality of outcomes, while meeting the identified need.

This chapter primarily concentrates on Option 4: Nullinga Dam for agricultural use, as Option 2: Improve MDWSS rules and operation is proposed to be carried out by government and SunWater as a reform process, and Option 3: Modernise MDWSS and convert losses is proposed to be carried out by SunWater internally as a number of smaller projects.

16.2 Delivery Model Categories

Traditional and non-traditional delivery models have different forms, advantages/disadvantages, risk profiles and implementation considerations for the State.

16.2.1 Traditional Delivery Models

Under all traditional delivery models, funding is provided by the public sector, demand risk is retained by the public sector and the asset is transferred to the State at the end of the construction period. A key



differentiator between traditional delivery models is the allocation of risk at key stages in the project lifecycle. There are a range of models available, each of which present opportunities and risks to the State.

16.2.2 Public Private Partnership (PPP) Delivery Model

The National PPP Guidelines require PPPs to be considered as a delivery option where the capital value of a project exceeds \$50 million.

A PPP is typically a long-term service contract between the public and private sectors where the State pays the private sector (typically a consortium) a service fee to deliver infrastructure and related services over an agreed project term. The private sector consortium typically designs, builds and finances the facility, and maintains and/or operates it to specified standards. PPPs typically make the private sector parties who build public infrastructure financially responsible for its condition and performance throughout the asset’s lifetime.

PPPs can deliver VfM when there is good opportunity for risk transfer, opportunities for whole of life costing and innovation, potentially higher asset utilisation and good opportunity for integration of design, construction and operations.

PPPs also have the potential to provide a greater degree of time/whole of asset cost certainty than ‘traditional’ delivery approaches.

16.3 Assessment Process

The evaluation of traditional and non-traditional delivery models focussed on their ability to achieve the two key VfM determinants being cost and quality (of outcomes). The evaluation was conducted using the following process:

- Delivery Model Workshop to establish assessment criteria, consider packaging opportunities and assess a range of traditional and non-traditional delivery models against the criteria
- Market Sounding with appropriate industry participants to seek market feedback on packaging, preferred delivery model and market appetite
- Refinement of the delivery model strategy taking into account market feedback.

16.4 Delivery Model Assessment

Key stakeholders and advisors attended a Delivery Model Workshop to conduct the preliminary assessment of both traditional and non-traditional delivery models. The sections below record the outcomes of that process.

16.4.1 Project Characteristics, Objectives, Constraints and Risks

Workshop participants reviewed the background to the PBC, the PBC objectives, the shortlisted options and the risk register. This identified a number of constraints and opportunities as outlined in the table below.

Table 1 Constraints and Opportunities

CONSTRAINTS	OPPORTUNITIES
SunWater’s strong preference is to be the operator of any new dam	Market for civil works is highly competitive
Need to adhere to Australian National Committee on Large Dams (ANCOLD) standards	Strong SunWater dam design engineering team



CONSTRAINTS	OPPORTUNITIES
There is no precedent bulk water PPP asset	Innovative design and savings in construction costs through early contractor involvement
The solution must interface with the Mareeba-Dimbulah Water Supply Scheme (MDWSS)	Transfer of some or all subsurface and weather risks to the contractor
Multiple contracting parties in dam projects increases complexity and can potentially ‘blur’ allocation of responsibilities	

Workshop participants also identified that a preliminary delivery model assessment was not required for options 2 and 3 for the following reasons:

- Option 2: Improve MDWSS rules and operation – It was proposed that this option would be carried out by government (DEWS) and SunWater where appropriate.
- Option 3: Modernise MDWSS and convert losses – SunWater have indicated that the activities proposed in Option 3 would be carried out internally by SunWater as a number of smaller projects.

The following analysis therefore focusses on assessment of potential delivery models for Option 4.

16.4.2 Precedent Delivery Models

Dam construction in Australia was at its peak from the 1960s to the 1980s and slowed significantly in the 1990s. The delivery model analysis has considered recent dam projects in Queensland (due to the planned location of the Nullinga Dam) and Tasmania (due to the high number of recent dam projects there relative to the remainder of Australia).

16.4.2.1 Queensland

The most recent dam project actively considered in Queensland was the Connors River Dam project. Although the project did not proceed, the project’s proponent (SunWater) did complete the procurement of contractors.

Connors River Dam was to be a 373,662 ML dam which transported water via a 133 kilometre pipeline to Moranbah primarily servicing coal mines (and associated communities) in Central Queensland's coal basins. It was designed to be a roller-compacted concrete dam, including a central spillway and aquatic fauna transfer device. It also involved a pipeline, associated infrastructure, upgrade of access roads and the commissioning of temporary resource extraction areas.

SunWater chose to use a competitive Early Tenderer Involvement (ETI) process to select the preferred tenderers to work with SunWater to finalise design, approvals and property requirements for the projects. Private sector contractors were required for both the dam and pipeline construction.

SunWater have indicated that the ETI model allowed contractors to build efficiency and innovation into the final design. The ETI model is similar to the ECI model, save that the project owner (i.e. SunWater) retains the Designer and the Tenderers have no design responsibility. The project owner’s design is at a much more mature stage and does not require the same degree of design development as is the case when an ECI model is used. Tenderers participate in value engineering and refinement of the project owner’s design and often appoint their own sub-design consultants to provide assurance or alternatives.



16.4.2.2 Tasmania

Six dam projects have been successfully delivered in Tasmania since 2006 with another three projects in construction. The table below provides an overview of the largest of those dams and the delivery model used.

Table 2 Overview of Large Dams and Delivery Models in Tasmania

DAM NAME	LOCATION	EMBANKMENT VOLUME (M3)	BUILT	DELIVERY MODEL	TYPE	BUILT TO BUDGET
Meander Dam	Meander	86,000	2006	D&C lump sum	RCC	✓
Milford	Conara South Esk	330,000	2012	D&C lump sum	Zoned Earth	✓
Dunns Creek	Upper Ringarooma	700,000	2014	D&C lump sum	Zoned Earth	✓
Carpenters	South Riana	160,000	2015	D&C lump sum	Zoned Earth	✓

16.4.3 Cost and Quality Criteria

Workshop participants were asked to consider what aspects of Option 4 were most important in the achievement of project objectives. Responses are summarised below:

- Interface—the quality of the interface with SunWater and the existing scheme is seen as very important
- Transfer of risk—ability to transfer key construction and maintenance risks
- Time to deliver—the time taken to deliver an operational asset is important to address market expectations
- Cost—minimising the cost to government (capex and lifecycle) is also very important
- Contractor capability—the project requires contractors who have a history of successful delivery and an adequate level of technical experience which will result in a dam that can operate in a safe but reliable manner
- Costs of the transaction—costs associated with developing and completing the transaction were seen as potentially prohibitive
- Innovation, flexibility and policy alignment were discussed but not considered significant issues for this project in comparison to the matters listed above.

The workshop then prioritised the list above, categorised them against the two value for money objectives, being (1) cost and (2) quality of outcomes, and applied weightings for all criteria as follows:

Table 3 Cost and Quality Criteria—Weightings

COST (45%)	QUALITY (55%)
Whole of Asset Cost (30%)	SunWater Interface (30%)
Risk Transfer (10%)	Market Expertise (15%)
Transaction Costs (5%)	Timeliness of delivery (10%)



Value for money objectives relating to quality were considered to be of higher importance than cost due to the importance of the interface with the existing scheme and the need to have a safe dam.

16.4.4 Packaging

Packaging involves the disaggregation of project components into distinct contracting or works packages. This can provide a range of opportunities and challenges for the procuring entity. The approach taken (consolidated project or disaggregated packages) can impact upon decisions made by both public and private sector entities during business case, procurement, construction and operational phases.

Participants formed the view that while it was possible to anticipate likely packages for Option 4 e.g. dam design, hydrology, road diversions and construction, it would be prudent to assume that only two packages (completion of the dam design and the construction of the dam) were relevant at the PBC stage. It was assumed that operation of the completed dam will be the responsibility of SunWater.

16.5 Assessment of Traditional Delivery Models

Workshop participants considered a range of traditional delivery models which included:

- Competitive Alliance (CA)
- Early Contractor Involvement (ECI)
- Managing Contractor (MC)
- Construction Only (CO)
- Design and Construct (D&C)
- Design, Construct and Maintain (DCM), and
- Design, Construct, Maintain and Operate (DCMO)
- Design, Construct , Finance, Maintain and Operate (DCFMO).

This long list was filtered into a short list by eliminating delivery models that didn't allow SunWater to operate the completed asset (so DCMO and DCFMO were not given any further detailed consideration).

The following table summarises the assumed allocation of responsibilities for various project functions to government or the private sector under each of the shortlisted options.

Table 4 Summary of Allocation of Responsibilities to Government and the Private Sector

FUNCTION	CA	ECI	MC	CO	D&C	DCM
Ownership	Gov	Gov	Gov	Gov	Gov	Gov
Design	Priv	Priv & Gov	Priv	Gov	Priv	Priv
Funding	Gov	Gov	Gov	Gov	Gov	Gov
Supply & Install	Priv	Priv	Priv	Priv	Priv	Priv
Interface Mgmt	Gov & Priv	Gov	Gov & Priv	Gov	Gov	Gov
Maintenance	Gov	Gov	Gov	Gov	Gov	Priv
Operations	Gov	Gov	Gov	Gov	Gov	Gov



16.5.1 Competitive Alliance

The workshop assessed the Competitive Alliance delivery model against the value for money objectives. A summary of assessment outcomes is provided in Table 5.

Table 5 Competitive Alliance Delivery Model Assessment

QUALITY (55%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
SunWater Interface (30%)	80/100	24	Collaborative approach should allow detailed consideration of existing scheme interface requirements with all alliance members.
Market Expertise (15%)	70/100	10.5	Limited experience with successful dam alliances, but early access to market expertise in a collaborative environment would allow for innovation.
Timeliness (10%)	70/100	7	Performance based remuneration encourages behaviour which will help meet timelines.
COST (45%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
Whole of Asset Cost (30%)	20/100	6	Opportunities to collaboratively explore options to reduce whole of life costs of the asset, but project owner bears risk of costs overruns in construction
Risk Transfer (10%)	10/100	1	Limited opportunity to transfer risks given that SunWater would be working collaboratively with the Contractor
Transaction Cost (5%)	20/100	1	Transaction costs generally higher for Alliancing (including requirements for ongoing administration of alliance structures)

The total weighted score for Competitive Alliance was **49.5**.

16.5.2 Early Contractor Involvement (ECI)

The workshop assessed the ECI delivery model against the value for money objectives. A summary of assessment outcomes is provided in Table 6.

Table 6 Early Contractor Involvement Delivery Model Assessment

QUALITY (55%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
SunWater Interface (30%)	80/100	24	Early involvement would allow the contractor to understand the existing scheme and factor those considerations into the design and SunWater operating requirements
Market Expertise (15%)	80/100	12	Participants felt that the market was well developed when operating under this delivery model
Timeliness (10%)	80/100	8	Shorter tender period would enable an operational asset to be delivered more efficiently



COST (45%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
Whole of Asset Cost (30%)	90/100	27	Better design and construction would lead to reduced whole of asset costs
Risk Transfer (10%)	100/100	10	Enables government to allocate an optimal level of risk before construction commences
Transaction Cost (5%)	70/100	3.5	It is in the best interests of both government and the contractor to reduce transaction costs

The total weighted score for Early Contractor Involvement was **84.5**.

Stakeholder experience indicates that this delivery model could minimise the cost of design and construction in a market that has insufficient work but may increase costs in an active market. An ECI model is often recommended where the proponent does not have an in-house design engineering team with strong design capability.

It is considered that SunWater does possess a strong dams engineering design capability. If SunWater confirms that this is the case, and will have a developed design available prior to tender, the Design and Construct (or perhaps ETI) approach would be a preferable delivery model.

16.5.3 Managing Contractor (MC)

The workshop assessed the MC delivery model against the value for money objectives. A summary of assessment outcomes is provided in Table 7.

Table 7 Managing Contractor Delivery Model Assessment

QUALITY (55%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
SunWater Interface (30%)	80/100	24	Would allow SunWater to retain control over the initial design but early engagement of the Managing Contractor in developing the design allows constructability issues and whole of life considerations to be addressed early
Market Expertise (15%)	40/100	6	Limited precedents of this model being used in Queensland for water infrastructure
Timeliness (10%)	70/100	7	Allows early involvement of all project participants



COST (45%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
Whole of Asset Cost (30%)	60/100	18	Whole of Asset Cost not the main focus within a MC model but can be kept to an acceptable level
Risk Transfer (10%)	100/100	10	The State would be able to transfer delivery risk (design & construction) onto the managing contractor
Transaction Cost (5%)	20/100	1	High upfront transaction costs for this model, which is not well understood by likely tenderers in the Queensland market

The total weighted score for Managing Contractor was **66**.

16.5.4 Construction Only (CO)

The workshop assessed the CO delivery model against the value for money objectives. A summary of assessment outcomes is provided in Table 8.

Table 8 Construction Only Delivery Model Assessment

QUALITY (55%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
SunWater Interface (30%)	90/100	27	High design input from SunWater will assist interface challenges
Market Expertise (15%)	90/100	13.5	Very simple tender for the market to understand, competitive market exists
Timeliness (10%)	60/100	6	Longer lead times for procurement processes which increases overall time
COST (45%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
Whole of Asset Cost (30%)	60/100	18	Early effort on design will assist in reducing whole of life costs but limited opportunity for Contractor to value add with costs efficiencies
Risk Transfer (10%)	70/100	7	State able to transfer some risks but would retain all design risk
Transaction Cost (5%)	90/100	4.5	Simple tender and transaction process reducing transaction costs

The total weighted score for Construction Only was **76**.



Stakeholder experience indicates that the State will have to pay a premium to transfer (or retain the risk and allow variations) for any unexpected/unidentified geotechnical or foundation conditions (latent conditions) not fully described in the design documentation as well as the time and cost risks of any subsequent changes in design that are required to meet performance outcomes.

16.5.5 Design and Construct (D&C)

The workshop assessed the D&C delivery model against the value for money objectives. A summary of assessment outcomes is provided in Table 9.

Table 9 Design and Construct Delivery Model Assessment

QUALITY (55%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
SunWater Interface (30%)	70/100	21	State would carry the risk of poor interface planning/design
Market Expertise (15%)	90/100	13.5	Simple model that is well understood by the market
Timeliness (10%)	80/100	8	Time certainty is high due to performance warranties and guarantees
COST (45%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
Whole of Asset Cost (30%)	80/100	24	State able to manage whole of asset costs but not always a focus for the D&C contractor
Risk Transfer (10%)	100/100	10	All design and construction risks included in a lump sum contract
Transaction Cost (5%)	90/100	4.5	Simple transaction that is well understood by the State and contractors

The total weighted score for Design and Construct was **81**.

Stakeholder experience indicates that a D&C delivery model allows the State to have a well advanced preliminary design with performance specifications, but also allows the successful D&C contractor to innovate and prepare a detailed design that meets the performance specifications and allows the construction role to be profitable. The D&C delivery model would require SunWater to have a strong internal design engineering team.

Stakeholder experience indicates that even when the winning bid is above the project budget, the two parties can work towards achieving a bid price that would allow the project to proceed.

The D&C delivery model was preferred by some stakeholders involved in the delivery model workshop.

16.5.6 Design, Construct and Maintain (DCM)

The workshop assessed the DCM delivery model against the value for money objectives. A summary of assessment outcomes is provided in Table 10.



Table 10 Design, Construct Maintain Delivery Model Assessment

QUALITY (55%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
SunWater Interface (30%)	50/100	15	State would carry the risk of poor interface planning/design
Market Expertise (15%)	30/100	4.5	Packaging design, construct and maintenance may limit the pool of experienced contractors
Timeliness (10%)	70/100	7	The addition of maintenance into the transaction will require more complex documentation and interaction with bidders. This may increase the time period to commencement of an operational asset
COST (45%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
Whole of Asset Cost (30%)	65/100	19.5	Contractor would maintain the asset. Low level of cost certainty for SunWater and might not be as efficient compared to SunWater maintaining the asset.
Risk Transfer (10%)	100/100	10	All design, construction and maintenance risks included in a lump sum contract
Transaction Cost (5%)	40/100	2	The addition of maintenance may increase transaction costs.

The total weighted score for Design, Construct and Maintain was **58**.

16.5.7 PPP Delivery Model

PPPs typically make the private sector parties who build public infrastructure financially responsible for its condition and performance throughout the asset’s lifetime. PPPs are often used where the State is seeking the whole-of-life innovation and efficiencies that the private sector can deliver in the design, construction and operating phases of the project.

The National PPP Guidelines require PPPs to be considered as a delivery option where the capital value of a project exceeds \$50 million.

PPPs can deliver VfM when there is good opportunity for risk transfer, opportunities for whole of life costing and innovation, potentially higher asset utilisation and good opportunity for integration of design, construction and operations. The delivery model workshop considered the following non-traditional delivery models:

- Build, Own, Operate, Transfer (BOOT)
- Availability Payment Model
- Hybrid Model
- Design, Build, Finance (DBF)



The view of delivery model workshop participants was that BOOT, Availability Payment and Hybrid models would not be commercially viable as the State would own the asset, SunWater would prefer to undertake the design and SunWater would operate (and most likely maintain) the asset.

The assessment in Table 11 was completed on the DBF non-traditional delivery model for completeness.

Table 11 PPP Delivery Model Assessment

QUALITY (55%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
SunWater Interface (30%)	20/100	6	Reduced opportunity for SunWater involvement and ability to ensure that interfaces are efficient
Market Expertise (15%)	20/100	3	Limited precedent PPP dam projects and no obvious market participants
Timeliness (10%)	40/100	4	Transaction duration may increase time to achieve an operational asset
COST (45%)			
CRITERION	SCORE	WEIGHTED SCORE (%)	COMMENT
Whole of Asset Cost (30%)	80/100	24	NA for this project as SunWater would seek to carry out O&M activity. Under alternate circumstances, the contractor/proponent is incentivised to maintain the asset to appropriate levels
Risk Transfer (10%)	60/100	6	Good opportunity for the State to transfer risk to the party best able to manage that risk
Transaction Cost (5%)	20/100	1	Contractor will be motivated to price risk into their bid. High transaction costs associated with a PPP transaction

The total weighted score for Design, Build, Finance was **44**.

16.6 Value for Money Assessment

The value for money assessment at the preliminary business case stage requires qualitative consideration of the potential for the Queensland Government to achieve value for money by delivering a project under a PPP arrangement with private finance rather than traditional delivery.

Table 12 summarises the qualitative value for money assessment consistent with the Building Queensland Business Case Development Framework Preliminary Business Case guidance material.

Table 12 Qualitative Value for Money Assessment

DRIVER	SCORE	DESCRIPTION
Project Scale	Low	Option 4 proposes a small Nullinga Dam
Risk Allocation	Medium	Opportunity for the State to transfer risk to the proponent



Whole of Life Costing	Medium	Proponent is incentivised to adhere to agreed costing levels
Innovation	Low	SunWater would prefer to complete most of the design
Improved Asset Utilisation	Low	Low opportunity to improve the proposed asset
Economies of Scale	Low	Low opportunity to achieve better economies of scale
Competitive Process	Low	Competitive bidding process may generate VfM but there are no obvious market participants
Overall Assessment	There is a low possibility of a PPP providing value for money.	

Analysis has concluded that a non-traditional delivery model would not be commercially viable for Option 4.

16.7 Preliminary Market Sounding

The Building Queensland Business Case Development Framework requires a preliminary business case to undertake preliminary market sounding. The market sounding process aims to seek market feedback on the project to enable a procurement strategy to be developed that will generate market interest, deliver value for money and appropriately allocate and manage risk. This includes obtaining feedback from contractors on:

- package structure
- delivery model
- early works scope and staging
- interface with existing operations
- procurement timetable
- market trends and characteristics.

16.7.1 Objectives of Market Sounding

The primary objectives of market sounding are to:

- attract a wide range of market participants to the project and thereby create greater competition
- optimise packaging and procurement options in a way that is most likely to address that market’s issues
- build market feedback into the proposed procurement strategy, including appetite for the procurement options available
- provide a formal mechanism of documenting the market’s views on commercial issues.

Secondary objectives of the market sounding process include:

- informing the market of the status of the project, including key features and potential timeframes
- investigating the feasibility of the project and interest from potential financial advisers/arrangers which can be fed into the value for money assessment.



16.7.2 Market Sounding Methodology

Preliminary market sounding should, where possible, try and avoid increasing the market's expectations about the likelihood of the project proceeding due to the number of variables that may influence project outcomes between this stage and the procurement/delivery stages.

The methodology for market sounding involved the following:

- questionnaire development
- participant selection
- interviews (telephone)
- documentation and analysis.

16.7.3 Questionnaire Development

Key stakeholders and advisors considered a range of topics that need to be investigated during market sounding which resulted in the following list of questions to be asked of participants:

1. The State's preference is to undertake the majority of the design process in-house, therefore it would seek to procure the construction function. The State would consider Early Contractor Involvement. Would you be interested in participating in our preferred model?
2. Would a different delivery model be better suited for the proposed project and if so, why would it produce better value for money (cost and quality of outcomes) for the State?
3. Do you think the project could be effectively delivered better as a single contract or by multiple packages? Why?
4. Based on your experience, and from a funding and financing capacity perspective, what are the considerations and likelihood that the Project could deliver value for money to the State if it were delivered as a PPP?

16.7.4 Participant Selection

Key stakeholders and advisors identified a list of organisations that might be interested in participating in the market sounding process. The participants were identified on the basis of the following criteria:

- recent activity in Queensland
- appetite for construction projects of this size and location, and
- market knowledge.

Market sounding participants included seven organisations that have delivered similar scale construction projects in Queensland recently.

16.7.5 Market Feedback

All participants in the market sounding, except for two with a PPP focus, indicated that they would be interested in participating in the project under an ECI model. While all participants stated that they would participate under an ECI model, all indicated that a D&C model would be preferred as they thought it provided better value for money for the State.

Participants thought that the D&C model would still allow SunWater to influence the design but also provide the selected contractor with the opportunity to innovate during the detailed design process.



Participants highlighted that contractors would be prepared to assume latent condition risk, but only if given the opportunity to conduct an appropriate amount of geotechnical exploration during the tendering process.

All market sounding participants indicated that a dam project of this size should be delivered in a single contract (D&C). Participants acknowledged that hydrology and road diversions are sometimes packaged separately, but more informed feedback could be provided after considering a design.

All participants agreed that a PPP delivery model would not be appropriate for (a) a project of this size; and (b) a project where design and operations would remain with an entity such as SunWater.

16.8 Outcomes of the Preliminary Delivery Model Assessment

The delivery model workshop identified that packaging was not a significant consideration for a project of this size and the PBC stage.

Workshop participants agreed that Value for Money objectives should be weighted as 55 per cent for quality and 45 per cent for cost.

Table 13 presents a summary of scores assigned to delivery models by cost and quality criteria.

Table 13 Delivery Model Summary of Scores

	WHOLE OF ASSET COST (30%)	RISK TRANSFER (10%)	TRANSACTION COST (5%)	TIMELINESS (10%)	MARKET EXPERTISE (15%)	SUNWATER INTERFACE (30%)	WEIGHTED SCORE
Competitive Alliance	20	10	20	70	70	80	49.5
Early Contractor Involvement	90	100	70	80	80	80	84.5
Managing Contractor	60	100	20	70	40	80	66
Construction Only	60	70	90	60	90	90	76
Design and Construct	80	100	90	80	90	70	81
Design, Construct and Maintain	65	100	40	70	30	50	57
Design, Build, Finance	80	60	20	40	20	20	44

The delivery model assessment concluded that the Early Contractor Involvement delivery model achieved the highest assessment score (84.5) against the evaluation criteria closely followed by Design and Construct (81).



The qualitative Value for Money assessment identified that there is no commercially viable non-traditional delivery model given that design, operations and maintenance is likely to be delivered by SunWater.

Market Sounding identified that participants would be interested in the project and in an Early Contractor Involvement model.

However, all participants indicated that they would prefer a Design and Construct model under a single package.

Market sounding participants also agreed that a PPP delivery model was not suitable for this project.

16.9 Recommendation

After considering the outcomes of the preliminary delivery model assessment and market sounding, key stakeholders and advisors formed the view that the preferred model was Design and Construct or Early Contractor Involvement (or potentially Early Tenderer Involvement).



CHAPTER 17

AFFORDABILITY ANALYSIS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

17	AFFORDABILITY	2
17.1	Purpose	3
17.2	Method	3
17.3	Option 2: Improve MDWSS Rules and Operation	3
17.4	Option 3: Modernise MDWSS and Convert Losses	3
17.5	Option 4: Nullinga Dam for Agricultural Use	4
17.6	Conclusion	5

TABLES

Table 1	Option 3—Estimated Capital and Ongoing Costs and Assumed Yield	3
Table 2	Option 3—Estimated Price for New Water Allocations.....	4
Table 3	Option 3—Breakdown of Estimated Capital Expenditure and Customer Revenue	4
Table 4	Option 4—Estimated Capital and Ongoing Costs and Assumed Yield	5
Table 5	Option 4—Estimated Price for New Water Allocations.....	5
Table 6	Option 4—Breakdown of Estimated Capital Expenditure and Customer Revenue	5



17 AFFORDABILITY

CHAPTER SUMMARY AND CONCLUSIONS

- This chapter outlines affordability considerations for shortlisted Options 2 to 4.
- The affordability assessment is limited by the assumptions and uncertainties that underpin the estimated costs and projected revenue, in particular, forecast demand for new water allocations.

Option 2: Improve MDWSS rules and operation

- As a reform option, Option 2 costs are comprised of operational costs of government wages and consultancy costs, with no capital expenditure.
- The relative affordability of Option 2 is considered high, subject to the budgetary and resourcing constraints of DNRM and SunWater.

Option 3: Modernise MDWSS and convert losses

- Option 3 costs comprise capital costs and operational costs.
- The capital costs of the modernisation works, volume of new water allocations available from conversion of losses, and sale price of new water allocations is critical to the affordability of Option 3.
- The relative affordability of Option 3 is considered medium to high, subject to further detailed assessment.
- Further detailed engineering, hydrological and costing analysis is required to better understand affordability considerations and the portion of capital costs able to be recovered from customers.
- Operational expenditure is generally funded by customers via annual charges, but further detailed assessment will assist to understand affordability considerations.

Option 4: Nullinga Dam for agricultural use

- Option 4 costs comprise capital costs and operational costs.
- The capital cost of the dam, volume of new water allocations available and the sale price of new water allocations is critical to the affordability of Option 4.
- The relative affordability of Option 4 is considered low to medium, and is subject to further detailed assessment.
- Affordability considerations and the portion of capital costs able to be recovered by customers will depend on a variety of factors, including the dam yield being revised to match the credible demand profile, and revised capital expenditure and operational expenditure.
- Operational expenditure is expected to be fully funded by customers via annual charges, but further detailed analysis will assist to understand affordability considerations.



17.1 Purpose

This chapter outlines affordability considerations for each shortlisted option.

17.2 Method

The assessment of affordability is based on a comparison of the estimated capital expenditure and price of new water allocations (revenue) associated with each option.

This assessment provides a partial indicator of affordability and is limited by the assumptions and uncertainties that underpin the estimated costs and revenue. The shortfall presented is based on a straight recovery of capital costs from customers only. Movements in the forecast demand for new water allocations will have implications for estimates of the capital costs shortfall. Further details of the estimated costs and revenues for the shortlisted options are provided in Chapter 16.

17.3 Option 2: Improve MDWSS Rules and Operation

Option 2 involves reform of MDWSS water instruments to increase the performance of the scheme and reduce current non-physical constraints. No new water allocations are created.

Costs consist of operational costs of government wages and consultancy costs of \$1 million over two years to implement reform measures. Option 2 involves no capital expenditure.

The affordability to the State of Option 2 is considered high, subject to the budgetary and resourcing constraints of the respective government agencies.

17.4 Option 3: Modernise MDWSS and Convert Losses

17.4.1 Summary of Estimated Costs

Option 3 involves infrastructure improvements to the MDWSS and the conversion of current loss allocations to new medium priority water allocations for sale to customers. Table 1 shows the low, central and high costs for Option 3 and assumed yield from the conversion of losses. Further information on these costs is provided in Chapter 16.

Table 1 Option 3—Estimated Capital and Ongoing Costs and Assumed Yield

SCENARIO	CAPITAL COSTS (\$2017M)	ONGOING COSTS (\$2017M PER ANNUM)	ASSUMED YIELD (ML PER ANNUM)
Low	29.7	0.56	8,300
Central	39.7	0.65	12,900
High	50.8	0.75	15,000

17.4.2 Critical Variables

The volume of losses able to be converted and the costs of the modernisation works are critical components to determining affordability. The potential yield from Option 3 is considered uncertain due to the preliminary nature of works undertaken for this option at this time. For example, at the low end it may be possible for the works to permanently reduce 20 to 75 per cent of actual losses within the particular areas of the MDWSS where the works are conducted, or at the high end 50 to 85 per cent.

Further hydrological and engineering assessments are required in to confirm the amount of loss savings that may be able to be made from modernisation works, and the capital costs of the works to achieve those



savings. Such a process would ensure that most cost-effective works for acceptable risk are pursued to enable the maximum loss savings.

17.4.3 Estimated Revenue and Shortfall

17.4.3.1 Estimated Capital Costs

Table 2 shows the cost per ML of new medium priority water allocations with full customer funding of capital expenditure for the low, central and high capital expenditure scenarios.

Table 2 Option 3—Estimated Price for New Water Allocations

CAPEX SCENARIO (\$2017)	LOW	CENTRAL	HIGH
Capex (\$2017)	29,709,429	39,360,771	50,841,869
Total new medium priority water allocations (ML)	8,300	12,900	15,000
Medium priority water allocation price (\$ per ML)	3,579	3,058	3,389

Table 3 shows the breakdown of potential customer funding of capital expenditure with the adopted benchmark of \$2,500 payable for new water allocations (see Chapter 16 for further details) and the shortfall.

The low capex scenario should be treated with caution due to the preliminary nature of work undertaken on Option 3. The central case and high capex scenario is considered more likely based on the work undertaken to date.

Table 3 Option 3—Breakdown of Estimated Capital Expenditure and Customer Revenue

SCENARIO (\$2017)	LOW	CENTRAL	HIGH
Capex (\$)	29,709,429	39,360,771	50,841,869
Total new medium priority water allocations (ML)	8,300	12,900	15,000
One-off price paid for medium priority water allocations by customers (\$ per ML)	2,500	2,500	2,500
Total customer contributions (\$)	20,747,500	32,176,250	37,497,500
Portion of capex funded by customers (%)	70	82	74
Capex funding shortfall (%)	30	18	26
Capex funding shortfall (\$)	8,958,429	7,181,021	13,340,869

17.4.3.2 Estimated Operational Costs

It is assumed operation and maintenance costs will be funded by revenue from water customers through annual charges.

17.5 Option 4: Nullinga Dam for Agricultural Use

17.5.1 Summary of Estimated Costs

Option 4 involves the construction and operation of Nullinga Dam and the sale of new water allocations to customers. Table 4 shows the low, central and high costs for Option 4. Further information on these costs is provided in Chapter 16.


Table 4 Option 4—Estimated Capital and Ongoing Costs and Assumed Yield

SCENARIO	CAPITAL COSTS (\$2017M)	ONGOING COSTS (\$2017M PER ANNUM)	ASSUMED YIELD (ML PER ANNUM)
Low	227	2.8	55,400
Central	323	3.6	55,400
High	397	5.4	55,400

17.5.2 Estimated Revenue and Shortfall

17.5.2.1 Estimated Capital Costs

Table 5 shows the cost per ML of new high priority and medium priority water allocations with full customer funding for the low, central and high capital expenditure scenarios.

Table 5 Option 4—Estimated Price for New Water Allocations

CAPEX SCENARIO (\$2017)	LOW	CENTRAL	HIGH
Capex (\$2017M)	227	323	397
High priority water allocation price (\$ per ML) – 35 ML	6,346	9,016	11,089
Medium priority water allocation price (\$ per ML) – 55,400 ML	4,309	6,123	7,531

Table 6 shows the breakdown of potential customer funding of capital expenditure with the adopted benchmark of \$2,500 payable for new water allocations (see Chapter 16 for further details) and the shortfall.

Table 6 Option 4—Breakdown of Estimated Capital Expenditure and Customer Revenue

SCENARIO (\$2017)	LOW	CENTRAL	HIGH
Capex (\$M)	227	232	397
Total new water allocations (ML)	55,400	55,400	55,400
One-off price paid for medium priority water allocations by customers (\$ per ML)	2,500	2,500	2,500
Total customer contributions (\$M)	132	132	132
Portion of capex funded by customers (%)	58	41	33
Capex funding shortfall (%)	42	59	67
Capex funding shortfall (\$M)	95	191	265

17.5.2.2 Estimated Operational Costs

It is assumed operation and maintenance costs will be funded by revenue from water customers through annual charges.

17.6 Conclusion

The following conclusions are drawn from the above analysis.

17.6.1.1 Option 2

- As a reform option, Option 2 costs are comprised of operational costs of government wages and consultancy costs, with no capital expenditure.



- The relative affordability of Option 2 is considered high, subject to the budgetary and resourcing constraints of DNRM and SunWater.

17.6.1.2 Option 3

- Option 3 costs comprise capital costs and operational costs.
- The capital costs of the modernisation works, volume of new water allocations available from the conversion of losses, and sale price of new water allocations is critical to the affordability of Option 3.
- The relative affordability of Option 3 is considered medium to high, subject to further detailed assessment.
- Further detailed engineering, hydrological and costing analysis is required to better understand affordability considerations and the portion of capital costs able to be recovered from customers.
- Operational expenditure is generally funded by customers via annual charges, but further detailed assessment will assist to understand affordability considerations.

17.6.1.3 Option 4

- Option 4 costs comprise capital costs and operational costs.
- The capital cost of the dam, volume of new water allocations available and the sale price of new water allocations is critical to the affordability of Option 4.
- The relative affordability of this Option 4 is considered low to medium, and is subject to further detailed assessment.
- Affordability considerations and the portion of capital costs able to be recovered by customers will depend on a variety of factors, including the dam yield being revised to match the credible demand profile, and revised capital expenditure and operational expenditure.
- Operational expenditure is expected to be fully funded by customers via annual charges, but further detailed analysis will assist to understand affordability considerations.



CHAPTER 18

PREFERRED OPTION FOR FURTHER DEVELOPMENT

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

18	PREFERRED OPTION FOR FURTHER DEVELOPMENT	2
18.1	Purpose	2
18.2	Approach	2
18.3	Selection of Preferred Options	2
18.4	Impacts of Preferred Options	4
18.5	Timeframe	6
18.6	Criteria for Success	6
18.7	Priority	7

TABLES

Table 1	Multi-Criteria Analysis of Shortlisted Options	3
Table 2	Economic Impacts of Option 2 and 3.....	4
Table 3	Financial Impacts of Option 2 and 3	5
Table 4	Option 2—Criteria for Success	6
Table 5	Option 3—Criteria for Success	7



18 PREFERRED OPTION FOR FURTHER DEVELOPMENT

CHAPTER SUMMARY AND CONCLUSIONS

- Option 2: Improve MDWSS rules and operation and Option 3: Modernise MDWSS and convert losses are the preferred options for further evaluation.
- Option 4: Nullinga Dam for agricultural use is not recommended to proceed to a detailed business case at this time.
- Key success factors for Option 2 are:
 - Modelling showing that the implementation of rule and operational changes will make a difference to water availability for irrigators in the MDWSS
 - Appetite of government and SunWater to implement improvements and reforms to scheme rules and operation
 - Change in water use practices by irrigators in response to the improvements, and associated increase in agricultural production
 - Considering potential changes in local management of the MDWSS distribution infrastructure that may affect the operation of the scheme.
- Key success factors for Option 3 are:
 - Deliverability and cost of the infrastructure improvements to the distribution infrastructure
 - Ability for SunWater to convert a suitable yield of loss allocations to new water allocations for sale
 - Purchase of the new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production
 - Limited negative impacts on the existing scheme and owners of existing allocations from the implementation of the option.

18.1 Purpose

This chapter outlines the assessment of the shortlisted options to identify the preferred option(s) to proceed to further evaluation.

18.2 Approach

The analysis of the four shortlisted options undertaken in the preceding chapters of this PBC was considered alongside the Building Queensland Prioritisation Framework categories, which are used for the purpose of prioritising projects across government. The Building Queensland Prioritisation Framework criteria of strategic, economic and financial, social and environmental and deliverability were weighted equally in the assessment.

18.3 Selection of Preferred Options

Table 1 outlines the outputs of the multi-criteria assessment for the selection of the preferred options.


Table 1 Multi-Criteria Analysis of Shortlisted Options

CRITERIA	OPTION 1: DO MINIMUM (BASE CASE)	OPTION 2: IMPROVE MDWSS RULES AND OPERATION	OPTION 3: MODERNISE MDWSS AND CONVERT LOSSES	OPTION 4: NULLINGA DAM FOR AGRICULTURE
STRATEGIC				
Alignment to government objectives	Low	Medium	Medium	Medium
Effectiveness in addressing the service need	Low	High	High	Medium
Market considerations	Medium	High	High	Medium
ECONOMIC AND FINANCIAL				
Estimated new medium priority water available (ML)	-	4,330 (additional use)	8,300 – 15,000 (new allocations)	55,400 (new allocations)
Estimated capital costs (2017\$M)	1.6	N/A	30 – 51	323 – 358
Estimated operational costs per annum (2017\$M)	6.1	1.0	0.56 – 0.75	2.8 – 5.4
Economic Net Present Value – Central Case (\$M)	-	31	73	6
Benefit Cost Ratio – Central Case	-	11.0	2.8	1.0
Economic Net Present Value – Upper Bound Sensitivity Analysis (\$M)	-	4	-9.0	-163
Benefit Cost Ratio – Upper Bound Sensitivity Analysis	-	1.8	0.8	0.4
SOCIAL AND ENVIRONMENTAL				
Social impacts	N/A	Positive (Medium) Negative (Low)	Positive (Medium) Negative (Medium)	Positive (High) Negative (High)
Environmental impacts	N/A	Negative (Low)	Negative (Medium)	Negative (High)
DELIVERABILITY				
Risk	Low	Medium	Medium	High
Potential for Value for Money from Public Private Partnership	N/A	N/A	N/A	No
	4	1	2	3

18.3.1 Conclusion

Option 2 and Option 3 are the preferred options to progress to further evaluation.



18.4 Impacts of Preferred Options

18.4.1 Strategic Impact

18.4.1.1 Options 2 and 3

Option 2 and Option 3 will contribute to the strategic objectives of the following government plans and policies:

- State Infrastructure Plan
 - Option 2 is consistent with increasing preference towards reform options rather than build new options
 - Option 3 is consistent with increasing preference towards better use and improvement of existing infrastructure options rather than build new options.
- Far North Queensland Regional Water Supply Strategy – Option 2 and 3 align with the findings of the Strategy that the future water supply shortfall for agriculture in the region may be met by efficiency improvement in the MDWSS.
- Queensland Agricultural Land Audit – Options 2 and 3 recognises the findings of the Audit that the MDWSS is strength of the region, with significant areas of land suitable for irrigated agriculture.
- Advancing North Queensland – Option 2 and 3 aligns with the priority area of water security by providing an option to address MDWSS irrigator’s current concerns with water security.
- National Water Infrastructure Development Fund – Option 3 aligns with the objective of the feasibility component of the fund to undertake the detailed planning necessary to inform water infrastructure investment decisions and stimulate regional economic benefits.

18.4.2 Economic Impact

Table 2 outlines the key indicators of the economic impacts of Options 2 and 3.

Table 2 Economic Impacts of Option 2 and 3

ITEM	OPTION 2	OPTION 3
Economic Net Present Value—Central Case (\$M)	31	73
Benefit Cost Ratio—Central Case	11.0	2.8
Economic Net Present Value—Upper Bound Sensitivity Analysis (\$M)	4	-9.0
Benefit Cost Ratio—Upper Bound Sensitivity Analysis	1.8	0.8

18.4.3 Social and Environmental Impacts

18.4.4 Social

18.4.4.1 Option 2

Option 2 was identified to have two low beneficial social opportunity impacts, three medium beneficial social opportunity impacts and two high beneficial social impact opportunities.

The key beneficial impacts generally relate to additional employment and regional growth.



Option 2 was identified to have six low detrimental social impacts, one medium detrimental social impact and zero high detrimental social impacts identified. The key detrimental impacts relate to changes to existing business practices and processes.

18.4.4.2 Option 3

Option 3 was identified to have three low beneficial social opportunity impacts, three medium beneficial social opportunity impacts and two high beneficial social impact opportunities. The key beneficial impacts centre on:

- additional employment via scheme construction activities and enhanced agricultural production
- regional growth via improved use of existing water resources, changes in land use to higher value crops and enhanced confidence to invest in long term business operations.

Option 3 was identified to have one low detrimental social impact, eleven medium detrimental social impacts and four high detrimental social impacts identified. The key detrimental impacts centre on:

- social impacts from competition for additional water allocations
- potential divisive local issue of foreign ownership
- changes to existing flow regimes via changes in infrastructure
- potential impacts on the Mareeba wetlands and associated tourism and cultural values.

18.4.5 Environmental Impact

The key environmental issues associated with Option 2 relate to the potential for the increased operational performance of the scheme to result in a (marginal) expansion of land under irrigation. The key environmental impacts for Option 3 relate to the potential for the creation of new water allocations and the associated expansion of land under irrigation.

Environmental issues associated with expansion of land under irrigation include:

- Changes to surface water and groundwater level and quality due to increases in farm inputs, such as pesticides and fertilisers. The water quality in the Barron Basin already exceeds aquatic ecosystem guidelines for protection of freshwater systems.
- Clearing of vegetation to facilitate new irrigation areas. Land surrounding the existing irrigation area is mapped as regulated vegetation and has the potential to contain threatened ecological communities. Clearing in these areas could trigger relevant approvals.

18.4.6 Financial and Commercial Impact

Table 3 outlines the key financial impacts of Options 2 and 3.

Table 3 Financial Impacts of Option 2 and 3

ITEM	OPTION 2	OPTION 3
Estimated capital costs (2017\$M)	N/A	30 – 51
Estimated operational costs (2017\$M)	1.0	0.56 – 0.75
Revenues – One off price for sale of water allocation (2017\$ per ML, medium priority)	N/A	3,058 – 3,579*

*The shortfall percentage is based on recoverable capital costs from customers with a benchmark purchase price of \$2,500 per ML for new water allocations, consistent with the average current trading price for water allocations in the MDWSS. This percentage is for illustrative purposes and based on straight recovery of capital costs only. It does



not take account of the take-up profile of new water allocations. Movements in the forecast demand for new water allocations will have implications for estimates of the capital costs shortfall.

18.4.7 Procurement Approach

18.4.7.1 Option 2

Option 2 will be implemented by the DNRM and SunWater. The procurement approach for any external advice to implement the reforms will be developed by DNRM and SunWater.

18.4.7.2 Option 3

Option 3 is intended to be delivered by SunWater as a number of smaller projects. The procurement approach will be developed by SunWater and all procurement will be completed in accordance with SunWater procurement policies and framework.

18.5 Timeframe

18.5.1 Option 2

Option 2 will be implemented by DNRM and SunWater, as the responsible entities for the relevant water instruments, subject to resourcing and budgetary constraints within those organisations. It is expected that the timeframe to implement Option 2 would be approximately two years. However, that timeframe will be dependent upon funding and resourcing decisions made in those organisations.

18.5.2 Option 3

In March 2017, the Queensland Government and SunWater submitted an Expression of Interest application to the NWIDF seeking a capital contribution towards several of the sub-projects in Option 3 to modernise the existing MDWSS distribution system. If the NWIDF funding application is successful, timeframes for implementation will be developed in accordance with the fund requirements. If the NWIDF funding application is not successful, the timeframe for implementation will be dependent on outcome of further evaluation and further funding and resourcing decisions made by SunWater.

18.6 Criteria for Success

18.6.1 Option 2

The realisation of the benefits from implementation of Option 2 is dependent on several key factors, outlined in Table 4. These factors will be used to determine the success of the option to meet the service need.

Table 4 Option 2—Criteria for Success

CRITERIA	MEASURE	RISKS
Modelling showing that the implementation of rule and operational changes will make a difference to water availability for irrigators in the MDWSS	Modelling shows predicted benefits	Modelling does not show any difference negating benefits from reforms
Ability of government and SunWater to implement improvements and reforms to scheme rules and operation	Change to rules and operation are made within suitable timeframe	Appetite from government and SunWater to implement reforms



CRITERIA	MEASURE	RISKS
Change in water use practices by irrigators in response to the improvements	Increase in water utilisation and agricultural production	Changes to rules and operation do not result in change in behaviour, benefits not realised
Transition to local management of MDWSS distribution infrastructure (if made) does not impact on the effectiveness of reforms	Acceptance of the rule and operational changes by the local management entity	Local management entity does not accept changes to bulk supply rules and operation

18.6.2 Option 3

Similarly, the realisation of benefits from the implementation of Option 3 is dependent on several key factors outlined in Table 5. These factors will be used to determine the success of the option to meet the service need.

Table 5 Option 3—Criteria for Success

CRITERIA	MEASURE	RISKS
Deliverability and cost of the infrastructure improvements to the distribution infrastructure	Infrastructure works being delivered within cost estimates	Works exceed cost estimates and financial exposure to meet shortfall in funding
Ability for SunWater to convert a suitable yield of loss allocations to new water allocations for sale	Infrastructure improvements deliver the estimated loss savings	Water savings are lower than estimated and return on investment is lower because less achieved from the sale of the water allocations
Purchase of the new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production	Estimated take up of water allocations is met Ongoing usage of new water allocations is consistent with estimated utilisation rates	Financial risk as return does not meet capital expenditure Economic risk as benefits from increase in agricultural production not realised
Limited negative impacts on the existing scheme and owners of existing allocations	Level of agricultural production in region remains consistent, particularly in area affected by the works Customer complaints	Delivery of infrastructure works impact on existing business operations impact on level of agricultural production in region

18.7 Priority

18.7.1 Option 2

The prioritisation of Option 2 is considered to be a matter for DNRM and SunWater, as the responsible entities for the water instruments.

18.7.2 Option 3

The prioritisation of Option 3 is considered a matter for SunWater, as the current owner and operator of the MDWSS.



CHAPTER 19

CONCLUSIONS

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

19	CONCLUSIONS.....	2
19.1	Purpose	3
19.2	Nullinga Dam	3
19.3	Service Need	3
19.4	Base Case	4
19.5	Anticipated Benefits	4
19.6	Options Analysis	4
19.7	Preferred Options for Further Evaluation—Option 2 and Option 3	7
19.8	Option 4—Recommendation	8

TABLES

Table 1	Options Analysis Outcomes.....	5
Table 2	Option 2 and Option 3—Key Dependencies for Success and Risks	7



19 CONCLUSIONS

CHAPTER SUMMARY AND CONCLUSIONS

- The following conclusions are made on the basis of the analysis undertaken in this PBC:
 - There is no Cairns urban water supply problem to be addressed in the next 30 years by a regional bulk water supply source such as Nullinga Dam.
 - There are three key agricultural demand drivers in the region: dry conditions and water security; changes in crop profile to higher value permanent plantings; and industry growth.
 - There is opportunity to expand agricultural production on the Atherton Tablelands and surrounding region by increasing the availability of supplemented water allocations.
 - As the service need is an opportunity (rather than a problem), it is considered there is no base case in which any sector will run out of water supply catastrophically.
 - Addressing the service need is anticipated to result in a number of regional benefits.
 - Following an options analysis, four options were shortlisted for further consideration:
 - Option 1: Do minimum (base case)—continuation of water trading and on-farm efficiency measures in the MDWSS
 - Option 2: Improve MDWSS rules and operations to increase operational performance and reduce current constraints
 - Option 3: Modernise the MDWSS distribution system via infrastructure works to reduce system losses and convert certain loss allocations into new water allocations for sale
 - Option 4: Design and build Nullinga Dam for agricultural use.
 - Option 2 and Option 3 are recommended to progress to further evaluation.
 - Option 2 will be implemented by DNRM and SunWater.
 - Option 3 will be implemented by SunWater.
 - The Nullinga Dam option is not recommended to be progressed to a Detailed Business Case at this time. Nullinga Dam (via a ‘swap’ arrangement of existing water allocations from Tinaroo Falls Dam) is not needed for Cairns urban water supply for at least the next 30 years and assessment has revealed limited certainty of information in relation to Nullinga Dam for agricultural use.
 - **The trigger for any further consideration of the progression of Nullinga Dam for agricultural use is recommended to be a satisfactory level of certainty about the demand for new water allocations at a nominated volume and a nominated price (e.g. a significantly large proportion of the dam yield at an appropriate price). This certainty may be developed via an approach from industry to government, or via government commissioning a detailed demand assessment for new water allocations in the region.**



19.1 Purpose

The purpose of this chapter is to set out the key conclusions in the PBC on the basis of the analysis undertaken. These conclusions support the recommendations made in the PBC.

19.2 Nullinga Dam

- The proposed Nullinga Dam is less effective than the existing Tinaroo Falls Dam due to yield and hydrology inefficiency. Tinaroo Falls Dam has a full storage capacity of 438,900 ML and a yield of 211,834 ML per annum. In a comparison, the 'large size' proposed Nullinga Dam has a full storage capacity of 491,000 ML and a yield of between 65,000 and 90,000 ML per annum, depending on the hydrological model used. This inefficiency is expected as the original decision was to build Tinaroo Falls Dam because of its more favourable features.
- The Nullinga Dam site suffers from inefficiency issues for irrigation purposes as it can only deliver water to a limited number of existing farms via current delivery infrastructure.
- It is not possible for Cairns to efficiently receive water from the proposed Nullinga Dam. Cairns would need to receive water from Tinaroo Falls Dam via additional releases down the Barron River. This would require MDWSS irrigation water allocation holders to 'swap' existing Tinaroo Falls Dam water allocations to Nullinga Dam water allocations. Irrigators are likely to have significant concerns with this: water from the proposed Nullinga Dam may have different price, quality and reliability characteristics.

19.3 Service Need

- There is currently no Cairns urban water supply problem to be addressed by an external water supply such as Nullinga Dam.
- Under current population and demand forecasts, CRC has an implementation plan of Council owned and operated demand and supply measures recognised within existing water resource planning frameworks to meet its future demand for at least the next 30 years. CRC does not have an identified need for water from a regional source (such as Nullinga Dam) until the very long-term. The measures include implementation of a demand management strategy and using currently held reserves in the Mulgrave and Barron Rivers through development of water supply and treatment infrastructure. Beneficial water trading opportunities have also been identified in the Mulgrave catchment.
- There are three key agricultural demand drivers in the region: dry conditions and water security; changes in crop profile to higher value permanent plantings; and industry growth.
- There is opportunity to expand agricultural production on the Atherton Tablelands and surrounding region by increasing the availability of supplemented water. In addressing this opportunity there are two key issues:
 - Agricultural production and growth is constrained when irrigators exceed their preferred 'scarcity buffer' (e.g. irrigation is constrained to 70 to 80 per cent water use as a portion of available water allocations to protect longevity of crops at dry times).
 - Water cannot be moved to certain agricultural production areas within the Atherton Tablelands and surrounding region because of constraints in the distribution system (e.g. in parts of the east and west MDWSS) and a lack of infrastructure in greenfield areas.



19.4 Base Case

- As the service need is an opportunity (rather than a problem), it is considered there is no base case in which any sector will run out of water supply catastrophically.
- However, as water allocations in the MDWSS are full allocated, it was concluded the base case is likely to feature:
 - Little or no increase in water deliveries to the extent that capacity has, or is close to being, reached (when available, data from 2016-17 will assist to establish if this is the case).
 - Increased moves by the irrigation sector towards on-farm water efficiency and higher value production (to the extent that high-value producers have not already reached optimal water use – trickle irrigation is widely used on tree crops).
 - Water trading at high values towards high value crops on the most fertile soils within the scheme – leading to an expansion of high value horticulture within the region.
 - Static or potentially modest expansion of sugarcane production by industry resulting from increased yields due to improvements in on-farm water use efficiency. Given the current water constraints, the base case is unlikely to see expansion of sugar cane without a new source/supply of water allocations.

19.5 Anticipated Benefits

- Addressing the service need is anticipated to provide the following key benefits:
 - Enhanced usage of water delivery infrastructure for agricultural production
 - Increase in regional employment from enhanced agricultural productivity
 - Improved use of existing resources through changing water business practices
 - Change in land use to higher value per hectare crops in suitable areas
 - Enhanced confidence to invest in long term business operations and succession opportunities
 - Increase in value and flexibility of existing water allocations
 - Reinforce importance of agriculture to the study area (character and identity).

19.6 Options Analysis

- The options analysis produced a long list of options to address the service need through consideration of the SIP policy approach and categories for options assessment, analysis of previous assessments, work undertaken for the PBC and the outcomes of stakeholder consultation. This is summarised in the following table. Four shortlisted options were selected for further consideration.



Table 1 Options Analysis Outcomes

LONG LIST OF OPTIONS	SHORTLISTED OPTION
Do nothing	No
REFORM	
Improve MDWSS rules and operation	Yes—Option 2
Increase on farm water use efficiency	Yes—Option 1
IMPROVE EXISTING / BETTER USE	
Modernise MDWSS distribution infrastructure and convert losses to new water allocations for sale	Yes—Option 3
Improve water trading	Yes—Option 1
Utilise (private) Quaid Dam/Mitchell Dam and build a pipeline	No
BUILD NEW	
Build Nullinga Dam for agricultural use – bulk supply to Walsh River delivery only (no distribution infrastructure)	Yes—Option 4
Build Nullinga Dam for agricultural use - limited interaction with western MDWSS	No
Build Nullinga Dam for mixed use - Cairns urban and agricultural water supply	No
Build Nullinga Weir for agricultural use	No
Raise Tinaroo Falls Dam	No
Harvest water from the Johnstone River and build a pipeline	No

19.6.1 Option 1: Do Minimum (Base Case)

- Analysis of the current situation concluded:
 - The majority of irrigators in the MDWSS have adopted on-farm water efficiency measures to maintain or improve crop yield per ML of water applied and 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’.
 - Recent dry conditions have increased water trading activity to address scarcity.
- Option 1 is considered a viable option as it provides for incremental expansion of agricultural production on the Atherton Tableland via existing mechanisms. However, other options if progressed would provide for additional water availability and have a greater capacity to meet the identified service need.
- The Queensland Government and Australian Government commitment to assess the feasibility of the proposed Nullinga Dam has raised expectations in the region for the possibility of a new water supply option to increase agricultural expansion and provide regional economic development. The PBC has been focused on a variety of options, not just Nullinga Dam.



19.6.2 Option 2: Improve MDWSS Rules and Operation

- Option 2 comprises a review of the MDWSS operating rules against the changed cropping and water use practices of the modern scheme to increase operational performance and reduce current constraints.
- The improvements are intended to increase water use within the MDWSS without undermining the current supply or reliability of supply, or creating new water allocations.
- Key potential opportunities include reviewing the water year to match the current demand patterns, improving carryover provisions to enable greater flexibility and use of this water, improving water ordering to address underperformance, and educating users about peak flow entitlements (ML per day) as the MDWSS moves to maximum use.

19.6.3 Option 3: Modernise MDWSS and Convert Losses

- It is estimated that current operational losses from the MDWSS are around 30,000 ML per annum.
- Option 3 involves a targeted modernisation of the MDWSS distribution infrastructure to reduce operational losses and increase the amount of water allocations available in the MDWSS.
- The key elements of Option 3 are:
 - Modernise parts of the MDWSS distribution system via a range of infrastructure improvements. The scope of these works and the amount/yield of loss allocations potentially able to be converted would be determined as part of further detailed investigation and may be done in stages. DNRM in-principle support for the conversion of loss allocations would also be sought prior to works commencing.
 - Following completion of the works, apply to DNRM to convert a specified amount of distribution loss allocations¹ to new tradeable medium priority water allocations (created by the savings from infrastructure improvements). The amount/yield of loss allocations able to be converted would be determined as part of any further detailed investigation.
 - Sell the new medium priority water allocations on the market.
- In March 2017, the Queensland Government and SunWater submitted an Expression of Interest application to the NWIDF seeking a capital contribution towards several of the sub-projects in Option 3 to modernise the existing MDWSS distribution system.

19.6.4 Option 4: Nullinga Dam for Agricultural Use

- Option 4 comprises the development of Nullinga Dam as a bulk water source for the expansion of irrigated agriculture in the region.
- The scope of inclusions and exclusions for Option 4 are:
 - Design and build a Nullinga Dam for primarily medium priority water allocations open to all customers and in particular for agricultural users. This would initially be for delivery of water to Walsh River customers within and potentially downstream of the MDWSS area, but with the flexibility for commercial distribution systems to evolve.
 - No distribution infrastructure for delivery of water from the dam to the MDWSS or elsewhere is included. Future connection to the MDWSS would be subject to the result of a process that identifies clear cost effective opportunities for new or augmented distribution infrastructure.

¹ SunWater has estimated the amount of loss allocations able to be saved could be 8,000 to 15,000 megalitres, depending on the works conducted.



- A ‘bulk only, river delivery’ Nullinga Dam simplifies design, costing, water pricing, stakeholder engagement, water planning and scheme operation. It also supports the continued functioning of MDWSS by not interfering with the current irrigation scheme and distribution system.
- Previous assessments of Nullinga Dam have provided for small, medium and large sizes. Option 4 has assessed Nullinga Dam on the basis of the ‘small size’ used in previous assessments to allow for analysis against the other shortlisted options. It is recommended the size of Nullinga Dam in any future evaluation be determined by further demand assessment, and the dam be designed (and resized) to match the volume of credible demand.

19.7 Preferred Options for Further Evaluation—Option 2 and Option 3

- Option 2: Improve MDWSS Rules and Operation and Option 3: Modernise MDWSS and Convert Losses are recommended to progress to further evaluation.
- Option 2 primarily involves changes to bulk storage rules and operation. It is low cost, has stakeholder support and projected economic benefits. A key focus of further evaluation will be modelling to ensure that the proposed rule and operational changes will make a difference to water availability for irrigators. Given its potential to impact on MDWSS operations overall it is recommended implementation involve ongoing consultation with the existing local management entity.
- Option 2 will be implemented by the DNRM and SunWater, as the responsible entities for the relevant water instruments in accordance with usual government and business practices. The nature of the further evaluation will be subject to resourcing and budgetary constraints within those organisations.
- Option 3: Modernise MDWSS and Convert Losses represents improving existing infrastructure, will produce new water allocations, is scalable and can be implemented in stages. Key focus of further evaluation should include the capital cost of works and potential yield of new allocations and the potential implications of the transition of the MDWSS distribution infrastructure business, assets and liabilities to a new local management entity.
- As the estimated capital costs of Option 3 are under \$100 million, SunWater, as the owner and operator of the MDWSS, will undertake the further evaluation of Option 3, with assistance from Building Queensland in accordance with the *Building Queensland Act 2015*.
- The implementation of Option 3 will be subject to resourcing and budgetary constraints within SunWater and dependent upon funding decisions of SunWater.
- Key success factors for the implementation of Option 2 and Option 3 are outlined in the table below.

Table 2 Option 2 and Option 3—Key Dependencies for Success and Risks

OPTION 2 - DEPENDENCY	OPTION 2 - RISKS	OPTION 3 – DEPENDENCY	OPTION 3 – RISKS
Modelling showing that the implementation of rule and operational changes will make a difference to water availability for irrigators in the MDWSS	Modelling does not show any difference negating benefits from reforms	Deliverability and cost of the infrastructure improvements to the distribution infrastructure	Works exceed cost estimates and financial risk exposure to meet shortfall in funding



OPTION 2 - DEPENDENCY	OPTION 2 - RISKS	OPTION 3 – DEPENDENCY	OPTION 3 – RISKS
Ability of government and SunWater to implement improvements and reforms to scheme rules and operation	Appetite from government and SunWater to implement reforms	Ability for SunWater to convert a suitable yield of loss allocations to new water allocations for sale	Water savings are lower than estimated and return on investment lower with less achieved from the sale of the water
Change in water use practices by irrigators in response to the improvements, and associated increase in agricultural production	Stakeholder risk as changes to rules and operation not accepted Economic risk as benefits not realised	Purchase of the new water allocations by irrigators within a suitable timeframe and associated increase in agricultural production	Financial risk as return does not meet capital expenditure Economic risk as benefits not realised
Local management considerations – a change in management of the MDWSS distribution infrastructure may affect the operation of the scheme	Transition to local management entity results in non-acceptance by new entity of changes to bulk supply rules and operation Ongoing close consultation with the local management entity is recommended during implementation	Limited negative impacts on the existing scheme and owners of existing allocations from the implementation of the option	Impacts on stakeholders

19.8 Option 4—Recommendation

The Nullinga Dam option is not recommended to progress to a Detailed Business Case at this time. Nullinga Dam (via a ‘swap’ arrangement of existing water allocations from Tinaroo Falls Dam) is not needed for Cairns urban water supply for at least the next 30 years and assessment has revealed limited certainty of information in relation to Nullinga Dam for agricultural use.

On this basis, it is recommended the trigger for any further consideration of Option 4: Nullinga Dam for Agricultural Use is a satisfactory level of certainty about the demand for new water allocations at a nominated volume and a nominated price (e.g. a significantly large proportion of the dam yield at an appropriate price). This certainty may be developed via an approach from industry to government, or via government commissioning a detailed demand assessment for new water allocations in the region.

In addition, it is recommended:

1. Any further assessment of Option 4: Nullinga Dam for Agricultural Use include the following key considerations:
 - a. Development of a robust agricultural economic profile for the sale and use of new water allocations (e.g. crop types and take-up by irrigators).
 - b. Development of the size of the dam, and the location of any distribution infrastructure, to meet market needs.
 - c. The potential to use a pre-commitment process for the sale of water allocations to water users prior to any procurement or construction activities being undertaken.
2. That, given the complexities associated with the use of Nullinga Dam as a water supply for Cairns due to the requirement for:



- a. existing Mareeba-Dimbulah Water Supply Scheme water allocation holders to 'swap' their existing water allocations for new water allocations from Nullinga Dam
 - b. Cairns Regional Council to obtain the 'swapped' Mareeba-Dimbulah Water Supply Scheme water allocations to allow for releases from Tinaroo Falls Dam down the Barron River,
- any further assessment of Nullinga Dam for Cairns urban water supply in the future include, in addition to relevant matters above, development of a better understanding of the options for the delivery of water from a bulk water supply in the Atherton Tablelands region to Cairns.



CHAPTER 20

IMPLEMENTATION PLAN

Nullinga Dam and Other Options Preliminary Business Case



CONTENTS

20	IMPLEMENTATION PLAN	2
20.1	Purpose	2
20.2	Option 2: Improve MDWSS Rules and Operation	2
20.3	Option 3: Modernise MDWSS and Convert Losses	2
TABLES		
Table 1	Mareeba-Dimbulah Water Supply Scheme Efficiency Project—Implementation Milestones.....	2



20 IMPLEMENTATION PLAN

CHAPTER SUMMARY AND CONCLUSIONS

Option 2: Improve MDWSS rules and operation

- Option 2 will be implemented by DNRM and SunWater, as the responsible entities for the relevant water instruments, in accordance with usual government and business practices.
- The implementation program, resourcing and funding for the implementation the Option 2 is dependent upon resourcing and funding decisions of DNRM and SunWater.

Option 3: Modernise MDWSS and convert losses

- Option 3 will be implemented by SunWater, as the current owner and operation of the MDWSS.
- The implementation program, resourcing and funding for the implementation of Option 3 is dependent upon resourcing and funding decisions within SunWater.

20.1 Purpose

This chapter outlines the implementation plan for further assessment of the preferred options.

It is noted that the implementation plan was based on the options as they were identified in the PBC, the identified timeframes have been developed to inform project cost estimates and the implementation plan may change subject to further assessment.

20.2 Option 2: Improve MDWSS Rules and Operation

Further assessment of Option 2 will be implemented by DNRM and SunWater, as the responsible entities for the relevant water instruments, in accordance with usual government and business practices.

The further assessment will be subject to resourcing and budgetary constraints within those organisations and dependent upon funding decisions of the organisations.

20.3 Option 3: Modernise MDWSS and Convert Losses

Further assessment of Option 3 will be implemented by SunWater as the current owner and operator of the Mareeba-Dimbulah Water Supply Scheme (MDWSS).

Should the estimated capital costs exceed \$50 million, Building Queensland may provide assistance to SunWater with further development of Option 3 in accordance with the Building Queensland Act. The implementation program, resourcing and funding for the implementation of Option 3 is dependent upon resourcing and funding decisions within SunWater.

Table 1 Mareeba-Dimbulah Water Supply Scheme Efficiency Project—Implementation Milestones

Works	Timeframe
PIPELINE CONSTRUCTION WORKS	JULY 2017–JUNE 2019
Survey and design	July 2017–March 2018
Award	July 2018
Construction	January–June 2019



Works	Timeframe
Analysis and confirmation of loss savings	July 2019–June 2020
Allocation available to market	July 2020
BALANCING STORAGE CONSTRUCTION WORKS	JULY 2017–JUNE 2021
Survey and design	July 2017–March 2018
Award	July 2018
Construction	October 2018–June 2020
Analysis and confirmation of loss savings	July 2019–June 2021
Allocation available to market	July 2020–July 2021
AUTOMATED CONTROL GATE INSTALLATION	SEPTEMBER 2018–JUNE 2021
Survey and design	September 2018
Award	January 2019
Construction	October 2018–June 2020
Analysis and confirmation of loss savings	July 2019–June 2021
Allocation available to market	July 2020–July 2021



CHAPTER 21

RECOMMENDATIONS

Nullinga Dam and Other Options Preliminary Business Case



21 RECOMMENDATIONS

The Nullinga Dam and Other Options Preliminary Business Case recommends that the Queensland Government:

1. Endorse that Option 2: Improve Mareeba-Dimbulah Water Supply Scheme rules and operation progress to further evaluation.
2. Endorse that Option 3: Modernisation of the Mareeba-Dimbulah Water Supply Scheme and conversion of losses progress to further evaluation.
3. Endorse that Option 4: Nullinga Dam for agricultural use not progress to further evaluation via a Detailed Business Case at this time. Nullinga Dam (via a 'swap' arrangement of existing water allocations from Tinaroo Falls Dam—see Recommendation 4) is not needed for Cairns urban water supply for at least the next 30 years and assessment has revealed limited certainty of information in relation to Nullinga Dam for agricultural use.
4. Note that the trigger for any further consideration of Option 4: Nullinga Dam for agricultural use is recommended to be a satisfactory level of certainty about the demand for new water allocations at a nominated volume and a nominated price (e.g. a significantly large proportion of the dam yield at an appropriate price). This certainty may be developed via an approach from industry to government, or via government commissioning a detailed demand assessment for new water allocations in the region.



GLOSSARY

TERM	MEANING
Aquis Resort	Aquis Great Barrier Reef Resort (proposed Integrated Resort Development at Yorkey's Knob north of Cairns)
BCDF	Building Queensland Business Case Development Framework
CRC	Cairns Regional Council
Cairns Water Security Strategy	Our Water Security: Cairns Regional Council Water Security Strategy (2015)
DAF	Department of Agriculture and Fisheries
DAWR	Department of Agriculture and Water Resources (Australian Government)
DEWS	Department of Energy and Water Supply
DILGP	Department of Infrastructure, Local Government and Planning
DNRM	Department of Natural Resources and Mines
DSD	Department of State Development
Ha	Hectares
HP	High priority
MDWSS	Mareeba Dimbulah Water Supply Scheme
MDIA	Mareeba Dimbulah Irrigation Area
ML	Megalitres
ML/a	Megalitres per annum
MJA	Marsden Jacob Associates
MP	Medium priority
NWI	National Water Initiative
NWIDF	National Water Infrastructure Development Fund
NWILF	National Water Infrastructure Loan Facility
PBC	Nullinga Dam and Other Options Preliminary Business Case
QCA	Queensland Competition Authority
QTC	Queensland Treasury Corporation
ROL	Resource Operations Licence
ROP	Resource Operations Plan
SRG	Stakeholder Reference Group
SunWater	SunWater Limited