NULLINGA DAM AND MAREEBA DIMBULAH WATER SUPPLY SCHEME IMPROVEMENTS

BUSINESS CASE/COST BENEFIT ANALYSIS SUMMARY

Published October 2019

D19/5551

PURPOSE OF THIS DOCUMENT	This document provides an overview of the Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements Detailed Business Case. The primary objective of this document is to outline the economic analysis undertaken and the key outcomes.
STATUS	This summary was prepared based on the contents of the detailed business case presented to the Building Queensland Board in June 2019. The information presented may be subject to change as the proposal progresses through future stages of development, delivery and operations.

CONTENTS

1 SUMMARY INFORMATION

PROJECT NAME	Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements Detailed Business Case	
LOCATION	Regional	
PROPOSAL OWNER	Sunwater	
PROPOSED DELIVERY AGENCY	Sunwater	
P90 COST ESTIMATES	NOMINAL[1]	PRESENT VALUE[2]
CAPITAL COST	$1,009.5 to $1,493.4 million	$713.7 to $1,068.0 million
INCREMENTAL ONGOING COST	$3.1 to $7.3 million p.a. as at 2036[3]	$2.0 to $5.1 million p.a.
NET PRESENT VALUE		-$565.1 to -$372.4 million
BENEFIT COST RATIO		0.10 to 0.12

[1] Nominal capital cost estimates are undiscounted.
[2] Present value cost estimate discounted at 7 per cent.
[3] Nominal ongoing operating and maintenance costs, undiscounted.

2 PROPOSAL OVERVIEW

The study area for the Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements Detailed Business Case is defined as the existing Barron Water Plan Area and covers approximately 5,200 km^2 (see Figure 1). The area includes the catchment of the Barron River and the upper reaches of the Mitchell and Walsh Rivers. The proposed Nullinga Dam site is located approximately 55 kilometres south-west of Cairns and 24 kilometres south-south-west of Mareeba, situated within the Mareeba Shire Council Local Government Area.

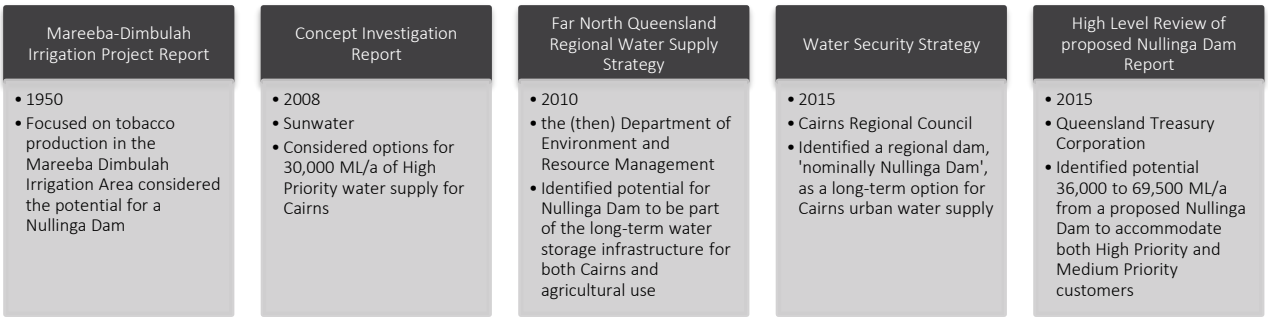
Figure 1 Study area (existing Barron Water Plan Area)

The Mareeba Dimbulah Water Supply Scheme is the major water resource development in the study area (defined by the existing Barron Water Plan Area), with Tinaroo Falls Dam the main water storage supplying the scheme. The Mareeba Dimbulah Water Supply Scheme involves inter-basin transfers between the Barron and Walsh rivers. Parts of the Walsh and Mitchell river catchments were included in the Barron Water Plan to enable the management of all supplemented water from the water supply scheme under a single water resource plan. Other important storages in the plan area include the Copperlode Falls Dam on Freshwater Creek and the Kuranda Weir on the Barron River.

Nullinga Dam was first proposed in the 1950s following the original investigations for the development of the Mareeba Dimbulah Irrigation Area, which was to support tobacco production. However, a decision was made to build Tinaroo Falls Dam in preference to Nullinga Dam, as it could supply more water to a greater area with a better yield and hydrologic efficiency. In addition to the Nullinga Dam site being in a lower rainfall area with a corresponding lower yield, the Nullinga Dam site suffers from distribution constraints for irrigation purposes and would require additional delivery infrastructure to address supply limitations, than were required for a Tinaroo Falls Dam, which was completed in 1958.

Nullinga Dam was revisited under various proposals over the last 70 years since. Notable historical reports that considered Nullinga Dam are identified below.

Figure 2 Past reports relevant for a potential Nullinga Dam



In 2015, with the completion of the Cairns Regional Council Water Security Strategy and Queensland Treasury Corporation's review, the Queensland Government made a commitment to assess the proposed Nullinga Dam. Following the Commonwealth Government's commitment of $5 million from the National Water Infrastructure Development Fund for a 'detailed examination of the economic feasibility of Nullinga Dam' in the Developing Northern Australia White Paper, Building Queensland was tasked with the development of a business case.

In April 2017, Building Queensland developed and submitted the Nullinga Dam and Other Options Preliminary Business Case to the Queensland Government. The preliminary business case confirmed that the existing Mareeba Dimbulah Water Supply Scheme would be unable to support additional water allocations for current or new customers without one, or all of the following modifications:

- changes to current Mareeba Dimbulah Water Supply Scheme rules/operations
- improvement works for existing water distribution assets
- investment in new water storage (Nullinga Dam).

The preliminary business case found that these initiatives would potentially stimulate irrigated agriculture in the region, supporting an opportunity for new or expanded agricultural activities. However, the demand assessment undertaken for the preliminary business case did not identify a compelling agricultural demand at that time, and similarly, did not identify any urgent requirement for additional urban water supply.

The preliminary business case concluded that a detailed business case should not be progressed until adequate long-term demand for water could be demonstrated.

In September 2017, subsequent to the preliminary business case, additional long-term demand for water allocations was identified. Building Queensland was advised of potential local operator demand, which would require new water allocations[4] to support the desired agricultural production.

In December 2017, after consideration of this new information, the Department of Natural Resources, Mines and Energy informed Sunwater and Building Queensland of the intention to proceed with the development of a detailed business case, with Sunwater as the nominated proponent.

By June 2018, Sunwater and the department entered into separate agreements with Building Queensland to deliver a detailed business case. As per the earlier recommendations, this detailed business case includes consideration of modernisation works of existing Mareeba Dimbulah Water Supply Scheme infrastructure, improvements in operating rules, and potential Nullinga Dam options.

[4] The total upper limit of the identified volume, at a given price, was in excess of the total dam yield, for any option, contemplated in the detailed business case.

3 SERVICE NEED

With the Mareeba Dimbulah Water Supply Scheme continuing to be highly utilised and fully allocated, and Cairns Regional Council identifying a long-term need for additional urban water supply requirements (in 40 years' time), the Commonwealth and Queensland Governments have made strategic commitments to examine the feasibility of this storage option.

The service need identified in the detailed business case is two-fold, recognising the:

- opportunity to increase water available for agricultural activities in support of potential future demand (considered the primary driver for the project)
- need to address future urban supply requirements for Cairns (considered the secondary driver, noting the need is in 40 years' time).

The primary aim of the Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements project is to provide access to additional water, within a fully allocated and highly utilised scheme, for potential agricultural development in the existing scheme. The ongoing lack of access to additional water is a contributing factor affecting further agricultural development, which is expected to be largely undertaken by existing customers looking to expand their local operations.

At a price of $2,000 for medium priority (MP) and $3,000 for high priority (HP) per megalitre (ML), the total demand for additional water allocations across the study area, under the central case (most likely to occur) includes 83,875 ML of MP (or equivalent). This demand is from existing customers who have indicated their willingness to pay for these allocations upon availability of the water and/or have identified expansion plans for existing operations[5].

Table 1 Demand for new water allocations (upon availability), at stated price

TYPE	TOTAL DEMAND – AGRICULTURAL AND URBAN ML/A
New HP allocation *Stated price of $3,000 per ML*	15,021
Conversion factor[6]	*1.429*
MP equivalent	21,458
New MP allocation *Stated price of $2,000 per ML*	62,417
Total MP or MP equivalent	**83,875**

In addition to the above demand, a reasonable growth allowance of 0.7 per cent per annum (based on observed historical growth trends) should be assumed under the central case (capped at a total of 20,000 ML/a of MP). After the finalisation of the demand assessment, another potential customer identified a requirement for a significant volume of MP allocations at a similar price to that identified above, which provides additional certainty to the demand forecasts.

Figure 3 identifies the proportion of agricultural crop types that are anticipated to be supported through provision of additional water allocations under the central case demand scenario.

[5] The central case demand scenario assessed in this detailed business case considers demand with and without potential expansion plans of local producers

[6] Barron Water Management Protocol (June 2017), 1 divided by 0.7

Figure 3 Proportion of crop types underpinning agricultural benefits for the central demand case

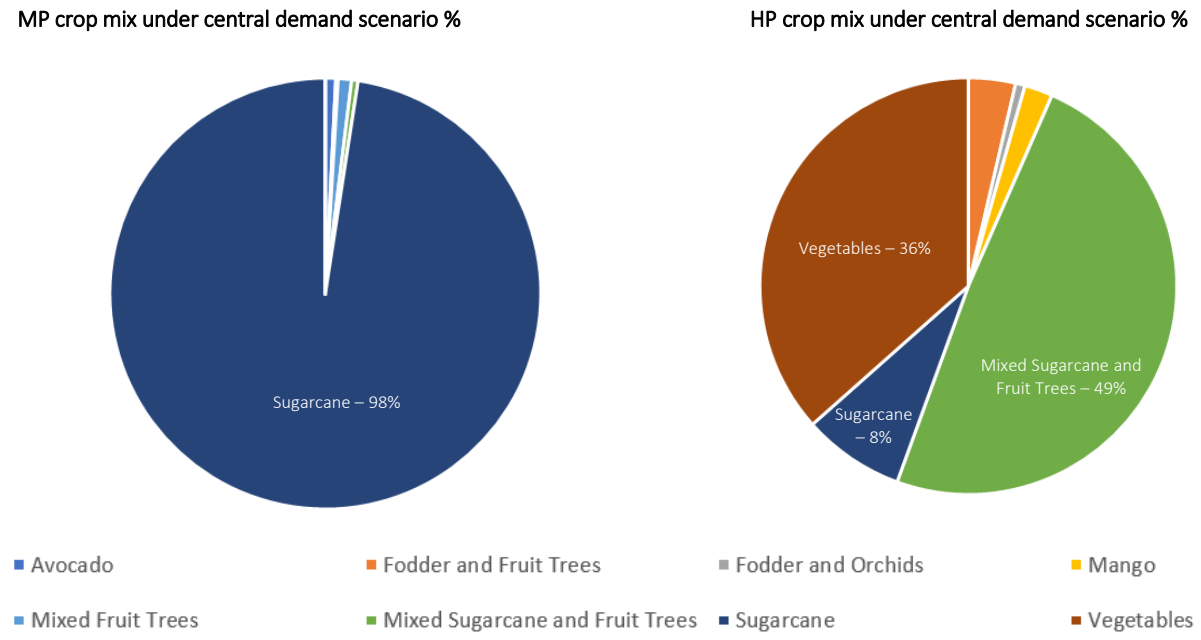
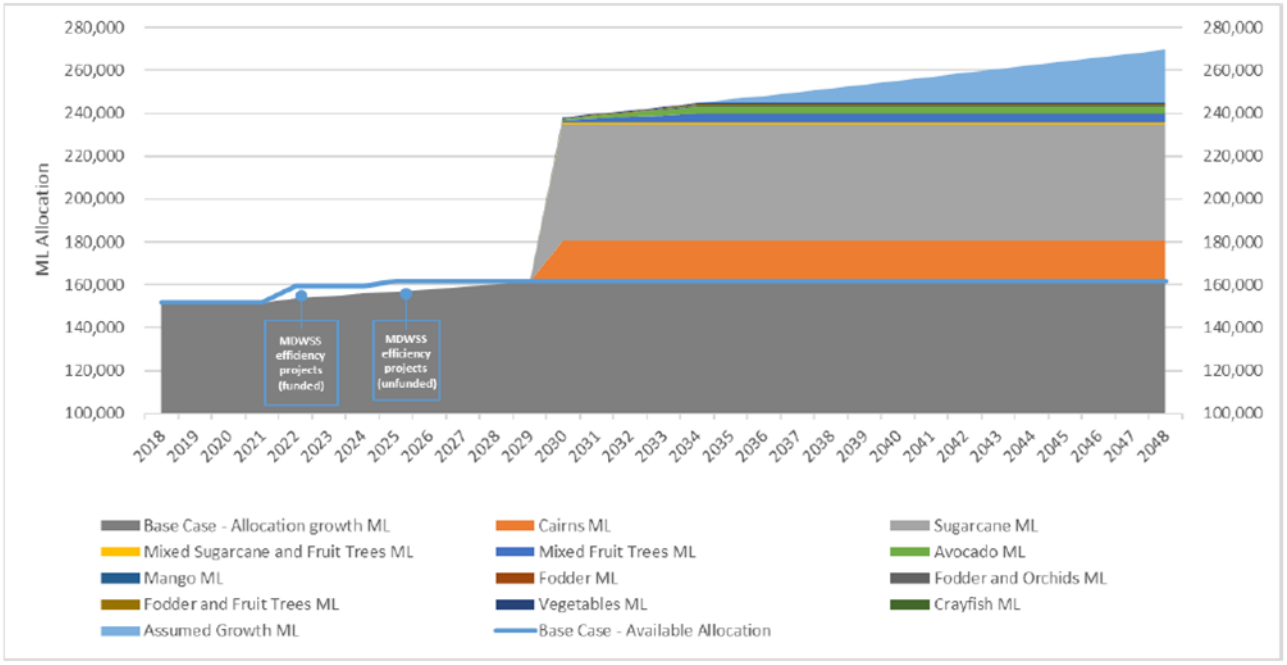


Figure 4 presents the central case demand profile which is based on responses from the request for information as 'likely' and is phased in over several years.

Figure 4 Central case demand scenario 'most likely to occur'



Under the central case demand scenario, at the stated water price of between $2,000 to $3,000 ML/a, both MP and HP customers will purchase the allocations from the first day it is available.

4 OPTIONS ASSESSMENT

The preliminary business case considered ten different options to meet the identified service need, including several sub-options. It identified the three highest scoring options and assessed these against a defined base case, including:

- improving Mareeba Dimbulah Water Supply Scheme rules and operations
- modernising Mareeba Dimbulah Water Supply Scheme distribution infrastructure
- building a new Nullinga Dam.

These options were then further considered as part of the detailed business case. Two sizes of Nullinga Dam were selected for further evaluation (including a 545m AHD and 556m AHD options) having consideration for the calculated yields, anticipated demand (both with and without potential local operator demand) and cost implications. Based on the recommendations of the preliminary business case, updated analysis and investigations, the following options were selected for further consideration and analysis in the detailed business case:

- Reference project 1: a Nullinga Dam (545m AHD) capable of supporting 58,000 ML/a, including consideration of both a standalone and conjunctive scheme approach, along with the associated distribution works.
- Reference project 2: a Nullinga Dam (556m AHD) capable of supporting 74,000 ML/a, including consideration of a standalone, partially conjunctive and fully conjunctive scheme approaches, along with the associated distribution works.

It is acknowledged that neither reference project is capable of fully meeting the estimated (most likely) demand, at the stated prices of $2,000 per ML for MP and $3,000 per ML for HP.

5 BASE CASE

The base case provides the benchmark against which the economic and social impacts of the Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements project are evaluated and quantified. A base case has been defined separately for each of the potential user groups likely to be impacted by the project.

As the primary service need for Nullinga is an opportunity—rather than a problem—it is considered there is no base case in which any user group will run out of water supply. However, there will be a point in time when Cairns Regional Council and Mareeba Shire Council, having exhausted more cost-effective water supply options, will either need to develop a dam, or other costly augmentation solution (e.g. desalination), solely focussed on urban services to meet urban and industrial water demand due to population growth.

Over the assessment period:

- Cairns' supply security is met by existing and planned source options on the Mulgrave and Barron rivers.
- Mareeba Shire Council and Tablelands Regional Council urban water supply security is adequately met through existing sources.

In absence of the Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements project, irrigated agricultural production is expected to be relatively stable, with a small increase in production when the Mareeba Dimbulah Water Supply Scheme Efficiency Improvement Project works are completed (which will provide an estimated 8,304 ML/a of MP), and with a gradual shift from lower to higher value crops expected to continue in the scheme.

6 REFERENCE PROJECT

The reference projects considered in the detailed business case would result in the delivery of a new Nullinga Dam. In addition to consideration of a standalone dam approach, a number of sub-options were assessed, where the dam would be integrated into the existing Mareeba Dimbulah Water Supply Scheme and be operated in conjunction with Tinaroo Falls Dam (the existing Mareeba Dimbulah Water Supply Scheme water storage infrastructure). These sub options require delivery of bespoke distribution infrastructure and works, as compared with the standalone approach.

Table 2 provides a summary of the reference projects and the associated upfront capital costs[7].

Table 2 Summary of reference projects and key metrics

No.	Description	Yield (ML/a)	Real upfront capital costs[8] (2018-19) $M	Nominal upfront capital costs[9] $M	Nominal capital costs (including capitalised maintenance) $M
Reference Project 1 – Nullinga Dam (58,000 ML/a)					
1A	Nullinga Dam (FSL 545m AHD), standalone, two proposed pipelines - Cairns and A3 Walsh River Pipeline	58,000	755.8	1070.9	1,112.1
1B	Nullinga Dam (FSL 545m AHD), conjunctive, upgrade of the Arriga Main Channel	58,000	713.7	1,009.5	1,027.9
Reference Project 2 – Nullinga Dam (74,000 ML/a)					
2A	Nullinga Dam (FSL 556m AHD), standalone, two proposed pipelines - Cairns and A3 Walsh River Pipeline	74,000	1,068.0	1493,4	1,551.1
2B	Nullinga Dam (FSL 556m AHD), partially conjunctive, upgrade of Arriga Main Channel and a new A3 Walsh River Pipeline	74,000	1,022.8	1429.3	1,454.8
2C	Nullinga Dam (FSL 556m AHD), fully conjunctive, upgrade of Arriga Main Channel and a new A3 West Barron Pipeline	74,000	999.1	1,395.7	1,417.4

The program schedule for Nullinga Dam allows for up to seven years for all planning works, including consideration and approval by Queensland Government, establishment of funding arrangements between all levels of government (where required), finalisation of binding commercial agreements with future customers, a detailed Environmental Impact Statement and other required planning approval activities, design development and procurement. While these timeframes can be accelerated, the proposed durations are based on industry experience and Sunwater advice and experience on previous similar projects and are consistent with typical approval and development timeframes for similar major projects. With an approximate three-and-a-half-year construction period, a Nullinga Dam would likely be completed in 2030 to 2031.

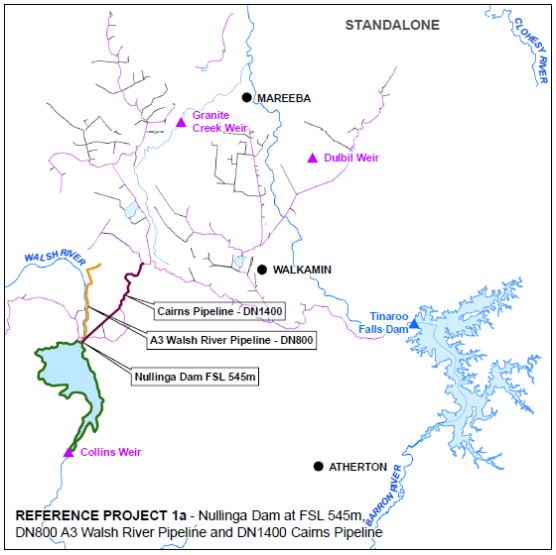
[7] The costs prepared for Nullinga Dam solutions are a Class 3 estimate.
[8] Excluding ongoing capitalised maintenance.
[9] Applied nominal escalation rates include 3.80% for implementation works, 6.95% for construction costs and 2.50% for operational and maintenance costs.

Based on recent modelling, there is a 46 per cent chance that Nullinga Dam will be filled within five years of completion, or 90 per cent that it will only be half filled. As a result, water sales have been assumed to commence after year five of operations. It is acknowledged that there have been limited environmental studies completed, and all reference projects would be subject to an Environmental Impact Statement. Furthermore, the existing water plan does not make allowance for a Nullinga Dam and consideration would need to be given to amending the plan if Nullinga Dam were to proceed to construction.

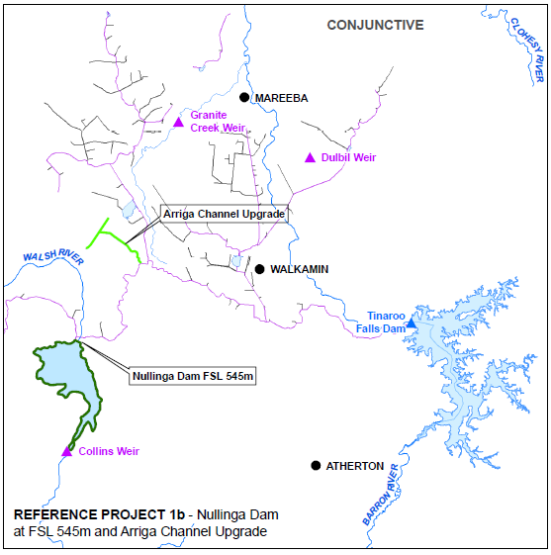
Figure 5 provides a snapshot of the scope of works under each of the considered reference projects. Importantly, it is acknowledged that conjunctive scheme approaches utilise and upgrade existing distribution channels where practicable.

Figure 5 Reference projects—scope of works

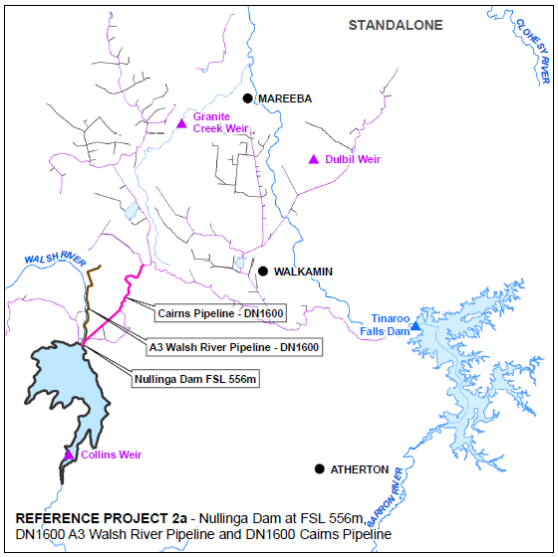
1A – Standalone



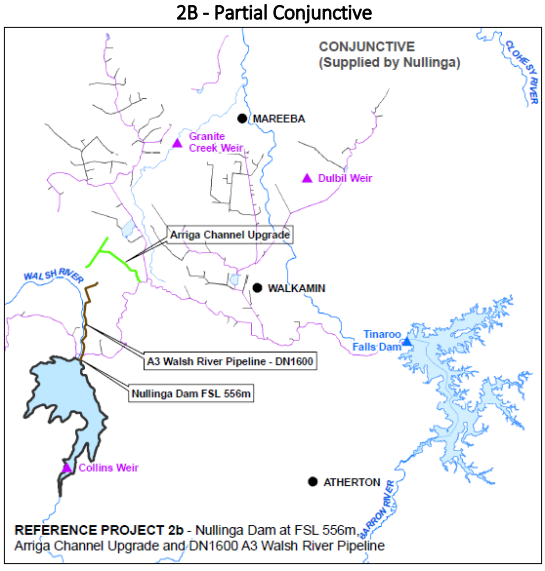
1B - Conjunctive



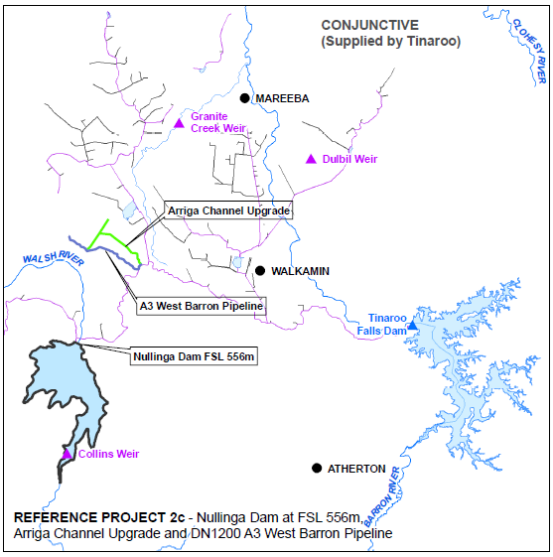
2A – Standalone

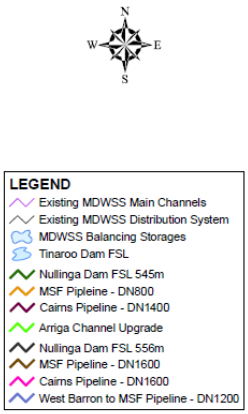


2B - Partial Conjunctive



2C – Full Conjunctive



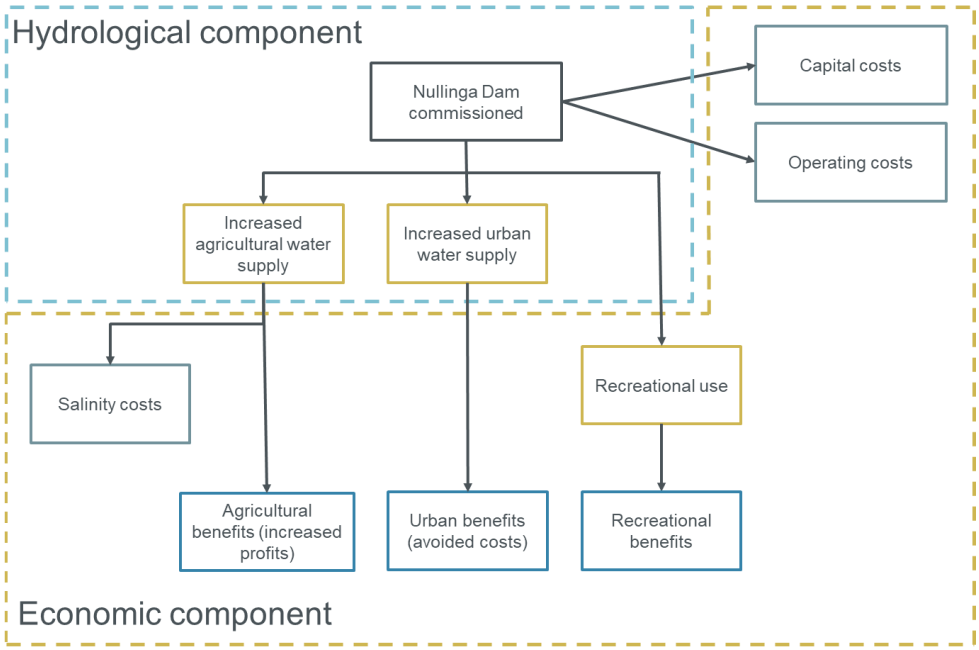


7 METHODOLOGY

A detailed cost benefit analysis was prepared to consider the benefit cost ratios (BCRs) and net present values (NPVs) of the reference projects through identification and quantification, where practicable, of the potential costs and benefits of the considered reference project/s.

Figure 6 outlines the potential costs and benefits, and further shows the link between these water supply initiatives and the benefits and costs via the intermediate impacts. The quantified costs include all required construction and operating expenses. The reference projects will increase the supply of water to agricultural users, which would deliver agricultural benefits in the form of increased profits for rural users. The increased supply also has the potential for agricultural costs due to increased salinity (if not appropriately managed).

Figure 6 Impacts and quantified costs and benefits



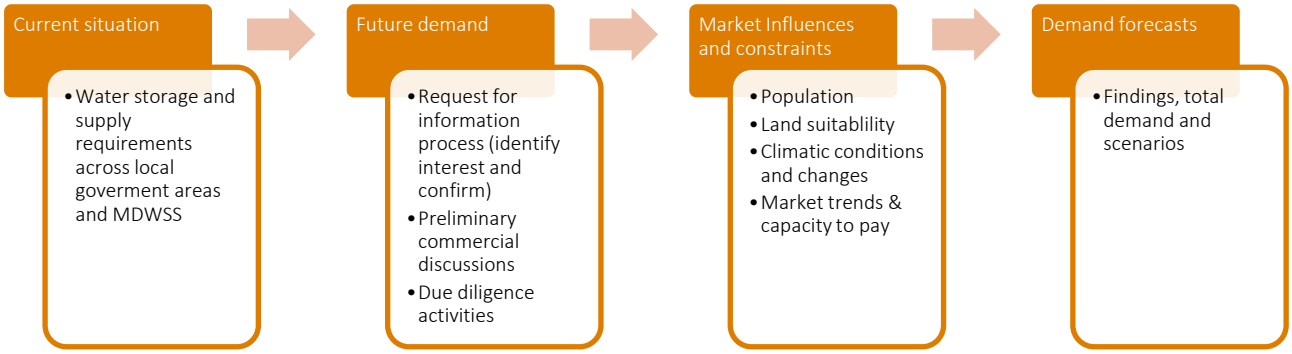
The reference projects will increase supply to urban users in Cairns, which may defer the need for planned supply augmentation investments under certain scenarios. Any associated reduction in supply augmentation costs would be an economic benefit. Finally, the development of the Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements project would generate recreational benefits.

The financial costs captured in the cost benefit analysis include the capital and operating costs for each reference project, while the primary benefits are increased water supply to agricultural and urban users. A structured approach was further used to ensure that all material social and environmental costs and benefits were considered and where possible quantified in the cost benefit analysis.

8 DEMAND FORECASTS

The total estimated (most-likely) demand has been determined through the consideration of the current supply and demand factors and the future water demands for both agricultural and urban customers. The demand assessment process undertaken as part of this detailed business case is shown in Figure 7.

Figure 7 Assessing the need and/or opportunity



Four primary influences on agricultural and urban water demand have been considered in the detailed business case. These include population growth, land use change, climatic conditions, and market trends/producer margins. Table 3 summarises some of the relevant issues, findings and implications of these influences for forecast demand in the study area.

Table 3 Demand influencers and/or constraints

SUMMARY OF ISSUE/S	IMPLICATIONS FOR DEMAND
POPULATION	
As part of the demand assessment, Cairns Regional Council provided their latest population forecasts to inform the detailed business case. Cairns Regional Council's population forecasts are based on Queensland Government Statistician's Office population forecasts, and are produced for low, medium and high population growth rates. Recent population growth in Cairns Regional Council has been tracking along the low growth population forecast. Population growth in Cairns has seen fluctuations over the last 30 years, from nearly 5% p.a. in the early 90's to less than 2% p.a. over the last decade. Despite this decline, history has shown that Cairns may experience increases in population growth over short periods.	Yes Building Queensland adopted the medium population growth estimate including demand management, as the basis for further analysis.

SUMMARY OF ISSUE/S	IMPLICATIONS FOR DEMAND
As at June 30, 2018, the estimated population reliant on this water supply network is 166,794. Under the medium growth projection, this will increase to 223,410 by 2036 and 281,339 by 2051.[10]	
LAND	
Land is not considered a constraining factor on the development of irrigated agriculture in the region. Analysis of soil suitability mapping has identified over 53,000 hectares with soils suitable for agriculture within and around the Mareeba Dimbulah Water Supply Scheme. While stakeholders have commented that the water from Nullinga would be used on existing crops to support yield increases, the actual crop type and mix that would be supported through additional allocations in the Mareeba Dimbulah Water Supply Scheme will be influenced by wider market forces, including production, consumption and competition and access to domestic and international markets.	No impact on the forecast demand (not a constraint)
CLIMATIC CONDITIONS	
Continued substantial increases for mean, maximum and minimum temperature are projected with very high confidence. For the near future (2020–2039), the mean warming is around 0.3 to 1.1 °C (10th to 90th percentile) above the climate of 1986–2005 (centred at 1995). More hot days and warm spells are projected with a very high degree of confidence. For example, in Cairns, in the near future (2020–2039), the average annual number of days over 35 and 40 °C is forecast to increase by 2.5 and 0.1 days respectively (from a current base of 3 days and 0 days) Changes to rainfall patterns are possible, though the direction and magnitude of change is unclear. Increased intensity of extreme rainfall events is projected with high confidence. However, the magnitude of change, and the time when any change may emerge from natural variability, cannot be reliably projected. Drought will continue to be a regular feature of the regional climate. It may change its characteristics as the climate warms, however, due to uncertainty in rainfall projections, there is low confidence in projecting how the frequency and duration of drought may change. With medium confidence, fewer but more intense tropical cyclones are forecast.	Uncertain Additional sensitivities have been considered - for the potential delay in a proposed Nullinga Dam reaching FSL - implications for CRC water security requirements to change
MARKET TRENDS AND PRODUCER MARGINS	
Consideration has been made of producer's capacity to pay upfront for irrigation water under several scenarios, ranging from a producer on a new farm to an established producer who wished to supplement current levels of irrigation. The estimates of irrigators' preparedness to pay upfront, based on the requests for information and detailed subsequent discussions, have been compared with the results of an analysis of the capacity to pay of irrigators for different crop types, which was considered as part of the detailed demand assessment. The vast majority (in excess of 90%) of current and future demand, in the MDWSS, is for sugarcane, where producers' capacity and willingness to pay are currently closely aligned i.e. close to $2,000 per ML for MP.	Yes The majority of customers seeking new allocations in the MDWSS are unlikely to be able to pay much beyond stated water prices upfront (i.e. $2,000 per ML for MP and $3,000 for HP) and maintain a healthy margin.

[10] Ibid

9 COST BENEFIT ANALYSIS RESULTS

The findings from the cost benefit analysis are provided in Table 4.

Table 4 Cost benefit analysis results for the considered reference project/s

REFERENCE PROJECT	1A Standalone 58,000 ML/a	1B Conjunctive 58,000 ML/a	2A Standalone 74,000 ML/a	2B Part. Conjunctive 74,000 ML/a	2C Full. Conjunctive 74,000 ML/a
Economic costs, present values $M					
Capital costs	$434.1	$412.2	$599.3	$575.7	$563.4
Operating and maintenance costs	$23.4	$10.8	$29.0	$13.7	$12.1
Total costs	**$457.5**	**$422.9**	**$628.2**	**$589.4**	**$575.5**
Economic benefits, present values $M					
Agricultural	$41.9	$41.9	$54.5	$54.5	$54.5
Urban	-	-	-	-	-
Recreational	$8.7	$8.7	$8.7	$8.7	$8.7
Total benefits	**$50.5**	**$50.5**	**$63.2**	**$63.2**	**$63.2**
NPV	**-$406.9**	**-$372.4**	**-$565.1**	**-$526.2**	**-$512.3**
BCR	**0.11**	**0.12**	**0.10**	**0.11**	**0.11**

PARAMETER	ESTIMATE/ASSUMPTION	SOURCE
Year construction starts	2020	Sunwater
Year operation starts	2031	Sunwater
Year first water	2036	Sunwater
Asset life	100 years	Sunwater
Appraisal period	2019 to 2060 (30 years of operations)	Building Queensland
Inflation	Consumer price index	Australian Bureau of Statistics
Base year	2019	Building Queensland
Discount rate	7 per cent real	Business Case Development Framework

10 SENSITIVITY ANALYSIS

Sensitivity analysis identifies key economic risks within the conducted analysis. It examines how much the results deviate consequently from changes in proposal driver/s, or combinations of drivers. Sensitivity analysis have been performed on the central case assumptions and key data inputs to provide further insight on the potential impact of movements in key variables on the NPV results of the reference projects. Table 5 summarises the assumptions that have been adjusted for the purposes of completing the sensitivity analysis on the NPV of the reference project.

Table 5 Reference projects sensitivities

ASSUMPTION/KEY DATA INPUTS	DESCRIPTION
Capital expenditure	Percentage variations ± 10/20%
Operations and maintenance costs	Percentage variations ± 10/20%
Discount rate	4% and 10%
Project timing	Start construction 2026

As is expected, the reference project NPVs are more sensitive to movements in capital costs, than movements in operation and maintenance expenditure.

Table 6 Sensitivity analysis, NPV results

REFERENCE PROJECT	1A Standalone 58,000 ML/a	1B Conjunctive 58,000 ML/a	2A Standalone 74,000 ML/a	2B Part. Conjunctive 74,000 ML/a	2C Full. Conjunctive 74,000 ML/a
Central case	**-$406.9**	**-$372.4**	**-$565.1**	**-$526.2**	**-$512.3**
Capital costs					
+20 per cent	-$493.7	-$454.8	-$684.9	-$641.4	-$625.0
+10 per cent	-$450.3	-$413.6	-$625.0	-$583.8	-$568.7
-10 per cent	-$363.5	-$331.2	-$505.1	-$468.6	-$456.0
-20 per cent	-$320.1	-$290.0	-$445.2	-$411.1	-$399.7
Operating and maintenance costs					
+20 per cent	-$411.6	-$374.5	-$570.9	-$528.9	-$514.8
+10 per cent	-$409.3	-$373.5	-$568.0	-$527.6	-$513.5
-10 per cent	-$404.6	-$371.3	-$562.2	-$524.9	-$511.1
-20 per cent	-$402.2	-$370.2	-$559.3	-$523.5	-$509.9
Discount rate					
4%	-$490.6	-$437.0	-$692.1	-$631.1	-$611.7
10%	-$332.3	-$308.7	-$456.0	-$429.7	-$419.5
Project deferral					
Project deferral	-$266.3	-$243.3	-$371.7	-$345.8	-$336.6
Different Ag Model					
Net margin model	-$414.4	-$379.8	-$573.0	-$534.1	-$520.2
Water market model	-$387.6	-$353.1	-$539.4	-$500.5	-$486.7

Several alternative scenarios to the central case assumptions were modelled, including:

- P50 results
- No expansion of local commercial operations
- 50-year (operations) evaluation period.

Table 7 Summary cost benefit analysis results, central case and scenarios

REFERENCE PROJECT	1A Standalone 58,000 ML/a	1B Conjunctive 58,000 ML/a	2A Standalone 74,000 ML/a	2B Part. Conjunctive 74,000 ML/a	2C Full. Conjunctive 74,000 ML/a
Results for P90 costs and benefits (central case)					
NPV $M	-$406.9	-$372.4	-$565.1	-$526.2	-$512.3
BCR	0.11	0.12	0.10	0.11	0.11
Results for P50 costs and benefits					
NPV $M	-$354.2	-$321.1	-$499.9	-$462.3	-$446.6
BCR	0.14	0.15	0.12	0.13	0.14
Results for no expansion of local commercial operations					
NPV $M	-$406.9	-$372.4	-$575.3	-$536.4	-$522.6
BCR	0.11	0.12	0.08	0.09	0.09
Results for longer evaluation period (including 50 years of operations v 30 years under central case)					
NPV $M	-$392.2	-$356.2	-$548.8	-$508.3	-$494.2
BCR	0.15	0.16	0.13	0.14	0.14

The findings from the scenario analysis include:

- all reference projects result in negative NPVs under all scenarios
- economic results improve under a P50 scenario, as the costs are incurred earlier than benefits
- there is no net change to the NPVs or BCRs for reference project 1A and 1B with the removal of local operator expansion plans, as the smaller dam solution cannot cater for this demand even under the central case
- a longer evaluation period marginally improves the NPVs of all reference projects.

11 SOCIAL IMPACTS

Should Nullinga Dam and Mareeba Dimbulah Water Supply Scheme Improvements project proceed, the social impact evaluation identified potential social benefits, including:

- improved agricultural productivity supporting the local and regional economies
- increased agricultural employment opportunities for the region
- creation of direct employment opportunities
- increased indirect employment opportunities for the region
- improved recreational facilities for residents and tourists
- increased employment and business supply benefits for Aboriginal and Torres Strait Islander persons and businesses
- improved local access and connectivity in the regional study area for residents and road users.

During construction a number of adverse social impacts, predominantly affect local landholders, were identified, including:

- the displacement of landholders and their families with up to 19 properties located in the inundation area of the dam
- a reduction in the size of land available for farming and other land use activities on properties surrounding the dam footprint due to the introduction of a flood margin easement
- a reduction in the size of land available for farming and other land use activities due to new road construction
- restricted use of and access to land on properties within the pipeline easement.