5 SERVICE NEED

CHAPTER SUMMARY AND CONCLUSIONS:

- This chapter considers the service need for the NDMIP through an examination of the current and future water demand and supply requirements for urban, agriculture and industrial customers in the Study Area.

Current Situation

The MDWSS supplies approximately 1,100 customers, with irrigation representing the largest component both in terms of volume and number. Historically, the level of utilisation (water use as a percentage of entitlements) by MDWSS customers has been between 50 per cent to 70 per cent.

As of 2017-18:

- utilisation has increased and exceeds 80 per cent, which is above the water security buffer generally desired by irrigators
- announced allocations have increased to 100 per cent
- customers requiring additional water need to either purchase permanent allocations from other customers or access water from the temporary water market
- permanent water prices during this time averaged $3,500 per ML, though some trades reached up to $4,000 per ML.

With the more recent increased rainfall, prices have softened to $2,800 to $3,000 per ML, though there is evidence that prices have since rebounded to $3,400 to $3,500 per ML. By contrast, temporary water is available for between $50 – $65 per ML, which may limit the demand for permanent water allocations. It is clear, however, that the current price is being justified by the margin yield from production rather than the price of temporary water.

Future Demand – Agriculture

The demand assessment undertaken for the DBC has identified, at a stated price of between $2,000 and $3,000 (MP and HP respectively), the (most likely) agricultural demand includes 64,828 ML/a of MP (and MP equivalent), from first year of water sales, with an annual growth, based on historical trends in the MDWSS, of approximately 0.7 per cent per annum.

It is acknowledged that there are high-end estimates that would result in a demand of approximately 144,828 ML/a of MP (and MP equivalent).

Future Demand - Urban

Based on an assessment undertaken by CRC, with medium demand growth and access to both the Barron and Mulgrave River strategic reserves, Cairns will require access to a new regional dam by the 2060's to meet their projected water needs while still meeting their stated Level of Service objectives. In addition, access to a second supplemented supply source would reduce the likelihood and frequency of water restrictions and potential water supply shortfalls.

The demand assessment undertaken as part of the DBC supports CRC's position that Cairns will most likely require an additional source of supply to service its urban requirements by 2063 if demand management initiatives are undertaken as currently committed. It is further acknowledged that, where currently planned augmentations are undertaken, particularly Barron River Stage 1 or Mulgrave 2 supply options:

- under a low demand growth scenario and developing Mulgrave Stage 2, CRC may not require an additional source of supply until 2081
- under a high demand growth scenario and only developing Mulgrave Stage 1, CRC may require an additional source of supply as early as the mid-2030s.

As part of the demand assessment activities undertaken in the development of this DBC, CRC submitted an RFI which indicated a preparedness to purchase an allocation of HP to provide additional water security for Cairns. Discussions with CRC confirmed their commitment to paying for this allocation from the first-year that water is available from a new regional dam (identified by CRC as a proposed Nullinga Dam), and their preference for trading this water to agricultural users until it is required.

Market influences and constraints

The following demand influencers have been taken into consideration:

- Population forecasts. QGSO forecasts have been utilised. A medium population forecast has been adopted for the central case.
- Land. Land availability and suitability is not considered to be a constraint in and around the MDWSS.
- Climatic variability and change. The current and forecast yields have been utilised in the development of solutions. The increasing variability over time has further been factored into the potential delay in achieving FSL and consideration of additional sensitivities for CRC water security requirements
- Market trends and producer margins. Consideration has been made of producers' capacity to pay for irrigation water under several scenarios, ranging from a producer on a new farm to an established producer who wishes to supplement current levels of irrigation. The estimates of irrigators' preparedness to pay, based on the RFIs and detailed subsequent discussions, have been compared with the results of an analysis of the capacity to pay of irrigators for different crop types.

  The majority of customers seeking new allocations in the MDWSS are unlikely able to pay much beyond stated water prices and maintain a healthy margin.

It is acknowledged that on-farm and distributional infrastructure is not considered to be a constraint in the mature MDWSS agricultural market.

Service Need

- The identified service need includes:
- Opportunity to increase water available for agricultural activities in support of expected future demand
  - access to water within the existing MDWSS is constrained, with existing allocations fully taken up and highly utilised. Access to water is the limiting factor preventing further agricultural development in the MDWSS. By making available additional water allocations for consumptive use, further agricultural development in the MDWSS is likely to occur.
- Need to address future urban supply requirements for Cairns
  - Under CRC's Water Security Strategy, with medium demand growth and access to both the Barron and Mulgrave River strategic reserves, Cairns will require access to Nullinga Dam by the mid 2050's in order to meet their projected water demand while still meeting their stated Level of Service objectives. In addition, access to a second supplemented supply source would reduce the likelihood and frequency of water restrictions and potential water supply shortfalls.

Total Demand

- In terms of agriculture, access to water within the existing MDWSS is constrained, with existing allocations fully taken up and highly utilised. Access to water is a limiting factor preventing further agricultural development in the MDWSS. By making available additional water allocations for consumptive use, at a price that aligns with producer's capacity to pay, further agricultural development in the MDWSS is likely to occur.
- At a price of between $2,000 and $3,000 per ML, the total demand for additional water allocations across the Study Area, under the central case (most likely to occur) includes 43,875 MP (or equivalent) without accounting for expansion of (known) potential operator's local production. This demand is from existing customers who have indicated their willingness to pay for these allocations upon availability of the water.
- Demand for new water allocations upon availability (including local producer expansion plans)

TYPE	TOTAL DEMAND AGRICULTURE AND URBAN ML/A
New HP allocation	15,021
Conversion factor	*1.429*
MP equivalent	21,458
New MP allocation	62,417
TOTAL MP or MP EQUIVALENT	**83,875**

The central case demand scenario assessed in this DBC considers demand with and without local operator's potential demand.

It is further noted that, in addition to the above demand:

- a reasonable growth allowance of 0.7 per cent per annum should be assumed under the central case (capped upto a total of 20,000 ML/a of MP)
- local operators have indicated an upper bound requirement of 120,000 ML/a (or an additional 80,000 ML/a above their lower bound estimate)
- further interest in a significant volume of MP allocations was also received after the formal submission period for RFIs had closed.

5.1 Purpose

This chapter details the service need for the NDMIP, through an examination of the current state of water supply and demand in the region, demand drivers and potential future water requirements. This chapter identifies the problem/opportunities to be addressed and anticipated benefits that would be realised if the service need is met.

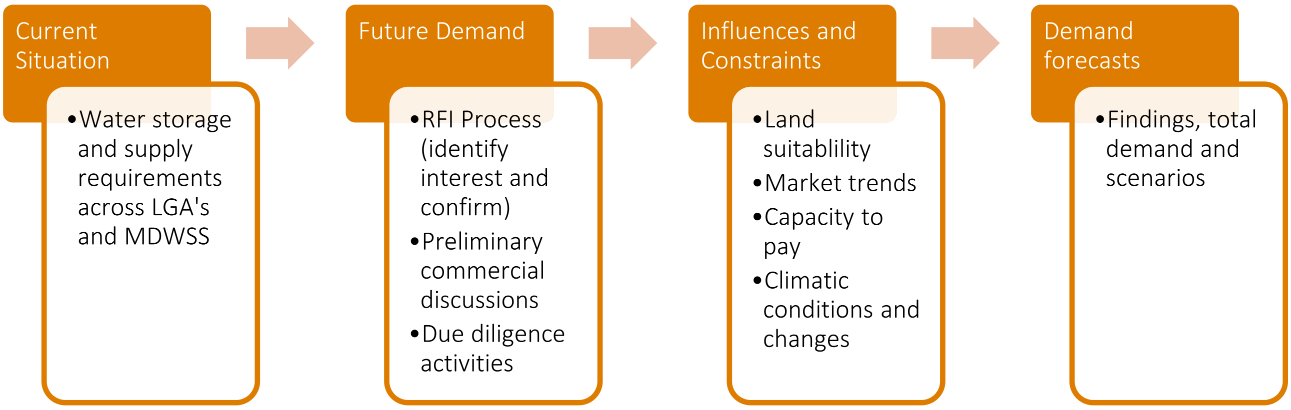
The findings and conclusions of this chapter are supported by previous studies, including:

- The Far North Queensland Regional Water Supply Strategy (FNQRWSS)
- Cairns Regional Water Supply Security Assessment (RWSSA)
- Cairns Regional Council's Our Water Security Strategy: Cairns Water Security Strategy
- Queensland Treasury Corporation – High Level assessment of the proposed Nullinga Dam
- Nullinga Dam and Other Options PBC
- Nullinga Dam: Assessment of water demand for DBC.

The assessment of water demand for the DBC was undertaken by Marsden Jacob Associates, who were engaged by Building Queensland.

Importantly, the service need/s for the NDMIP (refer Section 5.5) recognises the requirement to address future urban supply needs for Cairns and the opportunity to increase water available for agricultural activities in support of expected future demand. This finding is supported through an examination of the current supply and demand factors and the future water demands for both agricultural and urban customers. Demand assessment process undertaken as part of this DBC is shown in Figure 5-1.

Figure 5-1 Assessing the need and/or opportunity



5.2 Current situation

This section outlines the current state for water demand, water supply and water security for Cairns, Mareeba, Atherton and current customers serviced by the MDWSS.

5.2.1 Cairns

5.2.1.1 Current water supply

CRC has two main water supply sources to meet potable water demand in Cairns, comprising run of river extraction from Behana Creek and Copperlode Falls Dam (Lake Morris) on Freshwater Creek. CRC owns and operates both sources to meet the water demand requirements of Cairns and surrounding connected communities. As at June 30, 2018, the estimated population reliant on this water supply network is 163,210[29].

Copperlode Falls Dam, completed in 1975, is situated near the headwaters of Freshwater Creek with a catchment area of 44km^2 within the Wet Tropics World Heritage Area. Water stored in Copperlode Falls Dam is released downstream, with the intake for the Freshwater Creek Water Treatment Plant (Freshwater WTP), located at Crystal Cascades Weir. Raw water is extracted for treatment at the Freshwater WTP, located at Tunnel Hill. CRC, as the resource operations licence holder for Copperlode Falls Dam, is required to maintain a minimum flow of between 15-20 ML/day just downstream of the intake point to maintain environmental flows.

CRC also extracts water from Behana Creek, located south of Gordonvale within the World Heritage listed Wet Tropics Rainforest. Water is extracted from a small weir within the creek, with the maximum extraction rate limited by the streamflow of Behana Creek, the time of year and scheme operational constraints. Currently the maximum extraction rate is 44 ML/day, or up to 16,060 ML/a should the relevant streamflow conditions be met every day of the year. Key details associated with these water sources are in Table 5-1, below.

[29] CRC correspondence 27th August 2018

Table 5-1 Cairns' Water Supply Sources

	COPPERLODE FALLS DAM	BEHANA CREEK
Full Supply Volume (ML)	37,100	0.5
Dead Storage Volume (ML)	742	N/A
Useable Volume (ML)	36,358	N/A
Water Entitlement (ML)	30,625	16,060
Catchment Area (km^2)	45	35

The reticulated network supplied by Copperlode Falls Dam and Behana Creek extends from Palm Cove in the North to Gordonvale and Aloomba in the South on the coastal strip between the Coral Sea and the Great Dividing Range. Industry within the reticulated area is also connected to the reticulation network.

There is currently no irrigated agriculture supplied by Copperlode Falls Dam. There are however, small areas of irrigated agriculture within both the Freshwater Creek and Behana Creek catchments but these irrigators use run-of-river extraction from local watercourses for their irrigation supply. As all these irrigators are downstream of the extraction points for urban water supply, they do not impact on water security for CRC.

Figure 5-2 shows the recorded total water production by CRC from both the Freshwater Creek WTP and Behana Creek compared to total annual rainfall.

Since its construction, the storage behaviour of Copperlode Falls Dam has been dynamic, with the storage reliant on regular seasonal inflows to meet demand. To date, there have been no recorded water supply shortfalls as a result of Copperlode Falls Dam reaching its minimum supply volume.

Figure 5-2 Recorded storage behaviour of Copperlode Falls Dam between 1994 and 2019

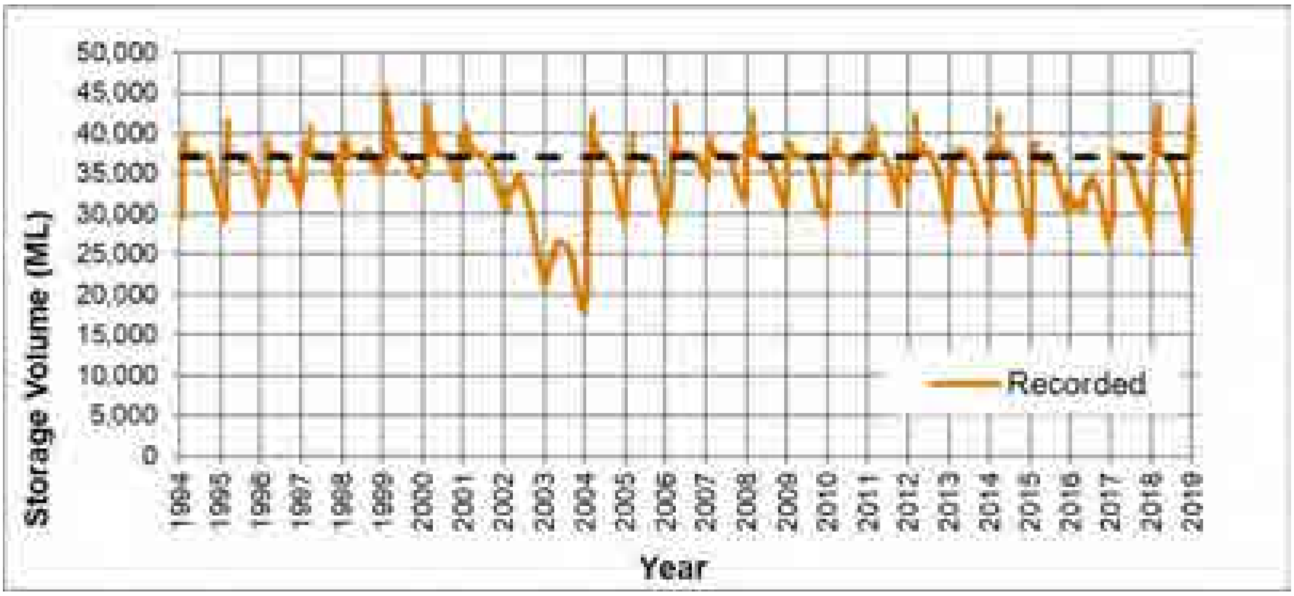
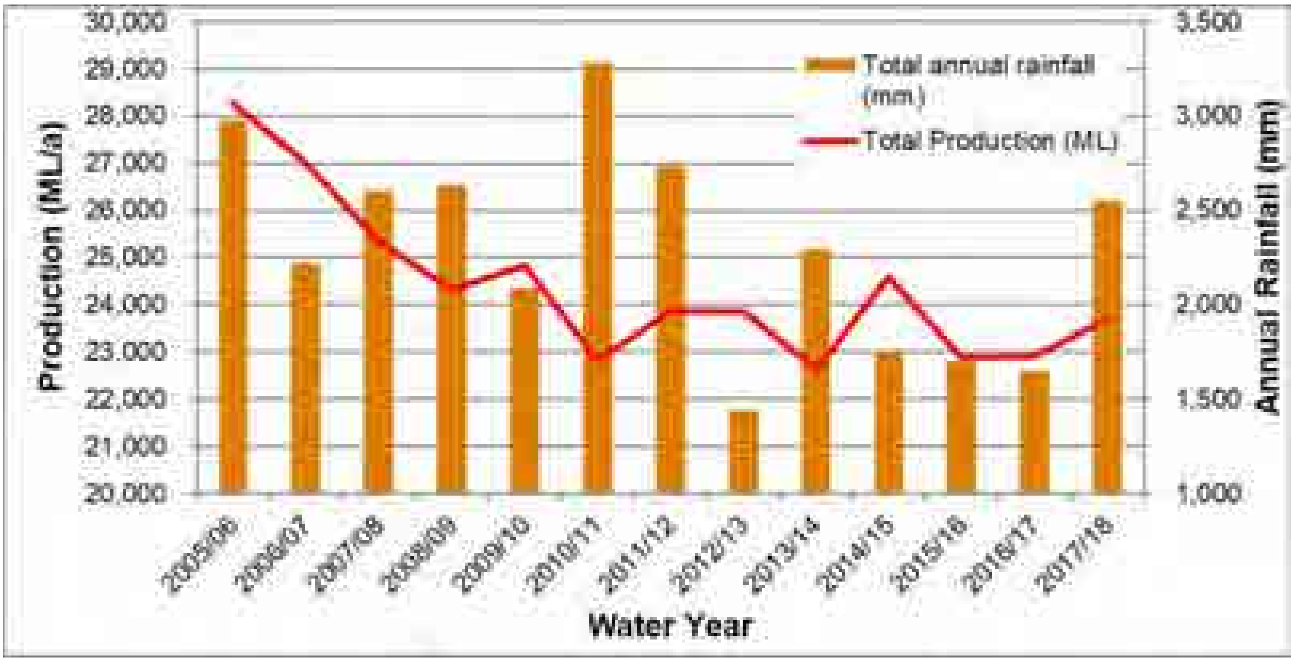


Figure 5-3 shows the recorded total water production by CRC from both the Freshwater Creek WTP and Behana Creek compared to total annual rainfall. Despite a growing population, total water production has decreased since the mid 2000's due to community response to water availability and demand management initiatives by CRC.

Figure 5-3 Total water production from Freshwater Creek WTP and Behana Creek vs total annual rainfall



While the historical performance of a water supply system offers an indication of supply security, its application to future performance is subject to limitations. The historical performance does not consider trends in demand patterns, climate variability or water demand. Historical performance is dependent on the water demand at the time, with water demand typically increasing proportionate with population growth. A period of low inflows that did not result in a water supply shortfall in the past may have failed under a higher water demand. More sophisticated tools, such as stochastic (computer generated data) modelling, are needed to account for a wider range of potential scenarios.

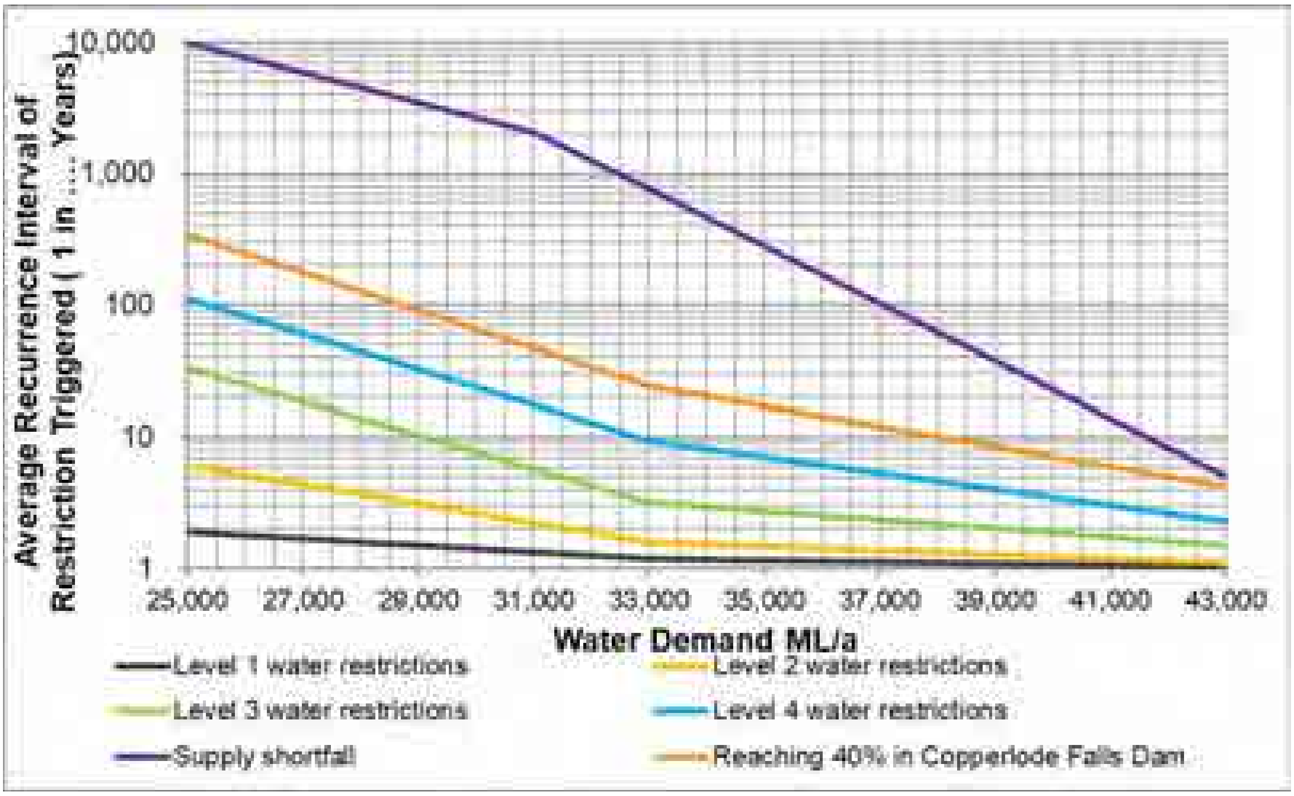
5.2.1.2 Cairns Regional Water Supply Security Assessment

In 2014, the then Department of Energy and Water Supplies released the Cairns Regional Water Supply Security Assessment (Cairns RWSSA). The Cairns RWSSA was developed in partnership with CRC to investigate and establish a shared understanding of the existing security of Cairns' current water supply system and its capacity to support future growth.

The RWSSA used stochastic hydrologic modelling to assess the performance of Cairns' water supply system. Stochastic modelling involves generating data sequences that incorporate key statistical indicators from the historical record. Stochastic modelling was used, which accounts for a wider variation of potential climatic scenarios than the historic record. One hundred replicates of 10,000 years of stochastic data were generated for the Copperlode/Behana water supply scheme. The results were aggregated, and the median output used to identify the likelihood of water supply shortfall for the system.

Figure 5-4 shows the frequency at which various water restrictions and the contingency response could be expected to be triggered, and the extent that Cairns might experience water supply shortfalls at a range of annual demands. As an example, under a total demand of 25,000 ML/a, Level 4 restrictions (represented by the blue line) are estimated to have an average frequency of occurrence interval of approximately 100 years. Under demands of 33,000 ML/a, the estimated average frequency of occurrence interval increases to approximately 10 years.

Figure 5-4 Frequency of water restrictions and supply shortfalls against total annual demand



Given the current water demand in Cairns remains under 24,000 ML/a, the Cairns RWSSA suggests the likelihood of Cairns experiencing a water supply shortfall at current demand levels is no greater than once every 10,000 years. Should water demand increase to 31,000 ML/a, this likelihood would increase to once every 2,000 years unless additional supply sources were developed.

5.2.1.3 Water security

In 2015, CRC released the Cairns Water Security Strategy (refer Section 6.3.1), which investigated the water supply needs of the region for the next 30 years and sets outs a preferred water supply strategy to meet these needs over the short, medium and long term.

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 Government Statistician's Office
- 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.

As part of this strategy, hydrologic modelling was undertaken to understand the performance of the existing supply sources against adopted Level of Service criteria, presented in Table 5-2. Level of Service refers to the frequency, severity and duration of water restrictions and shortfalls in water supply. In other words, how often will Cairns experience water restrictions.

Table 5-2 CRC Level of Service criteria and targets

Severity		Frequency	Use types subject to restrictions	
			Residential	Commercial, Industrial
Level 1 (80% storage)[30]	10% use reduction	1.5-year ARI[31]	Yes	No
Level 2 (70% storage)	15% use reduction	5-year ARI	Yes	No
Level 3 (60% storage)	20% use reduction	10-year ARI	Yes	Yes
Level 4 (50% storage)	25% use reduction	25-year ARI	Yes	Yes
Emergency (40% storage)	Planned Response	100-year ARI	Yes	Yes
Supply Storage (dead storage)	Supply Shortfall	>1000-year ARI (no simulated events)	Yes	Yes

Table 5-3 summaries the findings of the hydrological analysis of Cairns adopted Level of Service criteria for Copperlode Falls Dam and Behana Creek. The available yield from these sources is estimate as 26,000 ML/a, with level 1 and 2 restrictions the limiting factors of available yield. The likelihood of Cairns requiring the implementation of emergency supply measures is estimated to have a 300-year Average Recurrence Interval (ARI), or a 0.3 per cent risk of occurrence in any single year.

Table 5-3 Hydrological analysis for Copperlode Falls Dam and Behana Creek

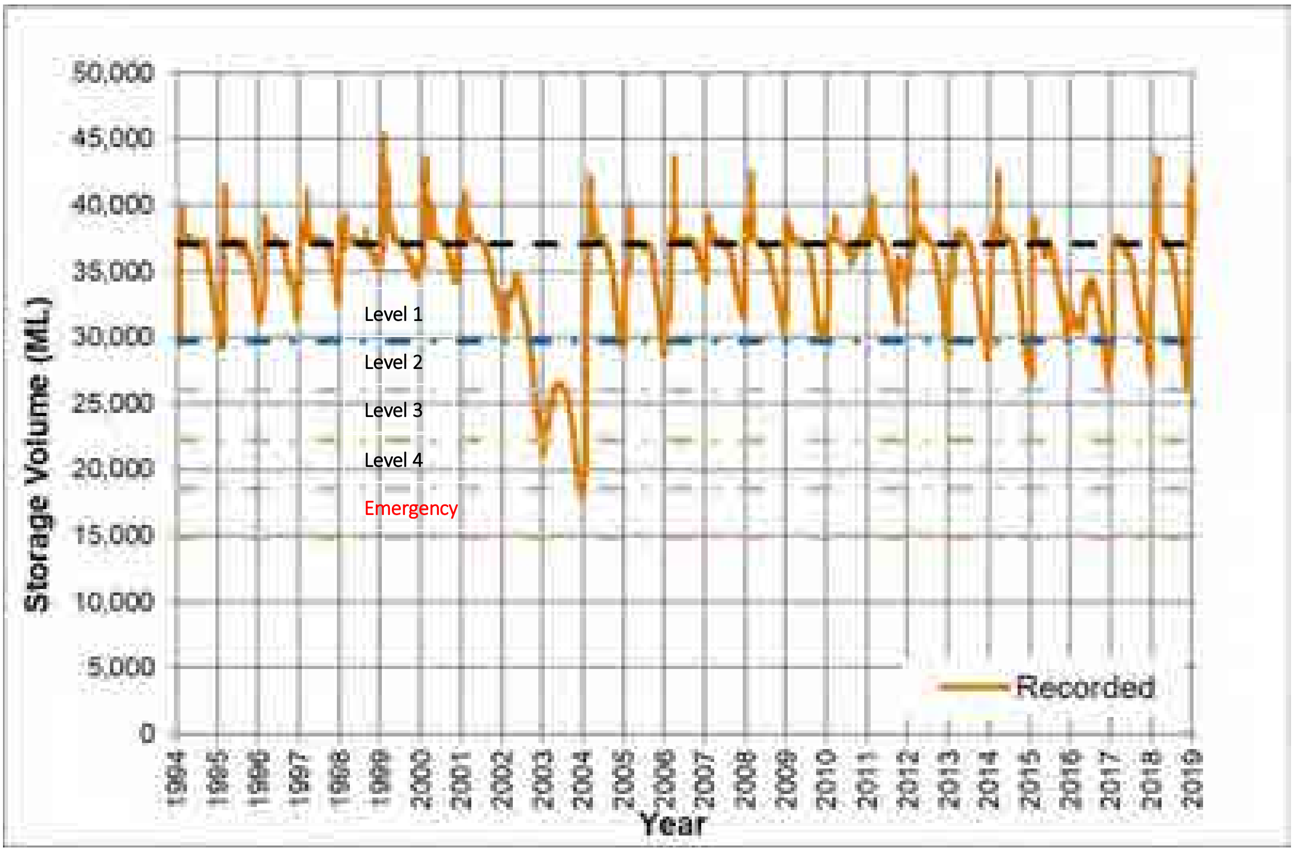
Severity		Target Frequency	Estimated frequency under LoS Yield of 26,000 ML/a	LoS Yield (ML/a)
Level 1 (80% storage)[32]	10% use reduction	1.5-year ARI[33]	1.5-year ARI	26,000
Level 2 (70% storage)	15% use reduction	5-year ARI	5-year ARI	
Level 3 (60% storage)	20% use reduction	10-year ARI	40-year ARI	
Level 4 (50% storage)	25% use reduction	25-year ARI	110-year ARI	

[30] Refers to the storage volume in Copperlode Falls Dam
[31] Average Recurrence Interval – the average time between events occuring
[32] Refers to the storage volume in Copperlode Falls Dam
[33] Average Recurrence Interval – the estimate probability of an event occurring (i.e. 1 in x years)

Severity		Target Frequency	Estimated frequency under LoS Yield of 26,000 ML/a	LoS Yield (ML/a)
Emergency (40% storage)	Planned Response	100-year ARI	300-year ARI	
Supply Storage (dead storage)	Supply Shortfall	>1000-year ARI (no simulated events)	>1000-year ARI (no simulated events)	

Based on historic trends, Cairns triggers level 1 restrictions (at a minimum) every other year, or approximately 50 per cent of the time. This can be seen graphically in Figure 5-5, where over a 25-year period, storage volumes fell below the level 1 trigger at least 13 times.

Figure 5-5 Historic Storage of Copperlode Falls Dam and restriction triggers



CRC have adopted the recommendations of the Cairns Water Security Strategy, which set out a long-term (30+ years) program of supply augmentations and demand management initiatives to ensure that Cairns has sufficient water to meet demand under normal and adverse environmental conditions. The preferred strategy is described in Table 5-4 outlines the preferred initiatives identified by CRC to support short and long-term water security.

Table 5-4 Cairns Water Security Strategy Initiatives[34]

INITIATIVES	COMMENTS	ESTIMATED YIELD
SHORT-TERM (1-5 YEARS)		
Demand management Strategy Smart metering	Commence as soon as practicable	Estimated savings 3,026 ML/a over four programs
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 (including Draper Road Water Treatment Plant Stage 2)	1st additional source 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)	2nd / 3rd additional source 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 3)	2nd / 3rd additional source 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)		
Conversion of MDWSS operational losses to allocations for urban use by Cairns	4th additional source 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	Up to 15,000 ML/a
Access water from a future regional dam (e.g. Nullinga Dam)		Up to 20,000 ML/a

The current implementation status of the above initiatives includes:

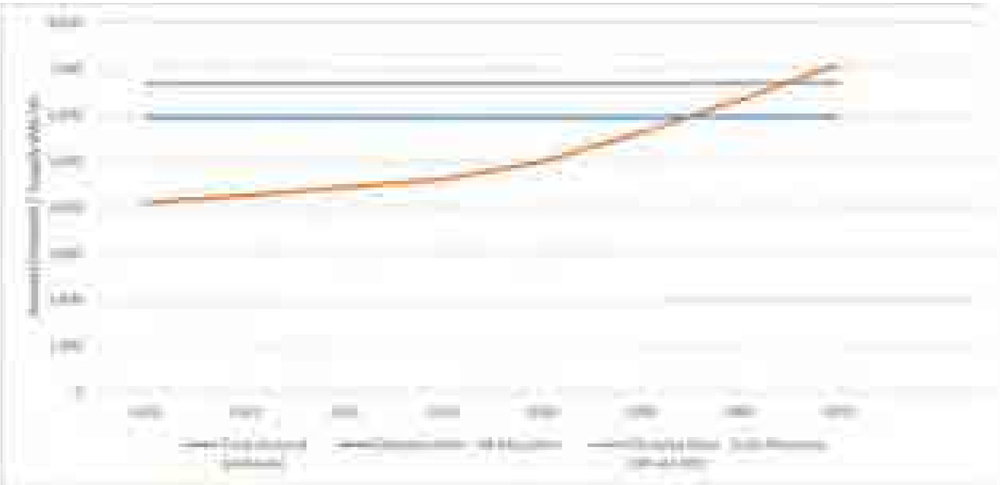
- Mulgrave River Stage 1 and the associated Draper Road WTP (Stages 1 and 2) are scheduled within CRC's long-term capital works program to be completed by mid-2026
- further assessment and monitoring associated with Mulgrave River Stage 1 is progressing accordingly
- various elements of all parts of CRC's Demand Management Strategy 2016-2025 are in progress. CRC's analysis of climate-corrected data indicates the Cairns per capita daily demand is currently being maintained below the baseline level of 418 L/c/d.

[34] *Cairns Water Security Strategy, 2015*

5.2.2 Mareeba

MSC supplies water to an estimated residential population of 22,209[35] within the communities of Mareeba, Dimbulah, Kuranda and Chillagoe, and sources water from both the MDWSS and the Barron River (outside of the MDWSS) to supply these communities. MSC currently holds just under 6,000 ML/a of HP allocations, of which approximately 4,500 ML/a is within the MDWSS and the remainder is available from the Kuranda Weir. In addition, MSC holds 700 ML/a of MP allocations.

Figure 5-6 Water demand and allocation for Mareeba Shire[36]



MSC data indicates that current water demand is just over 4,000 ML/a, with steady water demand growth expected for the foreseeable future. As shown by Figure 5-6, current water allocations are expected to provide adequate water supply and security for at least the next 30 years. As current water use averages 953 L/EP/day, there is an opportunity to defer the requirement to access additional water allocations through measures to reduce per capita water consumption.

Even if water demand growth does necessitate MSC accessing additional water supplies, the quantum of water that might be required for these towns is relatively small and might be more efficiently acquired through the water market rather than through the development of new water storage infrastructure. It is also noted that at least until 2050, Mareeba has a substantial unused allocation which could be diverted to other townships if required.

5.2.3 Atherton

TRC is responsible for providing services to a number of communities in the area, including Atherton, Malanda, Yungaburra, Tolga, Walkamin, Herberton, Ravenshoe and Mt Garnet. The estimated residential population of this LGA is 25,338[37]. Water supply is provided from a combination of local rivers, lakes and bores. Entitlements currently used to supply communities within the region are identified in Table 5-5.

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[35] ABS ERP 2017
[36] Mareeba Shire Council data (2018)
[37] ABS ERP, 2017

Table 5-5 Water entitlements for TRC

Location of Entitlement	Volume of entitlement (ML/a)	Communities Supplied
Barron River, Upstream of Tinaroo Falls Dam	3785	Atherton, Tolga
North Cedar Creek	480	Ravenshoe
MDWSS	460	Yungaburra
The Millstream	120	Ravenshoe (emergency supply)
	295	Millstream North and South
North Johnstone River	332	Malanda
Beatrice River	200	Milaa Milaa
Wild River	159	Herberton
Herbert River	130	Mt Garnett
Vine Creek	50	Bellview
South Cedar Creek	46	Cassowary

The MDWSS currently supplies the community of Yungaburra within the TRC region and could be used to supply Walkamin and Lake Tinaroo for emergency purposes, noting these two communities are currently supplied from existing bores. Recently, TRC has indicated to Sunwater that the existing supply to these communities is sufficient, and it is acknowledged that TRC will continue to develop water supply initiatives as required.

TRC currently has level 2 water conservation measures in place, limiting outdoor water use. While water supply may be restricted during dry conditions, due to the distance and terrain between Nullinga Dam and this potential demand, Nullinga Dam is not being considered as a potential supply source at this time.

5.2.4 Mareeba Dimbulah Water Supply Scheme

The MDWSS is the main water resource development in the Barron Water Plan area (the defined Study Area for the NDMIP), supplying urban and agricultural customers in the region[38]. This area comprises a number of catchments, including:

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

[38] 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

As shown by Figure 5-7, the main land use within the region is irrigated cropping and irrigated horticulture. Large proportions of land are also used for residential and farm infrastructure, services and areas set aside for the protection of natural resources. In addition, there remains large tracts of land within the MDWSS that remain undeveloped.

Figure 5-7 Current land use

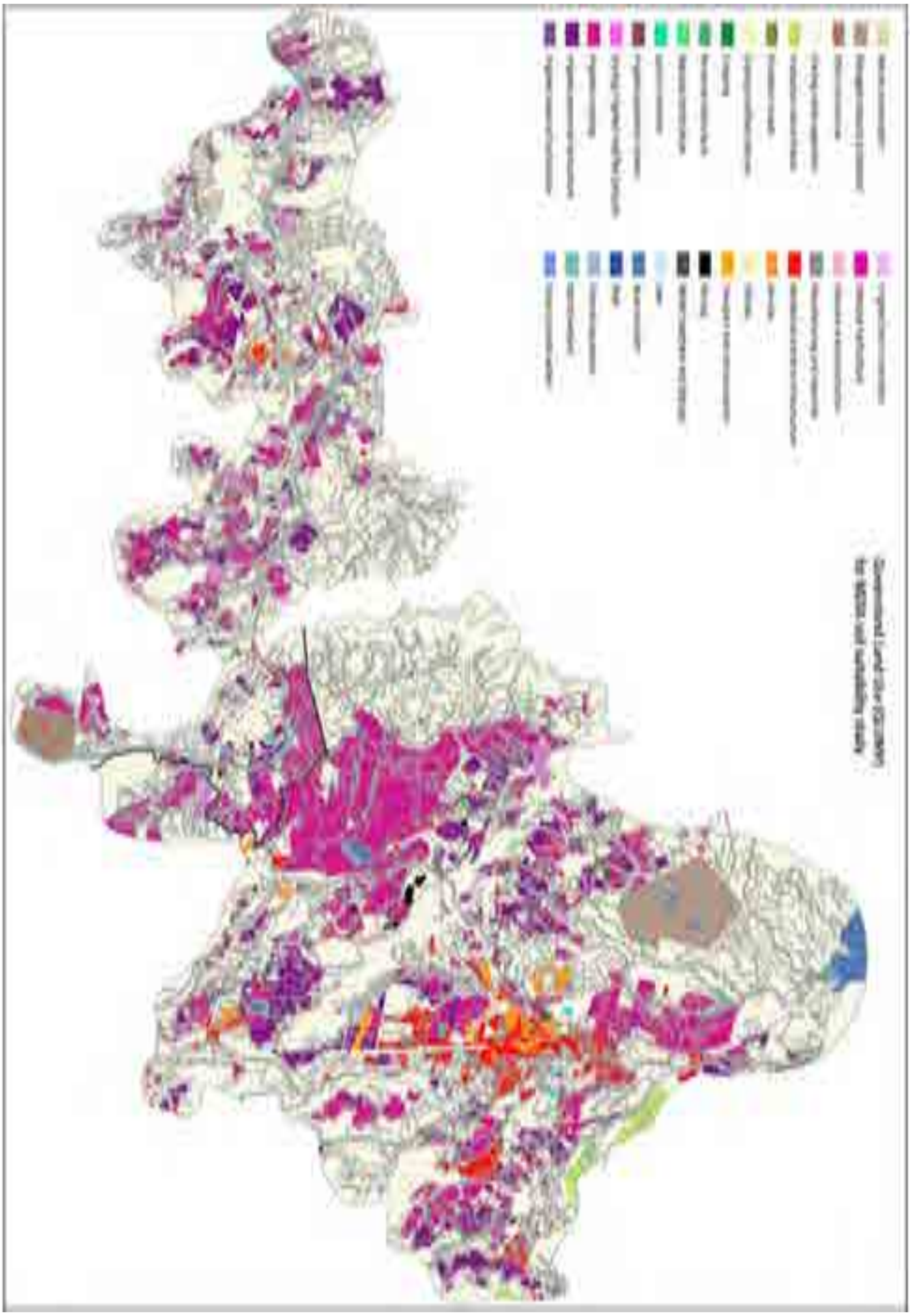


Table 5-6 summarises current water storage infrastructure across the MDWSS, which comprises Tinaroo Falls Dam and a number of small weirs. Tinaroo Falls Dam is a mass concrete, gravity structure located approximately 100 kilometres upstream of where the Barron River discharges into the Coral Sea near Cairns. Constructed in 1958, Tinaroo Falls Dam is 45 metres high and holds 438,900 ML at its full supply level. The small weirs were constructed in the late 1940's and supplied the MDWSS prior to the construction of Tinaroo Falls Dam.

Table 5-6 FSL, minimum operating level and dead storage volumes for existing water storage across MDWSS

Storage Asset	Description	Location	Full Supply Level (m AHD)	Full Supply Volume (ML)	Minimum Operating Level (m AHD)	Dead Storage Volume (ML)
Tinaroo Falls Dam	Mass concrete gravity dam with central ogee spillway	AMTD 101.4 km on the Barron River	670.42	438,920	637.68	1300
Dulbil Weir	Mass concrete gravity weir with centre and right bank ogee spillways	AMTD 5.6km on Tinaroo Creek	408.72	271	401.79	0
Granite Creek Weir	Mass concrete gravity weir with centre, right and left ogee spillways	AMTD 8.7km on Granite Creek	421.83	244	417.03	0
Collins Weir	Mass concrete gravity weir with central ogee spillway	AMTD 269.1km on the Walsh River	545.07	600	536.68	0
Bruce Weir	Mass concrete gravity weir with central ogee spillway	AMTD 230.9km on the Walsh River	454.32	970	453.14	500
Leafgold Weir	Mass concrete gravity weir with central ogee spillway	AMTD 217.5km on the Walsh River	435.67	260	434.37	93
Solanum Weir	Mass concrete gravity weir with central ogee spillway	AMTD 13.6km on Eureka Creek	462.82	345 (68 ML – 1995 survey)	461.68	10

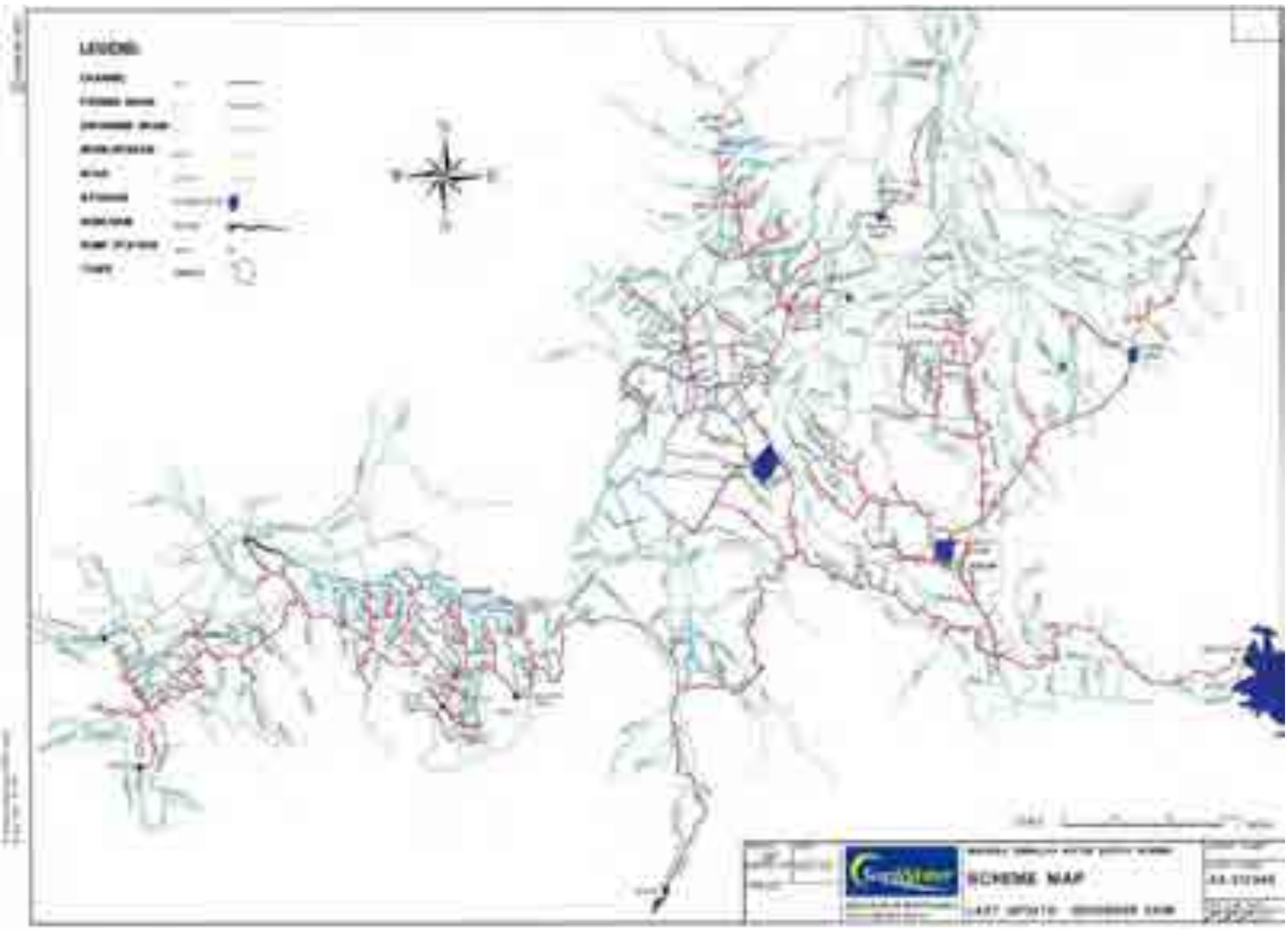
As shown in Figure 5-8, the distribution system is comprised of 5 balancing storages, 375 kilometres of channels and pipelines and 61 kilometres of drains. The vast majority of the channel distribution system is reliant on gravity to move water to where it is required, with 5 pump stations at Paddy's Green, Biboohra and Price Creek providing water to a limited number of customers at the upper reaches of the MDWSS.

There are some limitations on water use that are associated with the capacity of the infrastructure in place to supply water. For instance, under the current system, water released from Tinaroo Falls Dam can take up to 48 hours to reach irrigators at the furthest extents of the channel scheme, leading to higher comparative delivery losses / inefficiencies in these zones. This presents challenges to Sunwater in terms of managing water releases to fully meet the needs of irrigators without incurring excessive losses.

In addition, a number of the smaller weirs, including Bruce, Leafgold and Solanum Weirs, have been subject to siltation, reducing their storage capacity. A bathymetric survey conducted on Solanum Weir in 1995 revealed that the full supply volume had reduced from 345 ML to just 68 ML. Anecdotal reports indicate that, at full supply level, the depth of water is less than one metre in these weirs.

In recent years the capacity limits of specific elements of the delivery system have been reached—most notably for the East Barron system, for which peak demand exceeded the capacity of the system.

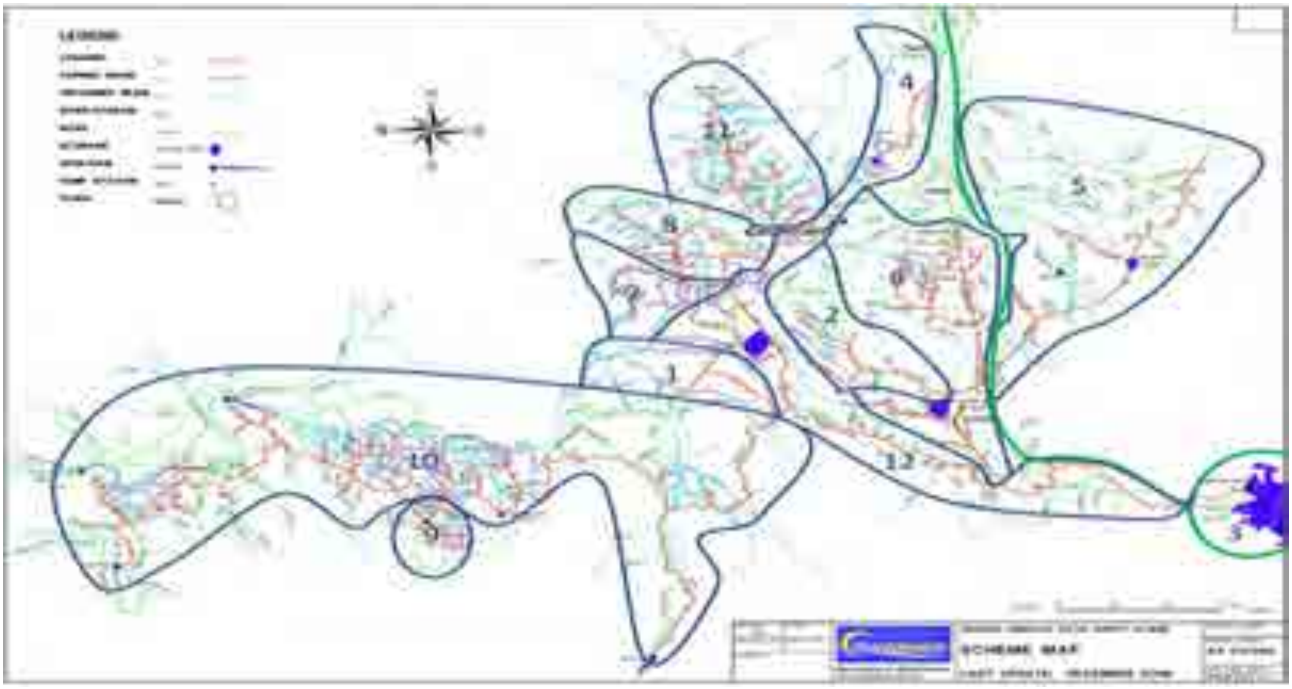
Figure 5-8 MDWSS Map



5.2.4.1 MDWSS subsystems

The MDWSS is operationally broken down into 12 sub-systems (Figure 5-9). In terms of water use, the South Walsh and the West Barron are the largest operational systems. The South Walsh and West Barron systems used about 28 per cent and 16 per cent of total water in 2015–16 respectively. Stakeholders advised that constraints in the East Barron mean that no further water can be provided to this subsystem.

Figure 5-9 Operational systems in the MDWSS



Zones: 1. Arriga, 2. Atherton Creek, 3. Barron River and Tinaroo Falls Dam, 4. Biboohra, 5. East Barron, 6. Mareeba, 7. North Walsh, 8. Paddy's Green relift, 9. Price Creek relift, 10. South Walsh, 11. Southedge, 12. West Barron.

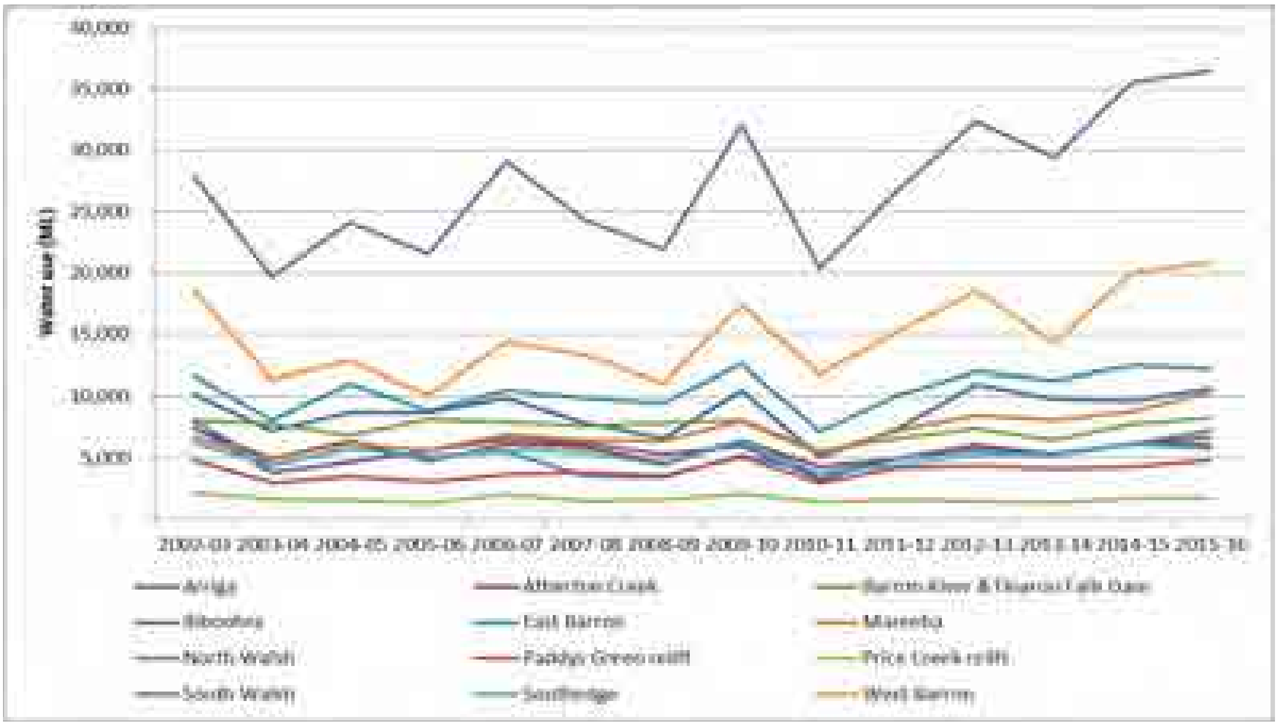
Between 2002-03 and 2015-16, the operational systems that have seen the most growth in terms of water use are South Walsh and Mareeba. The compound annual growth rates for South Walsh and Mareeba since 2002–03 are about 2.1 per cent and 3.5 per cent respectively (Figure 5-10). Overall, the compound annual growth rate in water use across the MDWSS has averaged approximately 0.7 per cent per annum over this period.

Recent years have also seen the capacity limits of specific elements of the delivery system being reached, most notably for the East Barron system, where peak demand now exceeds the capacity of the system. The Arriga main channel, which supplies a large proportion of existing sugarcane entitlements, also experiences capacity constraints during periods of peak demand.

Further, 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.

The limitations of the distribution system in the East Barron and Arriga areas are also a potential restriction on the expansion of irrigated agriculture.

Figure 5-10 Water use by operational system/s in the MDWSS



5.2.4.2 Irrigated Agriculture

The MDWSS covers an area of 111,721 hectares, including approximately 27,000 hectares of irrigated agriculture which includes a wide variety of crops, including Sugarcane, Avocadoes, Mangoes, Bananas and more.

The Department of Agriculture and Fisheries (DAF) publishes an agricultural profile for the broader Tablelands region, which confirms the dominance of sugarcane and the growth of new crops (Table 5-7). The (broader) Tablelands region is defined by the boundaries of the MSC and the TRC, with the MDWSS making up about half of the irrigated area.

Sugarcane is the dominant crop in the MDWSS, followed by perennial horticulture and broadacre cropping. In terms of perennial horticulture, the main crops grown in the region are bananas, mangoes and avocados. In recent years, there has been an increase in the number of bananas and avocados planted in the region due to high consumer demand.

The agricultural profile also shows that bananas and avocados are of considerably higher value, with revenue of $91 million and $83 million respectively in 2014–15, compared to gross revenue from sugarcane of $39 million, despite the area under sugarcane production being greater.

The comparatively high value per hectare of production from most irrigated agriculture crops is evident when compared with beef cattle and forestry.

Table 5-7 Crop mix and metrics across MDWSS

Crop Type	Area in 2014–15 (hectares)	Area variance since 2010–11 (hectares)	Volume sold (tonnes)	Gross revenue	Gross revenue per hectare
Aquaculture	30		258	$3,026,898	$100,897
Avocados	950	100↑	13,011	$82,901,505	$87,265
Bananas	1,850	578↑	50,500	$90,989,270	$49,134
Beef cattle	550,000		30,330	$34,740,000	$63
Blueberries	48		283	$11,320,000	$235,833
Citrus	480		7,840	$31,356,720	$65,327
Forestry	3,600		54,500	$3,332,000	$926
Hay	3,020	148↑	17,400	$3,747,000	$1,241
Mango	2,400	100↓	23,396	$50,678,160	$21,116
Sugarcane	10,956	3,015↑	1,064,714	$39,067,030	$3,566
Table grapes	87	33↓	522	$3,132,000	$36,000
Total	592,885			$552,265,539	$931

Recent discussions with irrigators in the region and with DAF have pointed to continued changes in the crop profile and industry growth as key drivers of future growth. This trend corresponds with the Tablelands Agriculture Profile data (Table 5-7), which shows that in 2015:

- sugarcane = 10,956 hectares, an increase of 3,015 hectares since 2010–11
- bananas = 1,850 hectares, an increase of 578 hectares since 2010–11
- avocados = 950 hectares, an increase of 100 hectares since 2010–11.

DAF recently produced a Profile of the Atherton Tablelands Citrus Industry (October 2018)[39] which reported that across the Atherton Tableland region, 124 growers had 1,133 hectares under production. While the Mareeba region has the greatest number of farms (472 ha over 65 farms), the Dimbulah area has the greatest area under production (644 ha over 56 farms). Limes are by far the most prominent citrus category grown in this region, followed by lemon, pomelo, mandarin, orange and grapefruit.

[39] https://publications.qld.gov.au/dataset/profile-of-the-atherton-tablelands-citrus-industry/resource/668f31e4-14b6-4855-b04a-867f2059dbcd

Table 5-8 Area and value by citrus type

Citrus Type	Total Area (Ha) – Trees > 4 years old	Total Area (Ha) – Trees < 4 years old	Approximate Value ($ million)	% of total citrus production by area
Lime	558.3	256.5	$47.9	71.9%
Lemon	87.9	109.2	$4.3	17.4%
Mandarin	4.8	74.5	$0.8	7.0%
Pomelo	15.6	5.2	$2.3	1.8%
Orange	5.8	8.9	$0.2	1.3%
Grapefruit	2.7	4	$0.1	0.6%
Total	675.1	458.3	$55.7	100%

The citrus industry profile indicates an expansion of the citrus industry in the MDWSS in the past few years, in particular for the lime, lemon, mandarin, grapefruit and pomelo categories. The region is now home to Australia's largest lime, red fleshed orange and pomelo production regions. Production in the region, along with the total value of production, is likely to further increase as more trees reach full production.

This confirms the observation from numerous stakeholders, including a consensus position at the SRG that there is a switch from lower value crops to permanent plantings of high value crops (avocados, bananas, mangos and table grapes have been identified) occurring in the MDWSS. These producers are acquiring land and water from lower value producers, including farms that previously produced tobacco, nuts or sugarcane.

5.2.4.3 Water availability, use and the current market

The MDWSS supplies approximately 1,100 customers, with irrigation representing the largest component both in terms of volume and number. Historically, the level of utilisation (water use as a percentage of entitlements) by MDWSS customers has been between 50 per cent to 70 per cent. Table 5-9 shows a snap shot of water use by customer segment for the 2017-18 water year, where the overall utilisation of entitlements (excluding conveyance loss entitlements) was approximately 71 per cent.

Table 5-9 Entitlement and availability by customer segment, 2017-18[40]

Customer Segment	Water Entitlement ML	Water Available ML	Water Delivered ML	Comment
Industrial	1,561	1,607	690	Barron Gorge Hydroelectric Power Station at Kuranda
Irrigation	151,202	151,983	89,093	Agricultural use
Urban	6,657	5,958	3,513	Towns such as Yungaburra, Mareeba, Mutchilba, Dimbulah.

[40] Sunwater Annual Report 2017-18, page 86

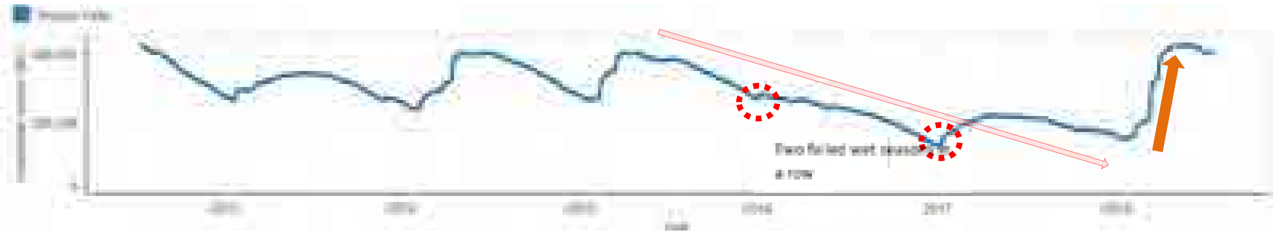
Customer Segment	Water Entitlement ML	Water Available ML	Water Delivered ML	Comment
Sunwater	45,004	45,004	24,615	Conveyance losses
Total	**204,424**	**204,551**	**117,912**	**Utilisation of 57.6%**

Since 2017-18, utilisation has increased and exceeds 80 per cent, which is above the water security buffer generally desired by irrigators. Irrigators tend to maintain a percentage of entitlement holdings as a buffer against dry conditions and low opening allocations. As a number of irrigators, particularly with higher value perennial crops, have indicated they would prefer to only use 70 per cent of the water entitlements on average, retaining 30 per cent as 'insurance' in the case of dry periods, even this value may be conservative.

Irrigators preference for higher retention of allocations as insurance during dry periods was seen during the recent extended dry period, from 2012-13 through 2016-17.

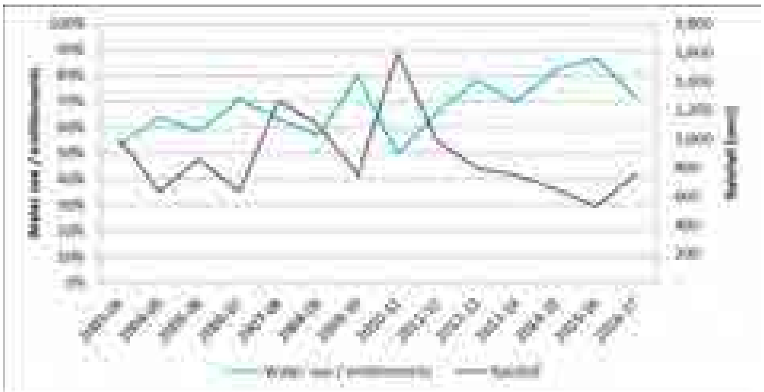
During this period, as shown in Figure 5-11, average annual rainfall fell below 915mm[41], and included two consecutive failed wet seasons, resulting in minimal inflows into Tinaroo Falls Dam and contributing to storage levels falling to 40 per cent of capacity.

Figure 5-11 Tinaroo Falls Dam accessible volume[42]



Interestingly, as shown in Figure 5-12, the annual level of water used in the MDWSS, from 2003 through 2017, has typically (though not always) had an inverse relationship to the amount of rainfall.

Figure 5-12 Water use and availability in the MDWSS



More recently this trend, i.e. the inverse relationship of rainfall and use, has started to shift. In 2018, there was a sustained increase in rainfall, as shown in Figure 5-11, resulting in an improvement in the dam storage level.

This increased storage level has contributed to a reduction in water security concerns across the MDWSS, noting Tinaroo Falls Dam, the primary water store for the MDWSS stores and

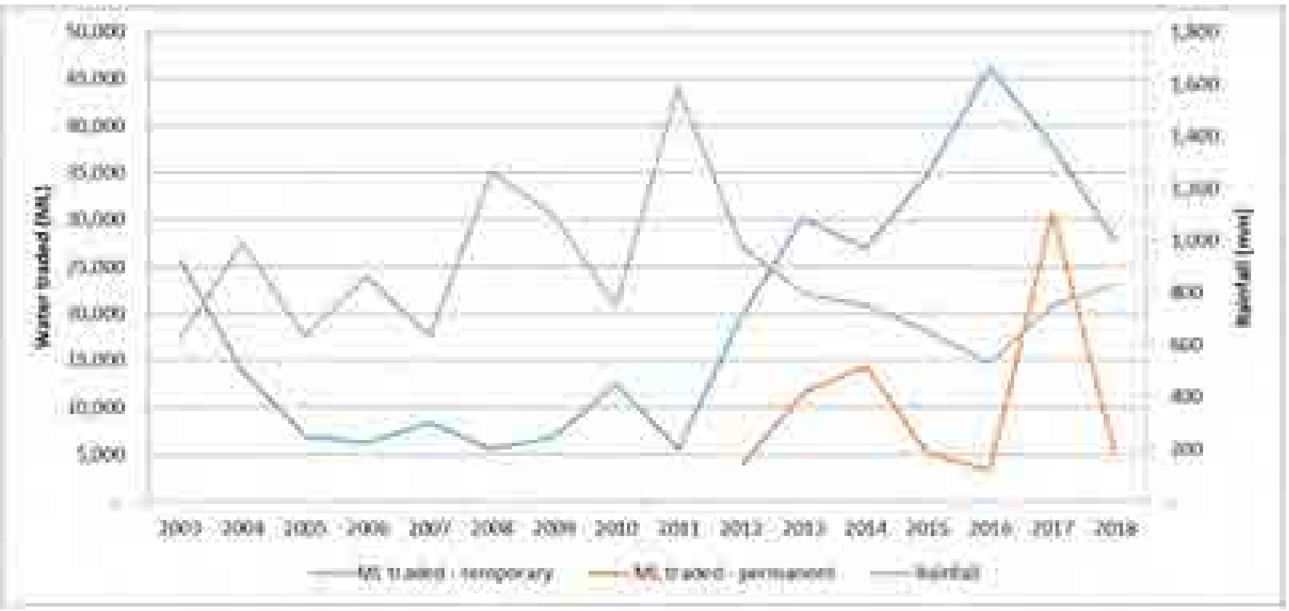
[41] Bureau of Meteorology, http://www.bom.gov.au/climate/averages/tables/cw_031066.shtml
[42] Ibid

releases water for irrigation, town water supply, hydroelectricity generation, environmental flows and recreational purposes.

With the end of the recent dry period, usable volume in Tinaroo Falls Dam rising to over 90 per cent, announced allocations have increased to 100 per cent. As of 2018, customers requiring additional water need to either purchase permanent allocations from other customers or access water from the temporary water market.

The reduction in current customer concerns over water security is further reflected in water trading data, with both permanent and temporary water trading decreasing in 2017-18. As shown in Figure 5-13, the level of water trading activity was markedly higher during the recent dry period, from 2012-13 to 2016-17, with the market for permanent water allocations peaking at over 30,000 ML. This peak was equivalent to approximately 20 per cent of tradeable MP allocations and coincided with Tinaroo Falls Dam falling below 40 per cent of capacity. During the same period, the temporary water market was even more active, reaching a peak of over 45,000 ML in 2016-17.

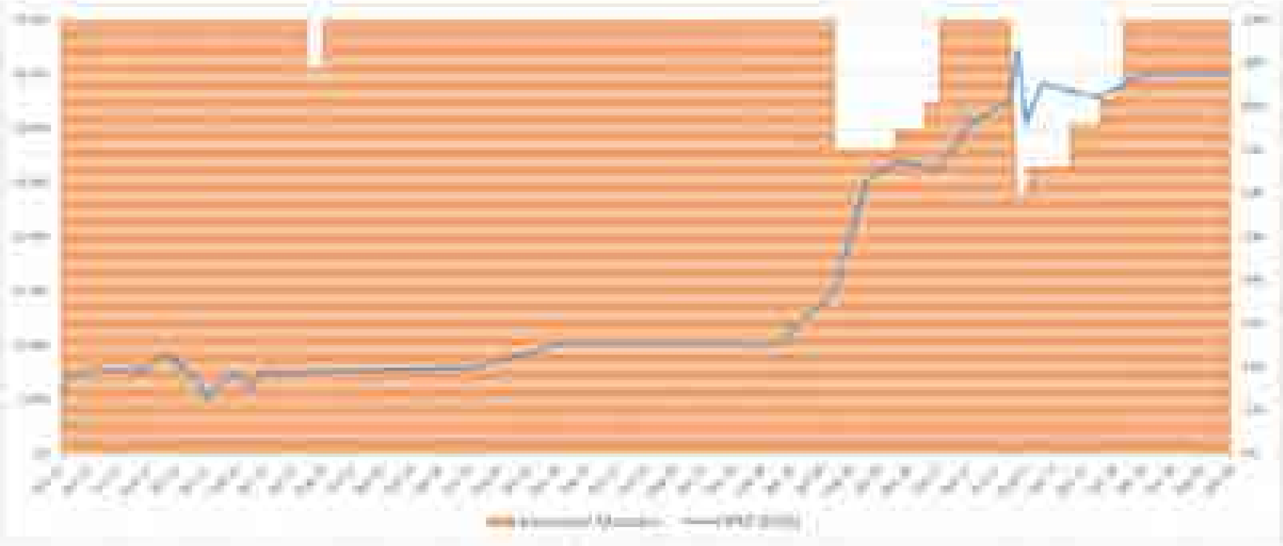
Figure 5-13 Rainfall and trading patterns[43]



As would be expected, permanent water prices increased during this recent dry period. Figure 5-14 shows that increases in the price of permanent water allocations have historically coincided with periods where announced allocations have been less than 100 per cent. Permanent water prices during this time averaged $3,500 per ML, though some trades reached up to $4,000 per ML.

[43] Ibid

Figure 5-14 Allocation and value ($/ML)



With the more recent increased rainfall, prices have softened to $2,800 to $3,000 per ML, though there's evidence that prices have since rebounded to $3,400 to $3,500 per ML. By contrast, temporary water is available for between $50 – $65 per ML, which may limit the demand for permanent water allocations. It is clear, however, that the current price is being justified by the margin yield from production rather than the price of temporary water.

Local operators currently seeking to purchase additional water allocations, indicated their unwillingness to pay more than $2,800 per ML, which is above previous indications of a preferred price of $2,000 per ML indicated in response to the RFI process (further discussed in Section 5.3.1).

5.2.4.4 Conclusions

Based on consideration of the current levels of demand and supply, it has been concluded that the MDWSS is fully allocated and highly utilised, which indicates that access to water is constraining expansion of agricultural production in the region.

5.3 Future demand

This section considers the forecast and potential water demand for both urban and agricultural customers.

5.3.1 Urban water demand

5.3.1.1 Demand drivers

Since the release of Cairns Water Security Strategy, CRC has continued to review and reassess both its water demand forecasts and planning for its planned future supply augmentations to meet this demand. Since the completion of the Nullinga Dam and Other Options PBC, CRC have reassessed its forecast population growth and future water demand due to:

- reconfiguration of the proposed Aquis Resort at the Great Barrier Reef as a tourism and real estate proposal without a casino
- need to align population growth forecasts with those released by the Queensland Government Statistician's Office (QGSO) for the LGA serviced by CRC (2015).

As a result of these changes, the population growth forecasts have been revised down from previous estimates.

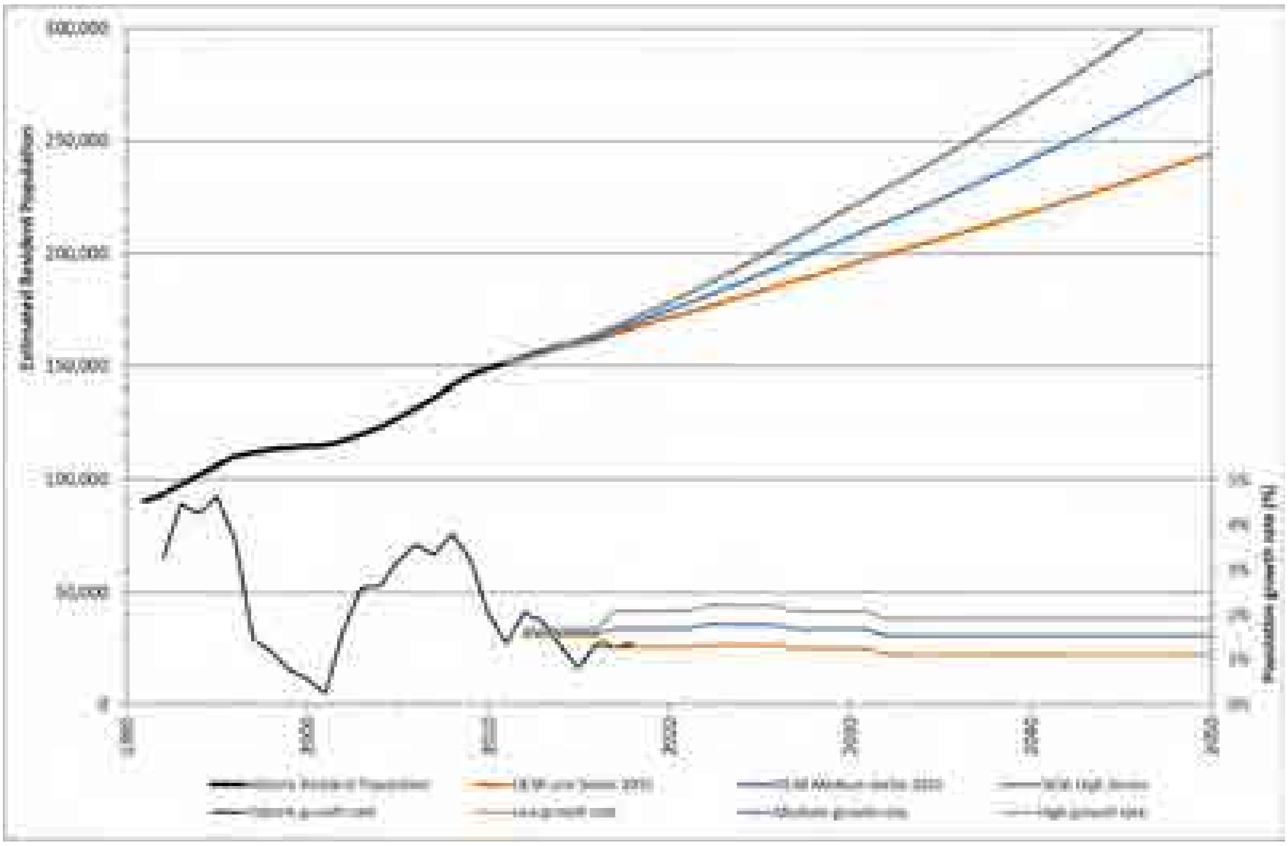
CRC's water demand forecasts are based on an estimated per capita demand, and are produced for low, medium and high population growth rates. Key data at each of the 5-year horizons forecast by the QGSO over the 2011-2036 period is summarised in Table 5-10 for the area serviced by the Cairns urban water supply scheme. Italicised population estimates for 2041 onwards are an extrapolation based on continuing growth at the rate estimated by the QGSO for the 2031-2036 period.

Table 5-10 Population data for Cairns urban supply area

Year	Resident Population of Urban Supply Area					
	Low growth	Growth rate	Medium growth	Growth rate	High growth	Growth rate
2011	150,992	-	150,992	-	150,992	-
2016	159,330	1.52%	159,956	1.60%	160,581	1.68%
2021	169,996	1.28%	174,024	1.68%	178,122	2.07%
2026	181,837	1.34%	190,186	1.77%	198,786	2.20%
2031	193,767	1.26%	206,923	1.68%	220,593	2.08%
2036	205,068	1.13%	223,410	1.54%	242,595	1.91%
2041	*217,101*	*1.13%*	*241,292*	*1.54%*	*266,880*	*1.91%*
2046	*229,792*	*1.13%*	*260,552*	*1.54%*	*293,536*	*1.91%*
2051	*243,218*	*1.13%*	*281,339*	*1.54%*	*322,843*	*1.91%*

As shown in Figure 5-15, recent population growth has been tracking on the low growth population estimate. Over this period, population growth has experienced variability, from 4.62 percent per annum in the mid-1990s to just 0.25 percent per annum in the early 2000s. Analysis of the historical population growth identified 15 and 30-year average growth rates of 2.31 percent per annum and 2.52 percent per annum, respectively.

Figure 5-15 CRC's Population Growth Projections



Based on the population growth estimates discussed above, Figure 5-14 shows the water demand estimates for each of the low, medium and high growth rates. The demand forecasts are also dependent on the success of CRC's 2016-2025 demand management strategy (DMS), with these impacts also considered in the below table.

Despite the decline in population growth rates over time, history has shown that Cairns may experience increases in population growth over short periods. To account for this and to align with the Cairns Water Security Strategy, Building Queensland have adopted the medium population growth estimate including demand management, as the basis for further analysis. Low and high demand scenarios have been considered.

Table 5-11 Water demand data for Cairns urban supply area

Year	Per capita demand (L/c/d)		Low growth ML/a		Medium growth ML/a		High growth ML/a	
	Baseline	In accordance with DMS	Baseline	DMS	Baseline	DMS	Baseline	DMS
2016	418	418	24,309		24,404		24,500	
2021	418	386	25,936	23,951	26,551	24,518	27,176	25,096
2026	418	377	27,743	25,022	29,017	26,171	30,329	27,354
2031	418	377	29,563	26,663	31,570	28,474	33,656	30,355
2036	418	377	31,287	28,218	34,086	30,742	37,013	33,382
2041	418	377	33,123	29,874	36,814	33,203	40,718	36,724
2046	418	377	35,059	31,621	39,752	35,853	44,785	40,392

Year	Per capita demand (L/c/d)		Low growth ML/a		Medium growth ML/a		High growth ML/a	
	Baseline	In accordance with DMS	Baseline	DMS	Baseline	DMS	Baseline	DMS
2051	418	377	37,108	33,468	42,924	38,714	49,256	44,425

The Cairns Water Security Strategy is based on a supply augmentation sequence that involves access to Cairns' strategic reserves before any water trading in either water plan area. Access to the Mulgrave strategic reserve (15,000 ML) is planned to be staged, with the second stage being subject to a comparative assessment against accessing the Barron strategic reserve (4,000 ML).

Although the comparative assessment is not yet scheduled to occur, an outcome may be that the development of Barron River (as Stage 1) is more favourable than proceeding with the second stage of the Mulgrave River. In this case, CRC would also re-evaluate if it would be more appropriate to continue with further stages of the Barron River, rather than return to the Mulgrave River. As Barron River Stage 1 involves full access of the strategic reserve, any further stage would involve securing additional water entitlements through the mechanisms provided in the Barron water plan.

Thus, two scenarios of supply augmentation outcomes have been considered in this DBC.

- **Scenario 1** assumes full access to the strategic reserves on the Mulgrave River and Barron River prior to securing additional water in the Barron (e.g. as could be enabled by Nullinga Dam)
- **Scenario 2** assumes Mulgrave River Stage 2 is not developed (for example, due to social and/or environmental reasons).

The timing of each scenario of supply augmentation outcomes described above is illustrated in Figure 5-16 based on the higher demand forecast for Cairns.

Figure 5-16 Annual demand / supply

5.3.1.2 Future demand

As identified in the Cairns Water Security Strategy, CRC will require access to additional water allocations to address water security requirements in the future and would require access to HP allocations for urban use.

It is currently understood that:

- Under a medium demand growth scenario (central case), which accords with the medium case estimates of population growth trends as reported by the QGSO, Cairns does require an additional source of supply to service its urban requirements to be in place by 2055 (i.e. assuming full access to both strategic reserves). However, demand management initiatives would delay the need for an additional source of supply to around 2063.
- Under a low demand growth scenario, CRC requires an additional source of supply in 2081 (if the Barron River Stage 1 or Mulgrave 2 supply options are developed before).
- Under a high demand growth scenario, CRC requires an additional source of supply in the mid-2040s if Barron or Mulgrave 2 options are developed. However, should there be high growth, coupled with the development of Mulgrave River Stage 1 (only), Cairns may have a need for water enabled by Nullinga Dam by 2037.

It is acknowledged that there is ongoing uncertainty around when CRC may need to access the water from a proposed Nullinga Dam. At the SRG meeting in October 2018, it was commented that CRC's population growth could be higher than the QGSO projections to 2036 of 1.65 per cent (medium projection) and 1.99 per cent (high projection). This is because analysis of the historical population growth identified 15 and 30-year average growth rates of 2.31 per cent and 2.52 per cent, respectively.

5.3.2 Agricultural Water Demand

5.3.2.1 Request for Information

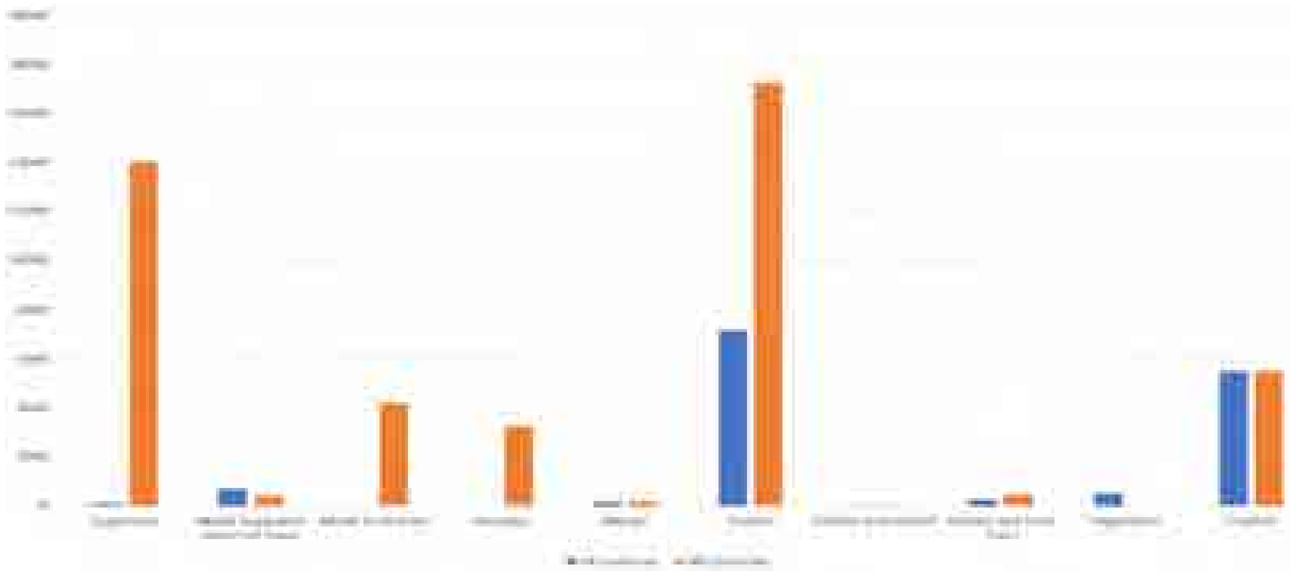
To understand the potential demand for new water allocations, a Request for Information (RFI) process was undertaken. The RFI sought information on the volume of demand from potential customers along with the intended use, location of intended use, a product preference and a pricing preference. The RFI was open between 18 July 2018 and 3 August 2018 and was publicly advertised in local, regional and national publications along with industry publications. The water demand assessment advisor established a webpage to provide further information on the RFI as well as accept submissions for potential demand.

Following the conclusion of this process, it was clear that the response rate from existing customers was well below what was expected. To ensure the demand assessment underpinning the DBC was as robust as possible, the RFI was held open until 24 August 2018 while large-scale commercial irrigators were directly contacted by the water demand assessment advisor. Industry representatives in the region also advocated for responding to the RFI in the region. Despite this, only three additional responses to the RFI were received.

In total, 25 respondents provided 37 submissions to the RFI. The response to the RFI represents only a small portion of the total number of irrigators in the MDWSS. The reasons for the low proportion of irrigators responding are not clear but there are reports of scepticism of the dam progressing, as well as confidence by higher value crop irrigators that they can acquire water from existing markets, due to their higher capacity to pay.

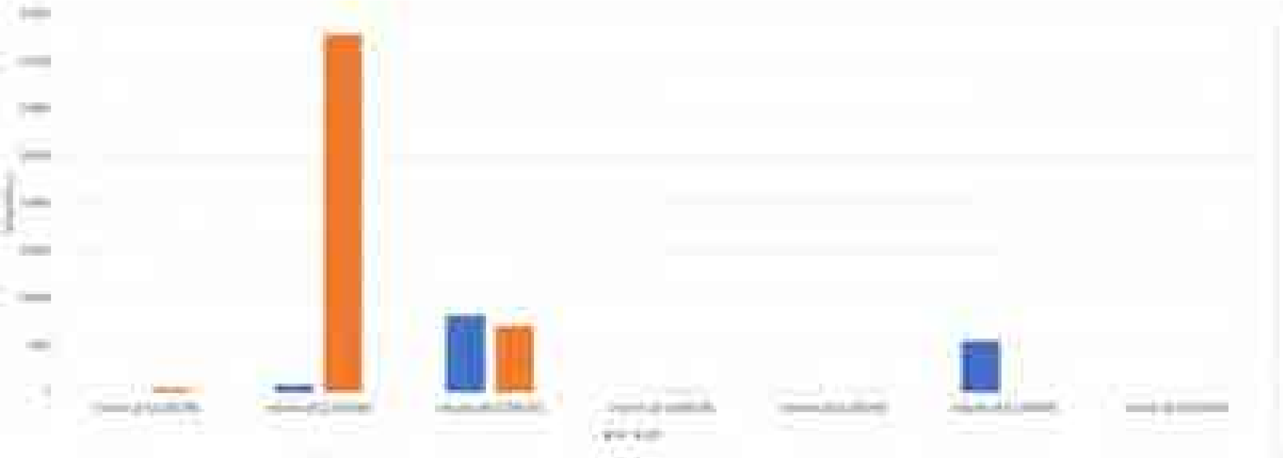
Respondents sought water for a variety of crop types, including sugarcane, avocadoes, mangoes and fodder. As shown in Figure 5-17, RFI respondents sought a total of 59,650 ML of allocations, consisting of 45,017 ML of MP water allocations and 14,388 ML of HP water allocations.

Figure 5-17 HP and MP volumes by crop type



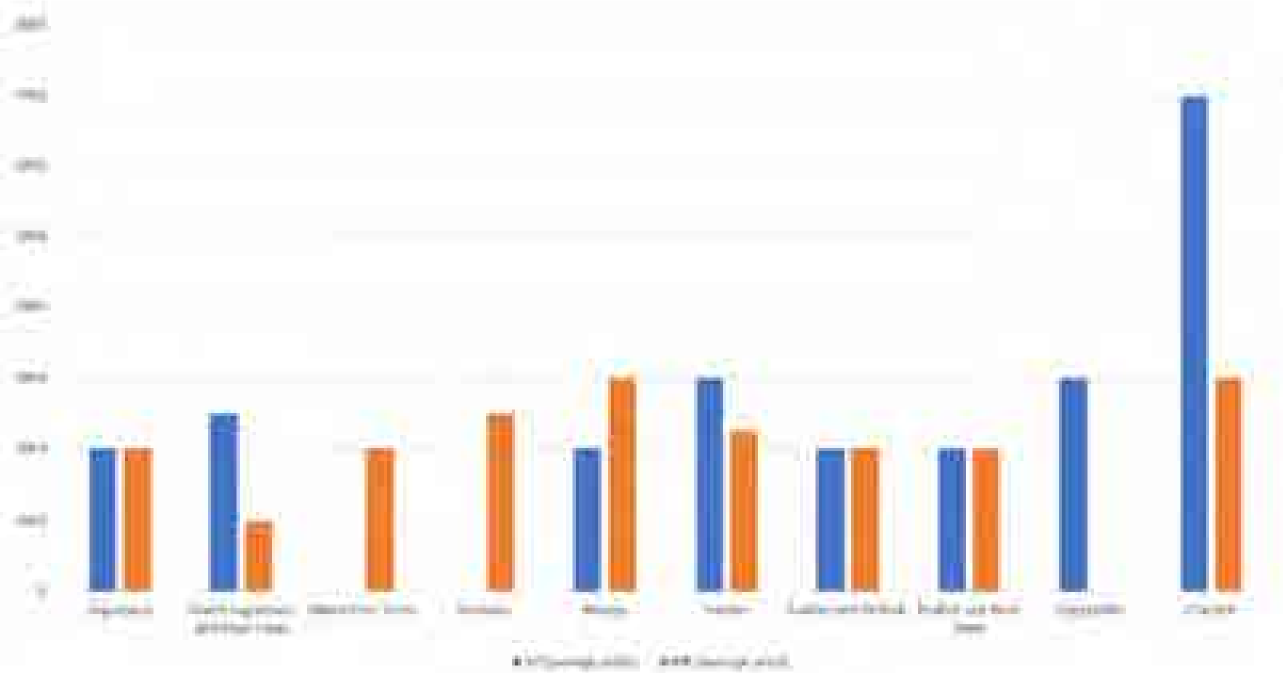
Respondents provided an indication of their preparedness to pay, with the results by volume presented in Figure 5-18 and by crop type presented in Figure 5-19. Figure 5-18 shows that the majority of respondents indicated demand at $2,000 per ML, with prices from $3,000 per ML from fodder, fruit trees, some vegetables and crayfish.

Figure 5-18 Willingness to pay (for given HP and MP volumes)



In terms of preparedness to pay by crop type, crayfish indicated the highest preparedness to pay, in particular for HP allocations.

Figure 5-19 Willingness to pay (for given HP and MP volumes), by given crop types



From the RFI process, demand was separated into three categories; likely, possible and unlikely. The following definitions and criteria were applied to determine which category each RFI response would be placed in.

Table 5-12 Categories and criteria for RFI response/s

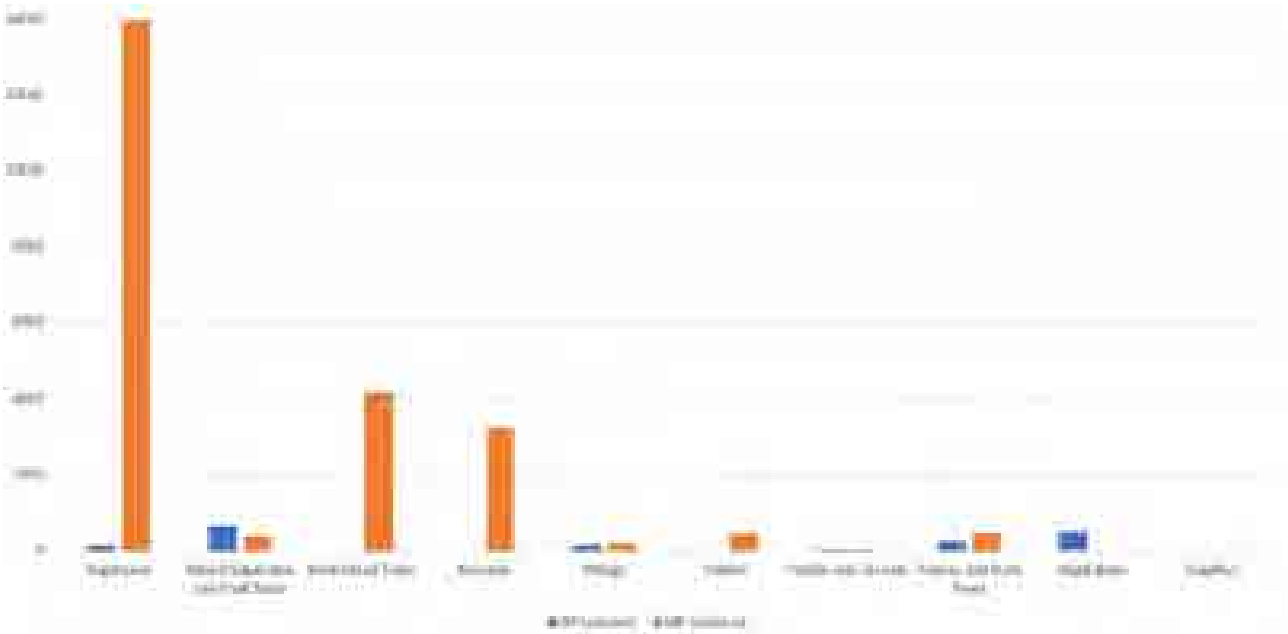
LIKELIHOOD	DEFINITION	CRITERIA
Likely	There is a strong likelihood the demand will materialise.	▪ Potential customer is already operating in the region ▪ Product is grown in the region ▪ Demand is indicated as being required immediately or within 3 years of Nullinga being constructed ▪ Outlook for prices/costs is favourable
Possible	The demand might materialise, but it is difficult to ascribe a timeframe.	▪ Product is grown in the region ▪ Demand is indicated as being required within the medium term ▪ Venture requires development (partners, capital or markets) ▪ Outlook for prices/costs is favourable
Unlikely	Not expected to materialise, but there is a slight chance that it might occur.	▪ Product is not grown in the region ▪ Venture requires development (partners, capital and markets) ▪ Product prices/costs are marginal/poor

Consideration of the responses based on this categorisation suggests that demand for water from all respondents is considered likely, except demand relating to a fodder enterprise and a crayfish project. The respondents in this category:

- are existing customers operating in the region
- require water for products grown in the region
- have a requirement immediately or within three years of construction of Nullinga Dam
- indicated demand for water at a time when sugarcane prices (the dominant crop) were at relatively low level, but with the expectation that prices are likely to improve over the period to 2030.[44]

Ongoing discussions with respondents resulted in the removal of some demand from the central case demand profile, i.e. it is not considered likely. As a consequence, the total volume of likely agricultural demand consists of 22,417 ML of MP water allocations and 1,688 ML of HP water allocations. While demand for water is related predominately to sugarcane production (14,000 ML) and tree crops such as avocados, mangoes and mixed fruits (9,327 ML), all of this demand is for MP water. Demand for HP water is largely spread across vegetables, fruit trees and sugarcane.

Figure 5-20 Willingness to pay (for given HP and MP volumes), by given crop types



In terms of location of demand, the majority of respondents in the likely demand category indicated Arriga, Dimbulah or Mutchilba as the location for delivery of the requested allocations. A small number of respondents indicted Mareeba or Paddy's Green as their location for delivery.

All of the likely demand is within the MDIA. Sunwater has advised that most land can technically be supplied from either the existing distribution system or supplemented streams. However, for some of the land to the north of the Walsh River it may be more difficult due to the distance and possibly height from the river. Also, the Arriga main channel, which supplies a large proportion of existing sugarcane production in the MDWSS,

[44] World Bank, Commodity Markets Outlook, 2018.

is capacity constrained. A supply augmentation would be required to deliver additional water supplies to this area.

Both Dimbulah and Mutchilba can be supplied from Nullinga Dam via gravity, but the remaining areas would require a pipeline connecting to the existing channel scheme in order to deliver water from Nullinga Dam. Approximately 2,000 ML of requested demand falls into this category.

Respondents to the RFI have indicated the time of commencement of demand and in some instances nominated the time profile of demand. However, the Nullinga Dam will not be able to supply water until all environmental approvals are secured after construction in 2026—that is, supply will not be available until 2030's at the earliest. Consistent with accepted profiles of time required for water uptake assessed by DAF, Table 5-3 sets out the likely timing of water uptake for the main enterprises.

Table 5-13 Number of years to reach full production by crop type[45]

Crop	Year 1	Year 2	Year 3	Year 4	Year 5	Years to full production
Fodder	100%					1
Sugarcane	50%	100%				2
Bananas	33%	67%	100%			3
Avocados	20%	40%	60%	80%	100%	5
Citrus[46]	20%	40%	60%	80%	100%	5
Mangoes	20%	40%	60%	80%	100%	5

5.3.2.2 Future Growth

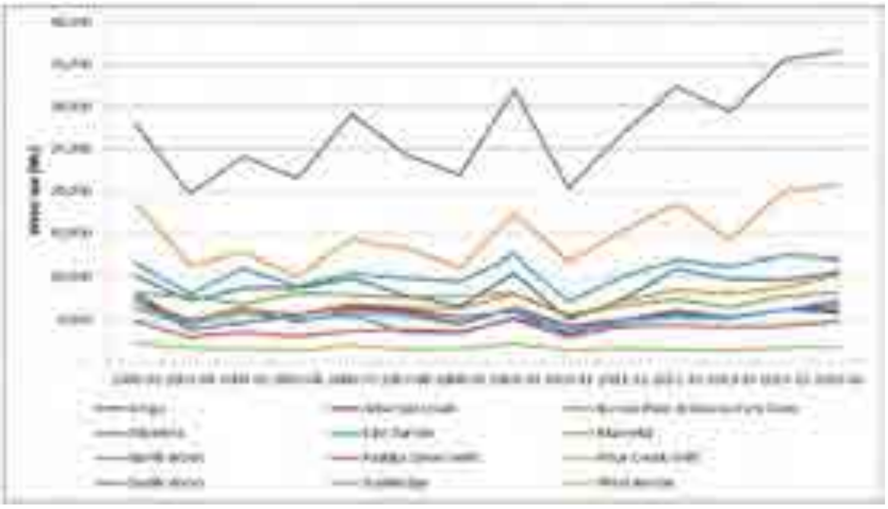
To account for the low response rate to the RFI compared to the considerable level of investment in on-farm infrastructure that is currently occurring in the MDWSS, the demand assessment included an allowance for future water demand growth.

Figure 5-21 shows the water use by subsystem in the MDWSS between 2002-03 to 2015-16. Over this period, the long-term rate of growth in agricultural water usage was 0.7 per cent per annum. Operational systems that have seen the most growth in terms of water use are South Walsh and Mareeba. The compound annual growth rates for South Walsh and Mareeba since 2002–03 are about 2.1 per cent and 3.5 per cent respectively.

[45] DAF 2017

[46] *Citrus, avocado and mango may take up to 7 years to deliver full benefits and may not deliver revenue for 3 years*

Figure 5-21 Water use (ML) from 2002-03 to 2015-16[47]



On this basis, the water demand profiles adopted for further analysis include a 0.7 per cent per annum allowance for future water demand growth. After allowing for full uptake of water associated with RFI demand, the growth allowance has been applied between 2034 and 2049. Due to the high level of uncertainty associated with demand projections, the growth allowance ceases at this time. On this basis, the growth allowance equates to approximately 20,000 ML per annum by the end of the evaluation period.

As the funded channel modernisation works (refer Section 2.4) are likely to be completed by 2023, the growth allowance will commence from this time. This equates to approximately 1,100 ML/a or 8,700 ML/a until 2030 (when Nullinga Dam is expected to come online). As the funded channel modernisation works will form part of the base case and is estimated to make 8,300 ML/a of allocations available for sale, the first 8,300 ML/a of this growth allowance will form part of the base case. While the remainder (400 ML/a) could form part of the reference project demand, due to the uncertainty associated with the growth allowance, it has been excluded from the reference project demand.

In total, the growth allowance applied to the demand assessment is capped at 20,000 ML/a, at an annual growth rate of 0.7 per cent per annum[48].

5.4 Influencers and constraints

This section examines a range of key influencers and constraints that can impact future demand and need to be considered, these include:

- land suitability
- market trends
- capacity to pay
- climatic conditions (variability and change).

Table 5-14 provides a summary on the implications of these influences on demand, with a detailed discussion provided further below.

[47] Sunwater data
[48] Ibid

Table 5-14 Demand influencers and/or constraints

SUMMARY OF ISSUE/S	IMPLICATION FOR DEMAND
POPULATION	
As part of the demand assessment, CRC provided their latest population forecasts to inform the DBC. CRC's population forecasts are based on QGSO population forecasts, and are produced for low, medium and high population growth rates. Recent population growth in CRC has been tracking on the low growth population estimate. Population growth in Cairns has seen ongoing 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. As at June 30, 2018, the estimated population reliant on this water supply network is 163,210[49]. Under the medium growth projection, this will increase to 223,410 by 2036 and 281,339 by 2051.	Yes Building Queensland have adopted the medium population growth estimate including demand management, as the basis for further analysis.
LAND	
Land is not considered a constraining factor on development of irrigated agriculture in the region. Analysis of soil suitability mapping has identified over 53,000 hectares with suitable soils for agriculture within and around the MDWSS. 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 MDWSS 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
CLIMATE	
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 very high 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 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 projected.	Unknown 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 PROUCER MARGINS	
Consideration has been made of producers' capacity to pay 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,	Yes The majority of customers seeking new allocations in

[49] CRC Correspondence, 24th August 2018

SUMMARY OF ISSUE/S	IMPLICATION FOR DEMAND
based on the RFIs and detailed subsequent discussions, have been compared with the results of an analysis of the capacity to pay of irrigators for different crop types. While the capacity of producers to pay is higher than stated for a variety of crop types, current and future demand for additional water allocation within the Study Area is predominately for sugarcane, where producers' capacity and willingness to pay are currently closely aligned	the MDWSS are unlikely able to pay much beyond stated water prices and maintain a healthy margin.

5.4.1 Land suitability

Currently, 50 per cent of the 53,000 hectares of suitable soils for agriculture identified in the MDWSS[50] is utilised for irrigated agricultural purposes, noting the area irrigated will fluctuate between 18,000 and 25,000 from year to year.

A large proportion of this land is in the western zones, particularly the South Walsh part of the system; while land towards the west of MDWSS is considered less fertile for agricultural purposes, it receives less rainfall and is therefore more dependent on water deliveries.

Soil suitability mapping has identified areas of potentially suitable land for:

- avocado of 20,025 hectares
- mango of 53,897 hectares
- sugarcane (furrow) of 20,161 hectares
- sugarcane (spray/trickle) of 53,177 hectares

This is a considerable increase on the results of the Queensland Agricultural Audit (2013) which found that there was between 7,000 and 9,000 hectares of land in the scheme area that could be further developed.

Land is not considered a constraining factor on development of irrigated agriculture in the region. While stakeholders have commented that the water from a Nullinga Dam 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 MDWSS will be influenced by wider market forces, including production, consumption and competition and access to domestic and international markets.

5.4.2 Market trends

Table 5-15 summarises current trends for select crop types. Based on these trends, it is clear that:

- there has been an increase in the global production of sugarcane over the last decade and ongoing protectionist policies in some international markets suggests ongoing (downward) pricing pressure is likely to continue
- expanded production of avocadoes and mangos may have an impact on pricing in the short to medium term, though it is noted that there's further opportunities to expand current market penetration (i.e. room to grow domestic and international sales).

[50] Soil mapping (DAF)

Table 5-15 Market trends and outlook

Crop type	Market trends / issues	Outlook
Sugarcane	▪ as of 2019, global production is expected to exceed consumption for the second year in a row, increasing stocks and placing downward pressure on prices[51] ▪ worst performing commodity on the Bloomberg Commodity Index for 2018 ▪ international government protectionist policies (e.g. India and USA) has seen growth in global sugar production over the last decade ▪ global consumers become more health conscious, food companies are responding by reducing sugars in their products and move towards alternative sweeteners ▪ global consumption of sugar is still rising, the pace of growth has slowed to an average 1.4 per cent in recent seasons, down from 1.7 per cent over the past decade	▪ overproduction is likely to continue in the short to medium term while international governments continue to implement protectionist policies for local producers (e.g. subsidies). ▪ prices will continue to be under pressure, with overproduction and possibility of a long-term reduction in demand as a result of increasing changes in consumer behaviour
Avocado	▪ recent and ongoing price growth on the back of high consumer demand (average wholesale price for avocados at the Brisbane market increased 78pc in 2017 compared to 2016[52]) ▪ Australian avocado production doubled in the five years to 2015-16, and forecast to double again by 2022-23[53] ▪ majority of Australian avocado supply is applied to meet domestic demand.	▪ ongoing downward pressure on prices and profitability in the medium term (next 5 to 10 years), with additional supply coming online ▪ Pricing and margin pressures may be alleviated through exploration and growth in export market (e.g. Japanese domestic market currently being targeted by the industry).
Mangos	▪ Australian industry is on track to produce over 10 million trays for the 2018-19 season (which runs from December to February), not far below the record crop of 2017-18. This is due to recent expansion in Mango plantings in northern Australia beginning to add to the supply of Mangos to the domestic market[54] ▪ consumption increased from 1.86 kg per capita in 2014 to 2.24 kg per capita in 2016. Around 43 per cent of Australian households purchased mangos in 2016. ▪ prices decreased last season, with the average price for Queensland mangoes sold in the Brisbane market were 20 per cent below the 2016/17 season average as a result of a long growing season resulting in an overlap of supply between Far North Queensland and the Burdekin region.	▪ short-term pricing pressure in the local QLD market ▪ domestic consumption has room to grow through continued investment in marketing[55] ▪ mature export market, though potential for expansion into the United States and the Middle East markets[56]

[51] ABARES March 2018 Outlook 2018 agricultural commodities report for the March Quarter
[52] Rural Bank's Australian Agriculture Outlook 2018
[53] ABARES March 2018 Outlook 2018 agricultural commodities report for the March Quarter
[54] NT Country Hour, https://www.abc.net.au/radio/programs/nt-country-hour/australia-forecast-to-produce-10-million-mango-trays-this-season/10377996
[55] Rural Bank, Australian Horticulture Annual Review 2018
[56] NT Country Hour, https://www.abc.net.au/radio/programs/nt-country-hour/australia-forecast-to-produce-10-million-mango-trays-this-season/10377996

Crop type	Market trends / issues	Outlook
	▪ price is more stable in the Melbourne market where NT produced mangoes are selling for an average of $21.39/8kg carton, down seven per cent compared to December 2017. ▪ main export markets for Australian Mangoes are New Zealand, Singapore, Hong Kong, China, South Korea and Japan	
Bananas	▪ production increased in 2016 ▪ 94 per cent of Australia's bananas come from north Queensland, primarily Tully where production increased by 42 per cent in 2016 to 163,966 tonnes. ▪ production increased around Atherton (+107 per cent), Babinda (+62 per cent) and Innisfail (+26 per cent)[57] ▪ consumption was 15.73 kg per capita in 2014, increasing to 16.37 kg per capita in 2016. ▪ 96 per cent of Australian households purchasing bananas in 2016. Bananas have been marketed well in the last few years particularly as 'nature's energy bar', encouraging consumers to choose bananas over processed energy products. ▪ in the five years to 2015–16 the number of Australian banana farms decreased by 33 per cent and the banana-bearing area increased by 41 per cent.	▪ increasing competition in the domestic market will continue to shift production of bananas towards a reduced number of larger and more efficient farms. ▪ production is projected to increase to 335,000 tonnes by 2022–23, up from a of forecast 315,000 tonnes in 2017–18[58]

5.4.3 Capacity to pay

To inform the analysis of future demand, consideration has been made of producer's capacity to pay 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. Where available, gross and net margin information from the Queensland Government's AgMargins website has been utilised in this assessment.[59] Representative and contemporary margin budgets were sourced for sugarcane, soybeans, and lucerne.

Gross margin budgets for avocados, bananas, and mangoes have been gathered from a variety of sources, and modified to reflect regional growing conditions, water requirements, and recent prices. These sources include DAF[60], Northern Territory Department of Business, Industry and Resource Development[61], and anecdotal evidence provided by local producers regarding crop yield response to water application.

The estimates of irrigators' preparedness to pay, based on the RFIs and detailed subsequent discussions, have been compared with the results of an analysis of the capacity to pay of irrigators for different crop types.

[57] Rural Bank, Australian Horticulture Annual Review 2018
[58] ABARES, Agricultural Commodities Outlook 2018, March Quarter
[59] AgMargins, Agricultural Gross Margin Calculator, http://agmargins.net.au/.
[60] Sugarcane-soybean rotation, avocado, lucerne, banana, mango.
[61] Mango.

Table 5-16 Comparison of preparedness to pay and capacity to pay

Crop	Preparedness to pay ($ per ML)	Gross margin (per ML)	Net margin (per ML)
Sugarcane	$1,000–$3,000 (mostly $2,000)	~$2,700–$3,300	~1,350
Avocados	$2,000–$3,000	n.a.	~$6,000
Hay (lucerne)	$2,000–$3,000	~$2,500–$2,700	~$1,700
Bananas	$3,000	n.a.	~$3,300
Mangoes	$2,000 - $4,000	n.a.	~5,000

The results of that comparison indicate that there is a higher capacity to pay than the preparedness to pay, for avocados and mangoes, though not for sugarcane (which makes up over 90 per cent of the known demand) or hay crops, where the difference is marginal.

5.4.4 Climate Variability and Climate Change

Australia's changing climate represents an ongoing and evolving challenge to individuals, communities, governments, businesses and the environment. Australia has already experienced increasing temperatures, shifting rainfall patterns and rising oceans.

The Intergovernmental Panel on Climate Change (IPCC) *Fifth Assessment Report* (IPCC, 2013) rigorously assessed the current state and future of the global climate system. The report concluded that:

- greenhouse gas emissions have markedly increased as a result of human activities
- human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes
- it is extremely likely that human influence has been the dominant cause of the observed warming since the mid- 20th century
- continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system.

As established above, both agricultural and urban water requirements will be impacted by the future climate characteristics of the region. In addition, the estimated availability of water from Nullinga Dam is heavily reliant on rainfall and evaporation patterns experienced by the Walsh River catchment. As a consequence, the future outlook of the climate in the region will heavily influence both the potential supply and demand within the MDWSS and its bulk water supply sources.

In 2015, CSIRO released a series of reports presenting potential projections for climate within clusters of Natural Resource Management (NRM) regions. CSIRO and the Australian Bureau of Meteorology have prepared tailored climate change projection reports for each NRM cluster. These projections provide guidance on the changes in climate that need to be considered in planning (noting the study area is within the Wet Tropic Cluster of these NRM regions).

The global climate model simulations presented here represent the full range of emission scenarios, as defined by the Representative Concentration Pathways (RCPs) used by the IPCC, with a particular focus on RCP4.5 and RCP8.5. The RCP's have been constructed from assumptions regarding emission trajectories and concentrations, energy use, population, air pollutants and land use, and the consequent radiative forcing and temperature changes. RCP 4.5 represents a pathway consistent with low-level emissions, which stabilise the carbon dioxide concentration at about 540 ppm by the end of the 21st century. RCP 8.5 is representative of a high-emission scenario, for which the carbon dioxide concentration reaches about 940 ppm by the end of the 21st century.

On annual and decadal basis, natural variability in the climate system can act to either mask or enhance any long-term human induced trend, particularly in the next 20 years and for rainfall.

5.4.4.1 Temperature

Temperatures[62] in the cluster have been increasing since national observations began in 1910, especially since 1960. Between 1910 and 2013, mean surface air temperature increased by 1.1 °C using a linear trend. For the same period, daytime maximum temperatures have increased by 1.0 °C and overnight minimum temperatures have increased by 1.2 °C using a linear trend. 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 (10^{th} to 90^{th} percentile) above the climate of 1986–2005 (centred at 1995), with only minor differences between RCPs. For the late in the century (2090) mean warming is 1.0 to 2.0 °C for RCP4.5 and 2.3 to 3.9 °C for RCP8.5.

More hot days and warm spells are projected with very high 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). By 2090, the number of days above 35 °C in Cairns is projected to change from 3 days currently to 11 days under RCP4.5 for median warming.

5.4.4.2 Rainfall

Changes to rainfall are possible but the direction and magnitude of change is unclear. There is *high confidence* that natural climate variability will remain the major driver of rainfall changes by 2030 (20-year mean changes of -10 to +5 per cent annually, and with a larger range seasonally) as it has been in the recent past. For 2090, the magnitude of summer and autumn changes is -15 to +10 per cent under RCP4.5 and -25 to +20 per cent under RCP8.5. The winter changes range from around -30 to +30 per cent under RCP4.5 and -40 to +45 per cent under RCP8.5. Such contrasting model simulations highlight the need to consider the possibility of both a drier and wetter climate in impact assessment in this cluster.

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.

5.4.4.3 Evaporation

With *high confidence* potential evapotranspiration is projected to increase in all seasons with the largest changes in summer by 2090. However, despite high model agreement, there is only *medium confidence* in the magnitude of the projected change due to shortcomings in the simulation of observed historical changes.

Changes in soil moisture and runoff are strongly influenced by changes in rainfall but tend to be more negative due to the increase in potential evapotranspiration. Decreases in soil moisture are projected, particularly in winter and spring, with medium confidence. The projected annual changes for RCP8.5 late in the century (2090) range from around −20 to +5 per cent with medium model agreement on decreases, except spring where there is medium agreement on little change.

[62] McInnes, K. *et al.,* 2015, *Wet Tropics Cluster Report*, Climate Change in Australia Projections for Australia's Natural Resource Management Regions: Cluster Reports, eds. Ekström, M. *et al.*, CSIRO and Bureau of Meteorology, Australia.

Runoff could increase or decrease following RCP4.5 and RCP8.5 for 2090 relative to 1986–2005, though the majority of models suggest decreases. There is low confidence in these projections because in addition to low agreement on direction of change by the models, the method used is not able to consider changes to rainfall intensity, seasonality and changes in vegetation characteristics.

5.4.4.4 Likelihood of Droughts / Floods / Cyclones

There is *high confidence* that the intensity of heavy rainfall events will increase, mainly due to a warmer atmosphere being able to hold more moisture. 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 regional climate. Projected changes to drought share much of the uncertainty of mean rainfall change, and as such there is no clear indication on changes to drought conditions, although there is a simulated tendency for an increase in extreme drought frequency. Given the importance of the El Niño Southern Oscillation for rainfall in the Wet Tropics cluster, it is worth noting that there is some indication that these events will intensify under global warming, which would lead to an intensification of El Niño driven drying. Meteorological drought will continue to be a regular feature of regional climate and while it may change its characteristics as the climate warms, due to uncertainty in rainfall projections, there is low confidence in projecting how the frequency and duration of drought may change.

Tropical cyclones are the major feature of severe weather in the Wet Tropics, causing strong winds, heavy rainfall, storm surges and severe ocean wave conditions. Forecasts for the Wet Tropics region predict a likely decrease in their frequency. These results are broadly consistent with projections of tropical cyclones over the globe that present a range of forecasts from little change through to substantial *decrease* in frequency. The proportion of the most intense cyclones is likely to increase over the century while the intensity of associated rainfall may increase further. In summary, tropical cyclones are projected with medium confidence to become less frequent with increases in the proportion of the most intense storms.

5.4.4.5 Consequences for the NDMIP

Based on this information, climate variability and climate change have the potential to significantly impact on both supply and demand aspects of any proposed Reference Project. As with all dams, Nullinga Dam is reliant on rainfall in order to deliver water to potential agricultural and urban customers. It is likely that climate variability will remain the key driver of rainfall variability for the short to medium term. Climate modelling has identified that changes to rainfall are possible, but the direction and magnitude of change is unclear. An increase in the frequency of extreme droughts has the potential to have a significant impact on the yield and associated reliability of Nullinga Dam.

Given this uncertainty, hydrologic modelling informing the yield and associated reliability of Nullinga Dam will need to consider both drier and wetter potential climates. The likely increase in potential evaporation will also impact on the availability of water by increasing losses from Nullinga Dam. Potential decreases to soil moisture and runoff would also be expected to impact on water availability from Nullinga Dam. This Impact will also need to be factored into hydrologic modelling when assessing potential climate change impacts.

In terms of potential impacts on urban demand, increases in both average temperatures and frequency of hot days has the potential to drive increasing water use for human consumption as well as outdoor water use. Potential changes to the frequency and intensity of rainfall events, along with increasing evaporation and decreasing soil moisture may also impact on outdoor water use. Given CRC's reliance on annual flows to fill Copperlode Falls Dam and their other current and planned supply augmentations are run-of river sources, any reduction in average rainfall or increase in the frequency of droughts, in particular extreme droughts, has the potential to have an impact on CRC's reliance on any new or augmented water source (able to support new water allocations), both to avoid increasing frequency and severity of water restrictions as well as increasing likelihood of water supply shortfalls.

In terms of agricultural water use, increasing evapotranspiration and decreasing soil moisture has the potential to lead to an increased reliance on irrigation to maintain soil moisture levels[63]. Changes to the likelihood and intensity of rainfall events, along with changes to intra-annual rainfall patterns would have impacts on the volume and timing of irrigation requirements. Given the trend towards high-value, perennial horticulture, any increase in the frequency of extreme droughts would have a commensurate impact on the productivity and viability of these operations without access to reliable water supplies.

5.5 Service Need

In consideration of the current water supply conditions (refer Section 5.2) and having regard to the need for additional urban supply demands (refer Section 5.3.1) and potential future opportunity to stimulate agricultural production to meet projected producer demand (refer Section 5.3.2), the primary problem and opportunity have been identified as the service need for the NDMIP.

The service need identified for further analysis is two-fold. Under CRC's Water Security Strategy, Cairns will require access to Nullinga Dam by the mid 2050's in order to meet their projected water demand while still meeting their stated Level of Service objectives. In addition, access to a second supplemented supply source would reduce the likelihood and frequency of water restrictions and potential water supply shortfalls.

In terms of agriculture, access to water within the existing MDWSS is constrained, with existing allocations fully taken up and highly utilised. Access to water is a limiting factor for further agricultural development in the MDWSS. By making available additional water allocations for consumptive use, further agricultural development in the MDWSS is likely to occur.

[63] Wang et al, Adaptation to climate change impacts on water demand, Mitigation an Adaptation Strategies for Global Change, June 2014

Figure 5-22 Identified Service Need (Need and Opportunity)

1. To address future urban water supply needs for Cairns

- Provide for increasing water demand growth in Cairns
- Reduce likelihood and frequency of water restrictions and water supply shortfalls in Cairns

2. Increase water availablility for agricultural activities in support of expected future demand across the MDWSS

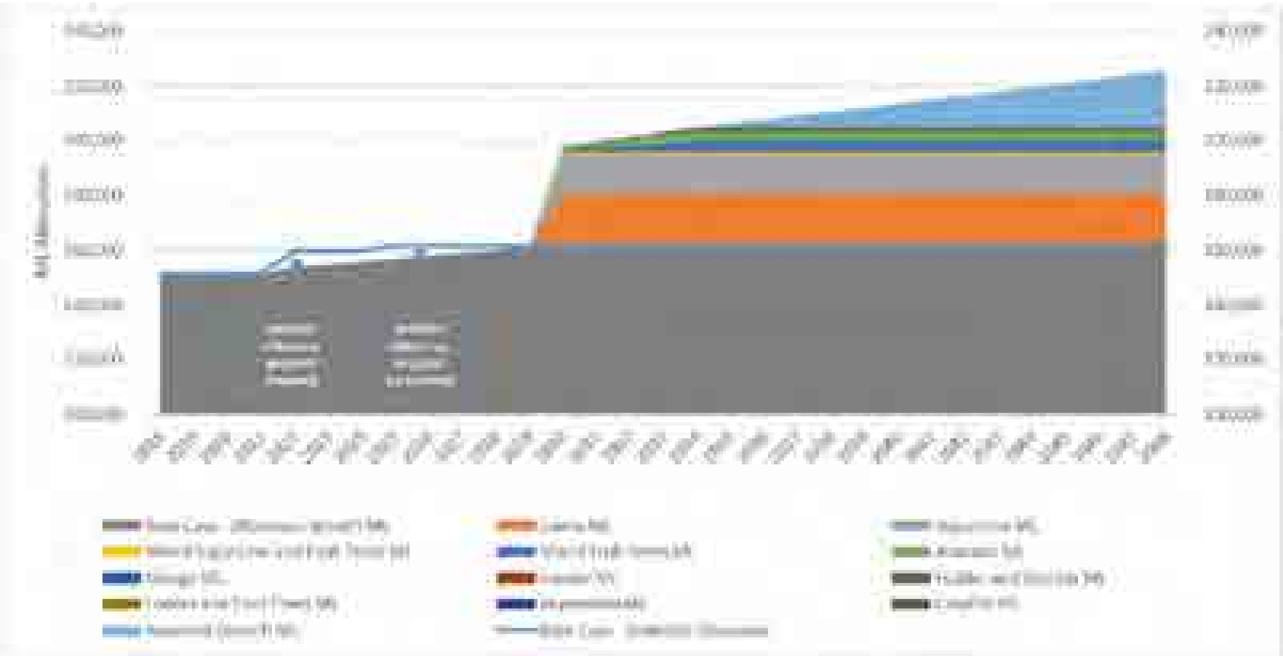
- Provide for incremental expansion of existing agricultural producers

5.5.1 Demand Profiles

The demand assessment considered six demand scenarios in detail. While the assessment determined three scenarios were 'most likely', only two have been adopted as the central case scenario for this DBC[64]. These include a scenario with and without proposed expansion plans of local producers.

- **Scenario A**: Demand is based on RFI responses classified as 'likely' and is phased in over several years (as per Table 11) and then 0.7 per cent annual growth rate thereafter. It also incorporates CRC's intention to purchase HP allocation.

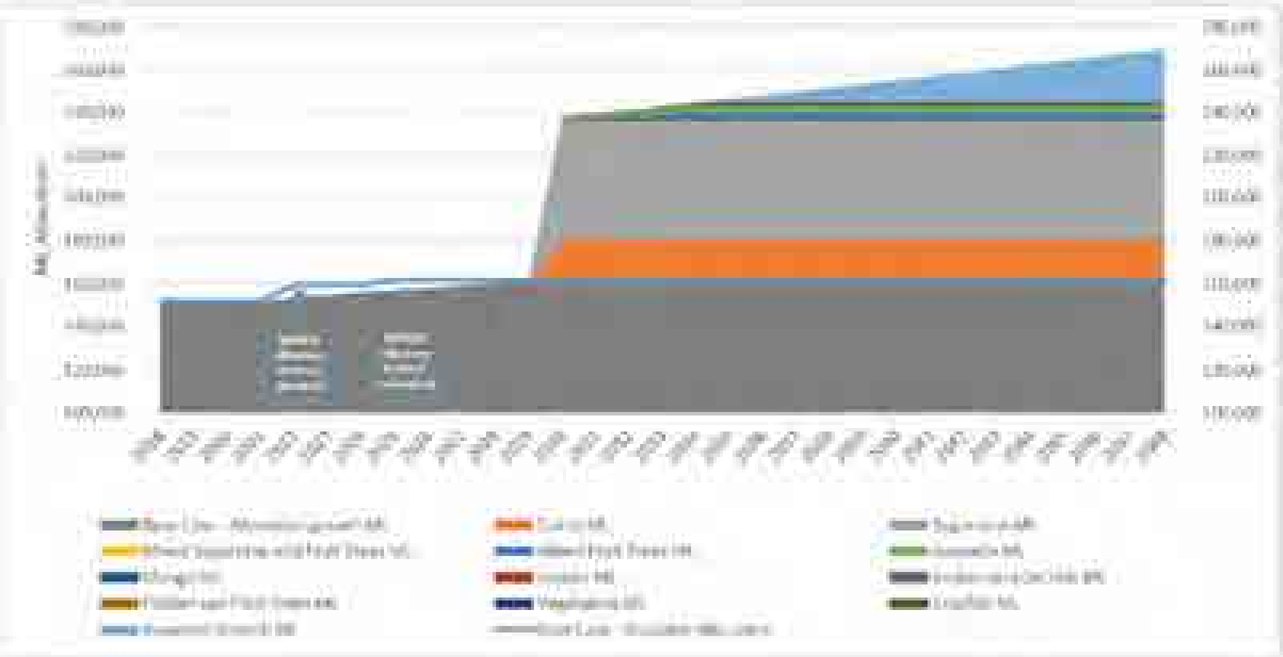
Figure 5-23 Demand profile for Scenario A



[64] It is acknowledged that the additional demand from another potential customer, identified after the formal submission period for RFIs was closed, is significant. However, as the potential new dam solutions considered in the DBC are already potentially oversubscribed at a stated price of $2,000 per ML of MP and $3,000 per ML for HP, this demand has not been included in the analysis.

- **Scenario B**: Demand is based on RFI responses classified as ‘likely’ and is phased in over several years, and then 0.7 per cent annual growth rate thereafter. It also incorporates CRC’s intention to purchase a HP allocation and 40,000ML MP/a to support potential expansion plans of local producers.

Figure 5-24 Demand profile for Scenario B



5.5.2 Total Demand

In terms of agriculture, access to water within the existing MDWSS is constrained, with existing allocations fully taken up and highly utilised. Access to water is a limiting factor affecting further agricultural development in the MDWSS. By making additional water allocations available, at a price that aligns with producer’s capacity to pay, further agricultural development in the MDWSS is likely to occur.

At a price of between $2,000 (for MP) and $3,000 (for HP) per 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[65].

Table 5-17 Demand for new water allocations (upon availability), at stated price

TYPE	TOTAL DEMAND AGRICULTURE AND URBAN ML/A
New HP allocation *Stated price of $3,000 per ML*	15,021
Conversion factor[66]	*1.429*

[65] The central case demand scenario assessed in this DBC considers demand with and without potential expansion plans of local producers
[66] Barron Water Management Protocol (June 2017), 1 divided by 0.7

TYPE	TOTAL DEMAND AGRICULTURE AND URBAN ML/A
MP equivalent	21,458
New MP allocation *Stated price of $2,000 per ML*	62,417
Total MP or equivalent	**83,875**

It is further noted that, in addition to the above demand a reasonable growth allowance of 0.7 per cent per annum should be assumed under the central case (capped up to a total of 20,000 ML/a of MP). It is further noted that there has been interest in a significant volume of MP allocations, after the formal submission period for RFIs had closed, from another potential customer.

5.6 Benefits

It is anticipated that addressing the need and opportunities outlined in Section 5.5, the benefits identified in Table 5-18 may be captured.

Table 5-18 Anticipated benefits from addressing the service need (for review / revision and update)

BENEFIT-RELATED PROJECT OUTCOME	BENEFIT DESCRIPTION	BENEFIT TYPE	BENEFIT UNIT OF MEASURE
Additional water available for customers in the Study Area	New agricultural production as a result of increase water availability (particularly in the MDWSS)	Quantitative, non-financial	ML used by ag. users
Increase in regional employment from increased agricultural production	Increase in number of direct additional agricultural jobs created	Quantitative, non-financial	FTEs
	Increase in agricultural sector contribution to GRP	Quantitative, financial	Dollars ($)
Improved use of existing resources	Improved hydrological performance without impacting EFOs	Quantitative, non-financial	EFOs and associated KPIs
	Reduction in water losses	Quantitative, non-financial	ML
Enhanced confidence to invest in long term business operations / opportunities	Level of business confidence within the agricultural sector	Quantitative, financial	Dollars ($)
Improved, enhanced or updated recreational offerings	Improved facilities for users	Quantitative Non-Financial	No. of recreational visitors

5.7 Stakeholders

Table 5-19 provides a summary of identified project stakeholders and their interests in the NDMIP. Further detail on stakeholder engagement is provided in Section 12.2.

Table 5-19 Stakeholders and project interest (For Review / Revision and update)

STAKEHOLDER CATEGORY	STAKEHOLDER	INTEREST/S
Internal Stakeholders		
Project Partners	Sunwater	Project proponent
	Building Queensland	DBC Lead (engaged by the proponent)
Commonwealth Government		
Departmental Ministers	Minister for the Environment	▪ Alignment with federal objectives and plans ▪ Infrastructure that is properly planned and timed ▪ Investment decision / approval ▪ Environmental approvals / requirements
	Minister for Infrastructure, Transport and Regional Development	
	Minister for Agriculture	
	Minister for Water Resources, Drought, Rural Finance, Natural Disaster and Emergency Management	
	Minister for Resources and Northern Australia	
Elected Minister/s	Federal Member for Kennedy	▪ Alignment with federal objectives and plans ▪ Infrastructure that is properly planned and timed ▪ Local economic, social and environmental impacts
	Federal Member for Leichhardt	
Cwlth Departments and Authorities	Department of Infrastructure, Regional Development and Cities	▪ Alignment with federal objectives and plans ▪ Infrastructure that is properly planned and timed ▪ Construction and operational impacts and mitigation / management activities ▪ Review of the DBC and investment justification ▪ Funding submission / application and agreement under the NWIDF
	Department of Agriculture	
	Department of the Environment and Energy	
	Great Barrier Reef Marine Park Authority	
	Infrastructure Australia	
Queensland Government		

STAKEHOLDER CATEGORY	STAKEHOLDER	INTEREST/S
Premier and Departmental Ministers	Premier and Minister for Trade	▪ Investment decision / approval ▪ Alignment with other QLD Government department objectives and plans ▪ Infrastructure investment that is properly planned and timed
	Deputy Premier, Treasurer and Minister for Aboriginal and Torres Strait Islander Partnerships	
	Minister for Environment and the Great Barrier Reef, Minister for Science and Minister for Arts	
	Minister for Natural Resources, Mines and Energy	
	Minister for State Development, Manufacturing, Infrastructure and Planning	
	Minister for Transport and Main Roads	
	Minister for Agricultural Industry Development and Fisheries	
	Minister for Local Government, Minister for Racing and Minister for Multicultural Affairs	
Elected Representatives	Member for Cook	▪ Alignment with Federal and State objectives and plans ▪ Infrastructure that is properly planned and timed ▪ Local economic, social and environmental impacts
	Member for Cairns	
	Member for Barron River	
Departments and Authorities	Office of the Coordinator-General (Department of State Development)	▪ Alignment with other QLD Government department objectives and plans ▪ Infrastructure investment that is properly planned and timed ▪ Review, input and feedback on the DBC ▪ Ongoing management and delivery activities
	Queensland Treasury	
	Department of Transport and Main Roads	
	Department of Environment and Science	
	Department of Agriculture and Fisheries	
	Department of Natural Resources, Mines and Energy	
Local Government		
Councils	Cairns Regional Council	
	Mareeba Shire Council	

STAKEHOLDER CATEGORY	STAKEHOLDER	INTEREST/S
	Tablelands Regional Council	▪ Improved conditions and services for local residents and businesses ▪ Job creation ▪ Impact on environment ▪ Advancing the area's status as an attractive place to invest ▪ Increase in agricultural production ▪ Cost of project
Community and Business		
Landholders	Directly affected landholders and tenement holders at the proposed Nullinga site, including properties impacted by associated inundation	▪ Accessibility, to and from property and local crossings ▪ Management activities (including engagement/communication, risk and delivery management activities) during construction and operations ▪ Property damage, loss and compensation
Environmental Groups	Australian Conservation Foundation Cairns and Far North Environment Centre	▪ Minimising and/or mitigation of environmental impacts ▪ Monitoring and reporting activities
Business	Various local commercial entities and producers	▪ Improved conditions for local residents, industry and the agriculture sector ▪ Minimal disruption to the local community and businesses during construction ▪ Advancing growth in the agricultural sector ▪ Job creation in the region

STAKEHOLDER CATEGORY	STAKEHOLDER	INTEREST/S
Industry Bodies	Tablelands Futures Corporation Regional Development Australia Far North Queensland and Torres Strait Mareeba Dimbulah Irrigation Area Council Mareeba Fruit and Vegetable Growers Association Mareeba Chamber of Commerce AgForce	▪ Improved conditions for the agricultural and industry sectors ▪ Advancing the region's status as an attractive place to invest
Utilities	Telstra, Optus, Energex	▪ Service supply requirements during construction ▪ Service supply requirements for operations
Community and/or Education Groups	James Cook University Advance Cairns	▪ Improved conditions for local residents, industry and the agriculture sector ▪ Minimal disruption to the local community and businesses during construction ▪ Effective WHS processes
Cultural Heritage	The Alliance of the Northern Gulf Indigenous Corporations (ANGIC) North Queensland Land Council (NQLC)	▪ Contributors to CHMP (nominated representatives) ▪ Effective implementation of the CHMP ▪ Any native title or cultural implications
Media	Television stations, print media, radio stations	▪ What is being done and by whom ▪ Project cost ▪ Why this is needed ▪ How long it will take to plan and build ▪ Value for money for taxpayers