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Water supply requirements in the North and South Burnett

Options Analysis

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4A	20 October 2020	Final report	Chris Hewitt, Sebastian Vanderzeil, Cameron Smith, Tom Vanderbyl	Matt Bradbury	Angus MacDonald

Statement by the Department of Natural Resources, Mines and Energy

The North and South Burnett Feasibility Study was funded by the Australian Government through the National Water Infrastructure Development Fund. The proponents for the assessment were the North Burnett Regional Council and the South Burnett Regional Council.

The two councils, as proponents, coordinated stakeholder engagements and public consultations.

To assist with managing the interrelationships related to matters such as demand for water and options across the study area and to maximise value for money, the Department of Natural Resources, Mines and Energy procured the consultant – Jacobs - on behalf of the Councils and provided advice on appropriate assessment processes where necessary.

The recommendations of the study reflect an independent assessment by Jacobs of options to increase water supply and security across the two local government areas.

Contents

Glossary

AA	announced allocation
BCDF	Business Case Development Framework
BCR	benefit–cost ratio
BIEDO	Burnett Inland Economic Development Organisation
BIA	Bundaberg Irrigation Area
BoM	Bureau of Meteorology
BRC	Bundaberg Regional Council
BRI	Boyne River Irrigators
BRIA	Boyne River Irrigation Area
BRIAC	Boyne River Irrigator Advisory Committee
BWSS	Bundaberg Water Supply Scheme
DNRME	Department of National Resources, Mines and Energy (Queensland Government)
DSDTI	Department of State Development, Tourism and Innovation (Queensland Government)
EIS	environmental impact statement
GVA	gross value of agricultural production
IA	Infrastructure Australia
IAC	(Sunwater) Irrigation Advisory Committee
IWSC	Irrigation and Water Supply Commission
LGAQ	Local Government Association of Queensland
NPV	net present value
NSP	Network Service Plan
NWIDF	National Water Infrastructure Development Fund
PHES	pumped hydro energy storage
PSC	Project Steering Committee
QBWOS	Queensland Bulk Water Opportunities Statement
QEGB	Queensland Electricity Generation Board
RECE	Rural Economies Centre of Excellence
RoR	rate of return
SANBAS	South and North Burnett Regional Agricultural Sub-Region

SBC	Strategic Business Case
SBRC	South Burnett Regional Council
SWASB	Sustainable Water Alternatives for the South Burnett Group
TPS	Tarong Power Station
WBBR	Wide Bay Burnett Region
WBBROC	Wide Bay Burnett Region Organisation of Councils

Executive summary

The North Burnett and South Burnett regions have substantial natural endowments—including being suitable for high-value agriculture (in terms of soil type and climate). They also have access to domestic and export markets and the strong expertise of existing farm enterprises. However, there is a need to improve the reliability and security of water in the region to strengthen and expand agricultural and industrial activity and ensure water security for urban users.

We undertook a structured assessment to identify preferred options for further development in the area—considering factors such as such as economic performance, social impact and affordability.

This options analysis (previously called a preliminary business case) has been prepared under the Building Queensland Business Case Framework. It builds on the assessment of service need and benefits identified within the North and South Burnett identified in the previously completed strategic assessment (previously called a strategic business case).

Our conclusion is that the Burnett region contains many opportunities to increase agricultural production and urban resilience, which will generate substantial economic value. Each of the shortlisted options for realising these opportunities have substantive advantages, but also potential risks, with affordability and environmental impacts chief among the risks identified in the analysis. These risks need to be better understood during the next phase of the assessment.

This options analysis provides four recommendations for advancing strategically important projects in North and South Burnett. The recommendations reflect the differences between the two areas that make up the study area.

The recommendations for North Burnett focus on irrigation opportunities and pursuing a detailed business case (in whole or in part) for two high-potential areas. Further analysis and de-risking will be necessary, in relation to, among other things, environmental approval, affordability and water user capacity and willingness to pay.

The recommendations for South Burnett are a strategic combination of build and non-build projects that seek to address the urban, irrigation and industrial challenges in the region. There is both significant uncertainty and opportunity in South Burnett over the short, medium and long term; therefore, this options analysis recommends using this study as a platform to build a water-focused economic roadmap for the region.

Background

Improvements in water reliability and security could generate material benefits for the economic and social lives of present and future residents in the region and the State of Queensland.

In particular, the region has underutilised high-quality soils with significant agricultural production potential for domestic and international markets. Projects to increase irrigated agriculture production in existing and new agricultural areas across the region will have a positive impact.

A strategic business case, completed in April 2020, and this options analysis form part of an Australian Government-funded feasibility study to examine a range of options that increase water supply and security and deliver new jobs and economic growth in the North Burnett and South Burnett regions of Queensland—collectively the Burnett region. The final stage will be detailed business cases dealing with the preferred options.

Water in the Burnett River Basin is allocated and managed under the *Water Plan (Burnett Basin) 2014*. This water plan effectively caps the total volume of water that may be allocated in the basin—that is, existing water entitlements plus new entitlements that relate to planning provisions, including additional volumes of unallocated water reserves specified in the water plan.

The Burnett region has both good quality and very good quality soil for agriculture. Across the region, approximately 14,000–36,000 hectares are currently used for irrigation, leaving over 600,000 hectares of at least class 2 (incl. some class 1) and class 3 soil available for irrigation.

Crops grown in the Burnett region, and crops that could be grown on the available soil with additional water, are high-value crops. The region produces high economic returns to the state. The export potential for additional agriculture is also strong.

Stakeholder engagement

Stakeholder engagement is critical to the development of a robust options analysis. As part of the options analysis, 45 different stakeholder entities (individuals and groups), across a range of industries, communities and interests, were consulted. The project team conducted multiple field trips to the region during the development of the strategic business case and built on those in-person meetings with ongoing connections and consultations during the options analysis. Field trips were restricted during much of the options analysis period due to travel restrictions related to the coronavirus pandemic (Covid-19). Virtual and telecommunications consultations were utilised extensively, and one-on-one meetings and group meetings were undertaken with stakeholders from across the Burnett region.

The stakeholder engagement built on the findings of the strategic business case, identifying critical features of the longlisted and shortlisted options. Stakeholders were directly consulted about the issues and concerns relating to the proposed projects, and valuable insights were obtained on problems and solutions.

Reviewing previous studies and the most up-to-date reports and assessments is an important part of understanding, assessing and measuring the options under consideration. This study has considered a large and diverse collection of studies and technical reports, including (but not limited to) the studies summarised in Appendix A and otherwise referenced in this document.

Options analysis

To take advantage of the region's natural endowments, and to address identified impediments to growth, a longlist of options was developed. This was done in consultation with local stakeholders, and with reference to the large number of previous studies that had been completed. The longlist consists of 28 options.

The **high-level assessment** sought to identify options that were not feasible, against four key considerations:

- strategic and policy alignment
- legal and regulatory concerns
- public interest considerations
- strategic risk.

Each option was measured as having low, medium or high feasibility against each of the considerations, and infeasible options were going to be excluded from further analysis. However, from the assessment, all options turned out to be feasible and continued to the next phase of the analysis.

The next phase was a qualitative **multi-criteria analysis** that scored each of the options. The criteria and weighting for the multi-criteria analysis were determined by the Project Steering Committee.

The purpose of the multi-criteria assessment was to further reduce the number of options so that a more detailed economic, financial and environmental assessment could be undertaken of a smaller number of options. In order for an option to be excluded, there needed to be convincing evidence to show that it was not worth pursuing at this time. However, a small number of projects showed considerable merit even though they were not suitable for the more detailed assessment in the options analysis. We recommend that they be pursued by the relevant government agency.

Table 1 shows the score of the multi-criteria assessment and whether the options has been shortlisted. The options are colour-coded as follows.

The option has been shortlisted, as there is evidence that it can feasibly deliver the service needs and benefits sought	**The option has not been shortlisted, as there is evidence showing that the option will not deliver the service needs and benefits sought as well as other identified options. However, there may be factors that change over time which could increase the value of the option**
The option has been referred to the state government for further investigation and implementation	**The option has not been shortlisted, as there is significant evidence that the option will not deliver the service needs and benefits sought**

Table 1: Results of the multi-criteria assessment of options

Option number	Option	Multi-criteria analysis
1	Construct a re-regulating weir on the Boyne River	MCA score = 3.70 This option provides a substantive increase in reliability for existing allocations to an area of high agricultural potential with risks relating to environmental impacts and affordability **Shortlisted**
2A	Raise Jones Weir	MCA score = 2.75 This option does not deliver water to areas of highest demand and alone does not solve the identified problems in the area. However, in combination with other options it is considered in the shortlist as option 4I **Not shortlisted**
2B	Raise Jones Weir and build a pipeline to area of urban or irrigation demand	MCA score = 2.15 This option alone is insufficient to meet identified demand. However, in combination with other options it is considered in the shortlist as option 4I **Not shortlisted**
3A	Raise Claude Wharton Weir	MCA score = 2.85 This option does not deliver water to areas of highest demand and alone does not solve the identified problems in the area. However, in combination with other options it is considered in the shortlist as option 4I **Not shortlisted**
3B	Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	MCA score = 2.55 This option alone is insufficient to meet identified demand. However, in combination with other options it is considered in the shortlist as option 4I **Not shortlisted**
4A	Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	MCA score = 3.10 This option provides the full amount of water demanded by a highly fertile agricultural area, although at higher cost and risk profile than alternative options that deliver the same benefits. **Shortlisted**
4B	Build a pipeline from Paradise Dam to Coalstoun Lakes	MCA score = 3.80 This option provides the full amount of water demanded by a highly fertile agricultural area for a relatively low cost and low environmental impact **Shortlisted**

Option number	Option	Multi-criteria analysis
4C	Up to 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	MCA score = 2.90 This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the plan **Not shortlisted**
4D	Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	MCA score = 2.90 This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the Water Plan, which may not be possible **Not shortlisted**
4E	Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	MCA score = 2.90 This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the Water Plan, which may not be possible **Not shortlisted**
4F	Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	MCA score = 2.90 This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the Water Plan, which may not be possible **Not shortlisted**
4G	Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	MCA score = 2.80 This option has very high costs, and the outcomes of this option can be achieved more simply, and cheaper, by option 4B, which is on the shortlist **Not shortlisted**
4H	Build a pipeline from Paradise Dam to Tarong–Boondooma pipeline via Coalstoun Lakes	MCA score = 2.75 This option has very high costs and would likely be unable to secure the necessary public and private funding to proceed **Not shortlisted**
4I	Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	MCA score = 3.80 This option provides the full amount of water demanded by a highly fertile agricultural area and opens up water allocations that will facilitate the accessing of this new water. The option includes parts that have been identified and had some level of consideration previously. **Shortlisted**
5	Construct a re-regulating weir on Barambah Creek (Barlil Weir)	MCA score = 3.70 This option provides reliable, high-yield new water to an area of high agricultural potential with some uncertainty regarding existing approvals (new approvals may be required) and affordability **Shortlisted**

Option number	Option	Multi-criteria analysis
6	Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	MCA score = 2.35 This option is relatively high-cost for a low-reliability water product that is unlikely to provide substantive economic benefits. The Water Plan constrains the total available water. This option requires the same water as option 5, which is considered a superior project, unless further water is made available. **Not shortlisted**
7	Convert Gordonbrook Dam to irrigation use	MCA score = 0.95 This option increases the water security problem in South Burnett and imposes more stress on Boondooma Dam **Not shortlisted**
8	Construct water recycling plant at Swickers facility in Kingaroy	MCA score = 3.65 This option provides new water to a highly productive industrial water user at a low cost, with minimal risk and having a positive environmental impact **Shortlisted**
9A	Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	MCA score = 3.15 This option provides increased urban water security and improved quality to Kingaroy at a relatively low cost **Shortlisted**
9B	Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	MCA score = 3.30 This option provides increased urban water security and improved quality, to Kingaroy at a relatively low cost, and new water for agricultural users **Shortlisted**
10A	Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	MCA score = 2.70 This option is a permutation of options 9B, 9A, and 10B, which are all progressing to the shortlist. Due to the high cost of manufactured water, this option is considered the least promising of the bundle **Not shortlisted**
10B	Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook Dam to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	MCA score = 3.30 This option provides increased urban water security and improved water quality to Kingaroy at a relatively low cost, and new water for agricultural users **Shortlisted**
11	Remove the 70,000 ML cut-off rule in Boondooma Dam	MCA score = 1.00 This option removes a risk management mechanism for urban, industrial and energy generation security for limited tangible benefit **Not shortlisted**
12	Raise Boondooma Dam	MCA score = 1.65 This option has relatively high cost, will provide limited yield and will not be able to recover a substantive portion of capital or operational costs. The dominant user, Tarong Power Station, is scheduled to shut in 2036. **Not shortlisted**

Option number	Option	Multi-criteria analysis
14	Optimise in-scheme unsupplemented access rules	MCA score = 3.30 This option provides operational and efficiency benefits at a low cost, and it is most suitable for it to be progressed by the government, as it requires a statewide policy approach **Referred to the government**
15	Greater utilisation of the Wivenhoe pipeline (for Blackbutt irrigation)	MCA score = 3.60 This option provides new water to a highly fertile agricultural area with high potential economic return for low risk and could potentially provide full cost recovery **Shortlisted**
16	Private water harvesting	MCA score = 2.70 This option provides operational and efficiency benefits at a low cost, and it is most suitable for it to be progressed by the government. **Referred to the government**
17	Agricultural supply chain improvements	MCA score = 2.85 This option potentially provides administrative and efficiency, and it is most suitable for it to be progressed by the government **Referred to the government**

The shortlisted options were then assessed against further measures in greater detail.

A **social impact evaluation** found that long-term increases in irrigation water supply can increase employment levels through greater agricultural production and associated food processing industries. New build projects can also provide the greatest potential for negative social outcomes mainly through their impacts on existing property rights, cultural heritage, lifestyle and the environment.

An **environmental assessment** reviewed the environmental impacts of each of the infrastructure options. Most of the infrastructure projects involve creating or increasing storages in waterways with significant existing development. This development may create some environmental issues that would need to be managed. This assessment did not identify any issues that could not be resolved, but a more thorough investigation will be required for the detailed business case, and potentially an environment impact statement prior to construction.

A **sustainability assessment** found that the water infrastructure projects will create a long-term water product that can be used to sustainably increase agricultural production. The design and material choice for each project should be done in a manner consistent with best practice sustainability objectives.

An **economic analysis** showed that the economic benefits of the shortlisted options are generally strong, with several projects estimated to have a positive economic net present value and a benefit–cost ratio above 1.0, based on P90 costs. This indicates that the scarcity of water has been an impediment to growth. These options have the potential to materially increase employment in regions that have suffered low employment growth. Other options have a BCR slightly below 1.0, and further investigation could reduce the project risks and increase the BCR above 1.0.

A **financial and affordability analysis** calculated the full-cost recovery prices for each of the options, as well as the necessary prices under a range of government funding scenarios. This analysis indicated that some options (particularly the new build options) will require some level of upfront government contribution to be financially viable. When the economics benefits to Queensland are strong, there may be merit in providing an upfront government grant, combined with private irrigator investment, to realise these benefits. This analysis also identified risks relating to the willingness of some water users to pay the necessary water charges to access increased water supply or benefit from improved water reliability.

Option	Construction jobs	Ongoing jobs	BCR	NPV ($ million)	Possible government funding required
Construct a re-regulating weir on the Boyne River	98	60	1.01	0.24	$8 million
Construct a re-regulating weir on Barambah Creek	24	27	0.94	-0.8	$1 million
Build a pipeline from Paradise Dam to Coalstoun Lakes	140	453	1.25	34	$67 million
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	225	419	0.71	−61	$175 million
Raise Jones Weir; raise Claude Wharton Weir; build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes; and extend the downstream extent of the Upper Burnett Water Supply Scheme	157	453	1.31	38	$36 million
Construct water recycling plant at Swickers facility in Kingaroy		230	4.5	37	$0 to $2 million
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)		146	1.32	12	$0 to $0.7 million
Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)		18	2.47	16	
Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)		18	2.15	7	
Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)			2.13	6	

All of the shortlisted options were found to have considerable merit, and they should be investigated further in some way.[1] We have identified the most appropriate mechanism for each option to be progressed. While some of the options require more assessment, such as through a detailed business case, others can be progressed more rapidly in a fit-for-purpose assessment. A detailed outline of next steps in included in Appendix I.

Table 2: Next steps

Option	Status	Next steps	Who	When
Construct a re-regulating weir on the Boyne River	Further targeted investigations are required to refine the understanding of the project's viability (Appendix I refers).	Consider undertaking the recommendation for this project (Appendix I refers), including targeted demand, geotechnical and hydrological assessments to further verify the viability and commercial veracity of the project. Subject to the outcome of those investigations, determine whether it is appropriate to progress to a detailed business case.	North Burnett Regional Council	Immediately
Construct a re-regulating weir on Barambah Creek (Barlil Weir)	Further targeted investigations are required to refine the understanding of the project's viability (Appendix I refers).	Consider undertaking the recommendation for this project (Appendix I refers), including engaging with Sunwater, conducting a more detailed affordability assessment, testing demand and capacity to pay, and	South Burnett Regional Council	Immediately

[1] Three options were considered for Coalstoun Lakes and it is recommended that the detailed business case determine the best one or two to proceed as reference projects for that analysis. As outlined in this study, the option to construct a 65,000 ML storage on Barambah Creek and an irrigation network primarily for Coalstoun Lakes is the weakest of the three Coalstoun Lakes options due to the higher cost and risk.

Option	Status	Next steps	Who	When
		determining requirements for environmental approvals. Subject to the outcome of those investigations, determine whether it is appropriate to progress to a detailed business case.		
Build a pipeline from Paradise Dam to Coalstoun Lakes	Proceed to detailed business case	Prepare a scope to engage a suitably skilled and experienced consultant to lead the detailed business case, noting that an early activity for the business case is to further investigate the three options and seek to find one or two preferred options. However, this activity is highly dependent on the decisions regarding the future of Paradise Dam and the water stored within the dam, which are yet to be made.	The Coalstoun Lakes irrigators in conjunction with DNRME	Immediately
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes				
Raise Jones Weir; raise Claude Wharton Weir; build a weir on the Burnett River and an irrigation network primarily for Coalstoun Lakes				
Construct a water recycling plant at Swickers facility in Kingaroy	Continue to pursue funding opportunities Incorporate this project in the 25-year Economic Blueprint for South Burnett	Proceed with this project as part of the South Burnett Integrated Water Initiative. Confirm the commercial and technical terms of the proposed treatment plant with Swickers and provide any suggested refinements or improvements. Engage with state agencies, including Trade and Investment Queensland, Regional Development Australia and the Department of State Development, Tourism and Innovation as key stakeholders, on actions to advance this project. Work with Swickers to identify available state government funding to support the investment in the water treatment facility on the basis that it will facilitate business and employment growth. Work with Swickers to lodge suitable funding applications.	Swickers and South Burnett Regional Council	Immediately
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	Commence commercial enquiries with Seqwater, Stanwell and other allocation holders Incorporate this project in the 25-year Economic Blueprint for South Burnett	Proceed with this project as part of the South Burnett Integrated Water Initiative. Undertake further investigation to identify any infrastructure requirements to deliver water from the centralised off-take to individual water users. Commence commercial enquiries with Seqwater regarding purchasing a volume of water from Wivenhoe Dam. Commence commercial enquiries with Stanwell regarding accessing the Wivenhoe pipeline.	Blackbutt irrigators and South Burnett Regional Council	Immediately
Procure a permanent transfer of high priority water from the Tarong Power Station to secure	Commence commercial enquires with Stanwell	Proceed with this project as part of the South Burnett Integrated Water Initiative. Undertake further investigation in relation to the volume of additional high priority water	South Burnett Regional Council	Immediately

Option	Status	Next steps	Who	When
the urban water supply for Kingaroy	Incorporate this project in the 25-year Economic Blueprint for South Burnett	allocations it requires from Boondooma Dam in the short and medium term. Commence commercial enquires with Stanwell in relation to purchasing the required volume of high priority water allocations from Stanwell, including price, limitations on availability and issues relating future volume escalations.		
Assess the viability of converting Gordonbrook Dam to irrigation-only use in the medium and long term	Initiate a technical assessment Incorporate this project in the 25-year Economic Blueprint for South Burnett	Proceed with this project as part of the South Burnett Integrated Water Initiative. Initiate a technical assessment of Gordonbrook Dam to investigate and determine the best future use of the dam, including potentially replacing the pumps and upgrading water treatment capabilities; environmental measures to control discharge into the water storage; converting to irrigation; selling the dam; or decommissioning the dam.	South Burnett Regional Council	Immediately
Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	Further investigation Incorporate this project in the 25-year Economic	Proceed with this project as part of the South Burnett Integrated Water Initiative. Further investigation with potential irrigation customers downstream of Bjelke-Petersen Dam to identify the strength of demand at various price and reliability points and additional private infrastructure required by individual irrigators to access water. Conduct further investigations into technical requirements, design, environmental impacts and cost of a channel and pump system (or alternative system identified).	South Burnett Regional Council	Medium to long term opportunity—after the conclusion of the detailed business case for the proposed Barlil Weir
Optimise in-scheme unsupplemented access rules	Further investigation	Investigate the potential reforms and refinement to the access rules.	State government	Subject to other priorities, this could commence in the short term.
Agricultural supply chain improvements	Requires a coordinated government approach	Create an intra-government working group to conduct further investigations to understand the impediments to supply chain efficiency in the North Burnett and South Burnett regions. Conduct further industry consultations and investigations to identify available mechanisms, including administrative actions, to address the supply chain deficiencies.	State government	Subject to other priorities, this could commence in the short term.
Private water harvesting	Further investigation	Investigate the viability and value of harvesting floodwaters.	State government	Subject to other priorities, this could commence in the short term.

The options analysis makes the following four recommendations:

Recommendation 1: Further assessments for North Burnett and South Burnett regional council areas

It is recommended that further assessments detailed in Appendix I should be undertaken to refine understanding of the following two projects:

a) Construct a re-regulating weir on the Boyne River.

b) Construct a re-regulating weir on the Barambah Creek (Barlil Weir).

The assessments identified should be undertaken in collaboration with appropriate stakeholders to narrow project risks prior to deciding whether it is appropriate to progress to a detailed business case for either project.

Recommendation 2: Detailed business case for Coalstoun Lakes

It is recommended that a separate detailed business case should be undertaken for Coalstoun Lakes consistent with the additional NWIDF agreement. The nature of the reference project should be informed by and be aligned with the outcomes of the studies on the future of Paradise Dam and the current Burnett Basin Water Plan. As the outcome of these studies will not be known until 2021, it is recommended that the detailed business case consider at least two reference projects—one project that is reliant on water from Paradise Dam and one that is independent of Paradise Dam.

Recommendation 3: Referral of efficiency measures to the Queensland Government for direct review

It is recommended that the Queensland Government investigate, in collaboration with Sunwater:

a) optimised in-scheme unsupplemented access rules

b) refinements and efficiency improvements to rules relating to private water harvesting

c) regulatory and operational refinements to support agricultural supply chain improvements.

Recommendation 4: South Burnett Integrated Water Initiative

It is recommended that South Burnett Regional Council conduct a further investigation, and take direct action, in relation to:

a) procuring a permanent transfer of high priority water from the Tarong Power Station to secure the urban water supply for Kingaroy

b) securing a combination of private and public investment for the construction of a water recycling plant at Swickers facility in Kingaroy

c) the viability and process of converting Gordonbrook Dam from urban to irrigation use

d) securing additional water for irrigators in Blackbutt from Wivenhoe Dam to be transported through the Wivenhoe pipeline.

The council should formulate a 25-year economic roadmap that addresses points a) to d) above and provides a strategic direction for how the region will prepare for and manage strategic water opportunities.

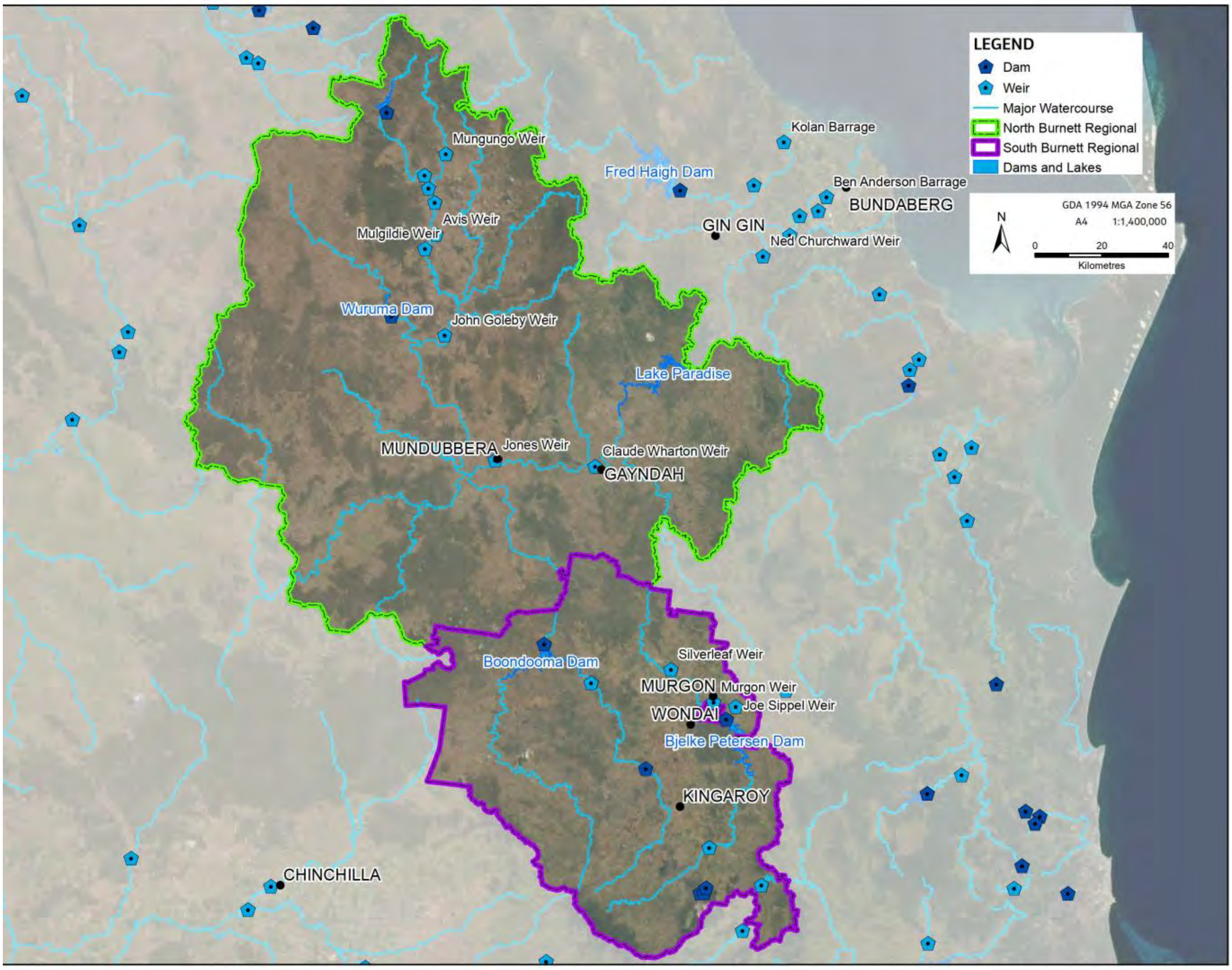
1. Study background

1.1 Study context

In November 2018, the Australian Government announced a grant via the National Water Infrastructure Fund to conduct a feasibility study to examine a range of options to increase water supply, reliability[2] and security[3], which would underpin an expansion of irrigated agriculture and delivering new jobs and economic growth in the North Burnett and South Burnett regions of Queensland. The grant is administered by the Queensland Department of Natural Resources Mines and Energy (DNRME).

The study area is provided in Figure 1-1.

Figure 1-1: Map of the study area



The objectives of the proposal are to:

- identify the extent to which insufficient access to reliable water supplies is constraining the economic development of the Burnett region, particularly in relation to agricultural and industrial production

[2] *Water reliability* refers to the portion of time that water demands can be met. It is usually specified in terms of the percentage of months (or, alternatively, years) of a defined historical period (usually 100 or more years) that a specific volume of monthly (or annual) customer water demands that are likely to be fully met by the volume of water available to that customer through the relevant water sharing rules

[3] Water *security* relates to the levels of service that might be expected from a water supply scheme when its surface water reserves become critically low. It is usually specified in terms of the frequency, duration and intensity of water restrictions that might be expected as a result of the long-term hydrologic risk of drought conditions occurring

- identify and assess the feasibility of water supply solutions that will provide the water supply reliability and/or accessibility required to enable an increase in the value of agricultural and industrial production.

There is a long history of studies, strategies and proposals examining the economic, environmental and climatological features and advantages of the North Burnett and South Burnett and associated potential for agricultural and industrial production (see Appendix A for a full literature review). For example:

- The highly fertile soils of the region are described in multiple documents. *Soils of the Riparian Lands of the Burnett River* in1996 (Appendix A, document 11) identified a high proportion of land close to the river that is suitable for irrigated cropping, and extensive areas suitable for irrigation some distance from the Burnett River. *Agricultural Land Resource Assessment of Coalstoun Lakes* in 2000 (Appendix A, document 30) identified significant areas suitable for expanded agricultural production based on soil quality and rainfall around the Coalstoun Lakes area.
- Multiple studies considered the economic advantages of the region, including proximity to domestic and international markets, existing transport infrastructure and human resources (*Economic Development and Innovation Strategy*: document 12; *Queensland Regional Profile: South and North Burnett,* 2019: document 14; *Water Transfer and Hydro Storage Study,* 2018: document 25; *Barambah Creek Proposal,* 2018: document 28).
- The *Regional Water Supply Security Assessment* in 2016 (Appendix A, document 16) considered the importance of water security to the economic development of the region. The assessment states that safe, secure and reliable water supplies are critical for sustaining economic growth the wellbeing of the community. Likewise, *Water for Economic Development* in 2018 (Appendix A, document 7) identified security and reliability concerns as a cause of low utilisation of water allocations.
- In the South Burnett, the South Burnett Regional Council's Water Futures Project aims to foster economic development, growth and regional sustainability by investigating known water supply and demand options, considering supply reliability, infrastructure capacity and water use efficiency initiatives.
- In the North Burnett, the Wide Bay Burnett Regional Organisation of Councils' (WBBROC) *Regional Water Strategy* (Appendix A, document 7) identified that within the North Burnett region, the realisation of opportunities to increase economic diversity and growth is currently hampered by a lack of reliable water.
- Various commercial projects' proposals for North and South Burnett identified the central importance of water reliability to generating economic activity and positive returns on the development of water storage and delivery infrastructure (*Getting Water for Peanuts*, 2018: document 26; *Barambah Creek Proposal*, 2018: document 28). The consultations relating the irrigation options on the Boyne River gave considerable attention to the issue of water reliability, including identifying water reliability as a primary benefit of the Cooranga Weir and Boondooma Dam Raising proposals (Appendix A, document 34).
- Water users surveyed on the Boyne River have consistently raised concerns about water reliability (Appendix A, document 38).
- *Irrigation on the Boyne River* in 2019 (Appendix A, document 42) concluded that improved water reliability would have positive impacts for the region, including improved efficiency, production improvements, expansion of the production area; and increases in the value to the regional economy.

A review of the above-mentioned and other studies and strategies identified three central themes:

1) The North Burnett and South Burnett regions contain significant environmental, climatological and economic advantages for agricultural and industrial enterprises, with associated regional economic benefits.
2) Water reliability and security are critical to these enterprises and the region.
3) There is a range of potential solutions for the water challenge in the North Burnett and South Burnett, including some low-cost initiatives that focus on the better use of existing water resources without the need for large-scale infrastructure development.

Guided by the findings of historical studies and strategies, a strategic business case (SBC) for the proposal was completed, in accordance with the Building Queensland Business Case Development Framework (BCDF) version 2 (Dec 2016). It was approved in April 2020.

The SBC found that there is a real and present service need—that is, to improve the reliability and security of water in the North and South Burnett regions to protect, strengthen and expand agricultural and industrial activity as well as ensure water security for urban users. The problems underpinning the service need were identified and confirmed via an Investment Logic Mapping process, and include:

- Problem 1: Security of urban water supply is poor and deteriorating, harming community welfare and limiting industrial expansion (South Burnett only).
- Problem 2: Existing agricultural supplemented water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment (North Burnett and South Burnett).
- Problem 3: Large areas of fertile land have no access to a reliable source of water, hindering crop yields, crop value and crop diversity due to dependence on unreliable seasonal rains (North Burnett and South Burnett).

The SBC concluded that improvements to the reliability and security of water can generate material social and economic benefits for present and future residents in the region and the State of Queensland.

It identified a longlist of options that could solve the identified problems and achieve the targeted benefits and recommended that a second stage (options analysis) be undertaken to further refine and assess the options.

The SBC options on the longlist are described briefly below.

Table 1-1: Options longlist

Option number	Option	Description
1	Remove the 70,000 ML cut-off rule in Boondooma Dam	The existing water sharing rules prevent medium priority (irrigation) supply once the water stored volume in Boondooma falls below 70,000 ML. This rule was designed to underpin the reliability of high priority water entitlements and was established prior to the construction of the Wivenhoe to Tarong pipeline. Removing the cut-off rule would require reform of the water sharing rules for the Boyne Tarong Scheme.
2	Interchangeable water allocations between schemes	This option may provide a means for water allocations to be moved from an underperforming water supply scheme to a location where new water infrastructure is being contemplated but where unallocated water reserves in the water plan are insufficient to underpin the additional yield at the new location. The reliability of water allocations in the scheme from which the water allocations are moved would also be improved due to there being less volume to supply in that scheme
3	Optimise in-scheme unsupplemented access rules	This option would involve optimising in-scheme unsupplemented access rules to enable the use of forecast (rather than the current actual) downstream water levels when making water harvesting announcements (in relation to both the commencement and cessation of water harvesting events). This will allow greater utilisation of water harvesting opportunities by existing unsupplemented water allocations and support expansion of irrigated agriculture.
4	Greater utilisation of the Wivenhoe to Tarong pipeline	There currently is a pipeline from Wivenhoe Dam to the Tarong Power Station. It is primarily used to supply water to the Tarong Power Station (used in conjunction with Boondooma Dam). If this pipeline could be greater utilised, there would be less requirement for existing water allocations to be held in Boondooma Dam, thus freeing up water for other users—such as urban and industrial users.
5	Raise Boondooma Dam	Raise the wall by 12 m (or similar) using fixed crest structure without gates to increase capacity by 396,000 ML, to 600,000 ML.
6	Raise Claude Wharton Weir	Raise the Claude Wharton Weir full supply level by 1.5 m by installing crest gates to replace lost volume from rubber bag deflation.
7	Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	Raise the Claude Wharton Weir full supply level by 1.5 m by installing crest gates to replace lost volume from rubber bag deflation. This water could then be transported through a pipeline to areas where soil suitability is high, possible to the South side of the Burnett River, or to Coalstoun Lakes. A pipeline reduces transmission losses and allows water to be delivered to suitable areas that are not adjacent to a river.

Option number	Option	Description
8	Raise Jones Weir	The weir could be raised by 1.4 m to double to volume of stored water. The land has been acquired and some design work done by Burnett Water.
9	Raise Jones Weir and build a pipeline to area of urban or irrigation demand	The weir could be raised by 1.4 m to double to volume of stored water. The land has been acquired and some design work done by Burnett Water. This water could then be transported through a pipeline to areas where soil suitability is high. A pipeline reduces transmission losses.
10	Construct a re-regulating weir on the Boyne River	It takes five to ten days for water to reach irrigators on the Boyne River after been released from Boondooma Dam with significant losses incurred (up to 50 per cent). There are further inflows downstream of the dam that could be captured if there were a re-regulating weir. Other potential locations to investigate include at 33.8 AMTD and 33.95 AMTD.
11	Construct a re-regulating weir on Barambah Creek	Build a new weir on Barambah Creek to increase water reliability of existing allocations. This will also improve alignment of agricultural water allocations to demand in areas containing fertile soils. Potential solutions include Barlil Weir (135 km upstream of its convergence with the Burnett River and about 8 km north-west of the township of Murgon). The Barlil Weir could have a capacity of 1,000 ML and annual yield of 3,000 ML.
12	Water harvesting	This off-stream storage concept is based around harvesting wet-season floodwaters for later use to irrigate riparian and near riparian lands. It could be expected that this type of development would be replicated in multiple locations across lands that have previously been identified noting static lift and distance from watercourse.
13	Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	The dam site located at 39.3 km is located downstream of the confluence with Boonara Creek upstream of where the valley opens out into broad plains. A 48 m high dam is needed for 250,000 ML storage with the spillway on the right abutment. The abutments slope at 20–22 degrees in basalt and the riverbed was obscured with water at the time of the geological appraisal. There are multiple possible combinations of irrigation networks that could be developed.
14	Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	Site at 41.6 km—this is located downstream of the confluence with Boonara Creek where the creek makes a sharp bend from the northeast to the northwest. The site is in a steep gorge with left bank slopes of greater than 50 degrees and right bank slopes increasing from 12 degrees to 40 degrees about 35 m above the river. The riverbed was obscured but a rock bar was causing the water to drop 1.5 m at the dam axis. The left abutment was noted to have evidence of land sliding and instability. There are multiple possible combinations of irrigation networks to deliver this water
15	Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	Site at 43.0 km—this is located upstream of the confluence with Boonara Creek. A 62 m high dam with storage of 280,000 ML was recommended. The dam site is in a symmetrical valley of 20-degree slopes. Water was ponded over the riverbed obscuring observation of rock. A tributary constrains the downstream end of the left abutment at this site and the saddle of the right abutment presents a good location for a spillway structure. The dam has a capacity of 210,000 ML. There are multiple possible combinations of irrigation networks to deliver this water as per Option 13.
16	Build a pipeline from Paradise Dam to Tarong–Wivenhoe pipeline via Coalstoun Lakes	Vertical integration project with hydro-electricity generation for pumping water to high demand areas with surplus electricity fed into the grid. Infrastructure: for water (170 km pipeline, pump-stations, balance reservoirs, distribution networks); and energy (head and tail ponds, penstock, transmission). A 170 km pipeline connects Paradise Dam to Tarong–Boondooma pipeline. Source 55 GL from Paradise Dam.
17	Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	A 100 km pipeline between Paradise Dam and Lake Boondooma would transfer surplus Paradise Dam water allocations. Multiple pump stations and 2.2 MW of power are required to manage elevation. ▪ Routing pipeline through Coalstoun Lakes. ▪ Stored water (post-transfer) to facilitate creation of new 20,000 ha of irrigation areas. ▪ Resetting water allocations so that Tarong Power Station water requirements (30,000 ML per year) are supplied from Wivenhoe.

Option number	Option	Description
		▪ Connecting the Wivenhoe, Boondooma and Paradise storages through formalising (making operational) the common terminations at Tarong.
18	Up to 100,000 ML dam or weir on Barambah Creek and irrigation network primarily for Coalstoun Lakes	100,000 ML dam at Barambah Creek with a distribution system for Coalstoun Lakes. Irrigation area—3,500 ha; water allocation—21,000 ML for Coalstoun Lakes, 3,000 ML for downstream users. A pipeline and channel scheme to take the water from the dam to the irrigation area, including balancing storages and relift, due to the gain in elevation.
19	Agricultural supply chain improvements (e.g. local value-add/increase processing of peanuts and blueberries)	The option proposes developing a supply value chain for the region and addressing supply chain gaps and constraints. This review seeks to understand ▪ the opportunities for local value add, local jobs and opportunities for processing to occur within the region (e.g. for peanuts, pecans and blueberries) ▪ the impediments, particularly regarding economies of scales and reliability that could be addressed through additional/more reliable water sources
20	Tarong Power Station to source more of its water from Wivenhoe Dam	Tarong Power Station currently has two main sources of water for its operation and water security: Wivenhoe Dam and Boondooma Dam. The primary source is from Boondooma Dam, which is lower cost, and supplementary water is sourced from Wivenhoe Dam. During drought conditions Tarong Power Station often takes higher volumes from Wivenhoe Dam to preserve storage levels at Boondooma Dam. If Tarong Power Station was to utilise the water from Wivenhoe Dam more, there would be less usage of the Stanwell allocation held in Boondooma Dam, thus freeing up this water for other users in the region, including irrigators, urban and industrial.
21	Tarong Power Station to source more of its water from manufactured water[4] products	The Luggage Point treatment plant provides purified recycled water to the Western Corridor Recycled Water pipeline. When not needed for urban use, it may be possible for the recycled water to be supplied to the Burnett region through the Wivenhoe to Tarong pipeline. Likewise, if other manufactured water plants need to be kept running for operational reasons, but not for water security reasons, the water could be used by Tarong. This would reduce its reliance on Boondooma.
22	Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	When there are significant inflows, pump water from Barambah Creek, into Barker Creek to be stored in Bjelke-Petersen Dam. As Bjelke-Petersen Dam is rarely full, there is capacity to improve the capture of water to be used by current and new irrigators. This option could also provide for pumped hydro opportunities.
23	Convert Gordonbrook Dam to irrigation use	Gordonbrook Dam is a 6,600 ML storage that provides urban water to Kingaroy. There are significant water treatment issues when the water falls below 50 per cent. To supplement the loss of urban supply, Kingaroy would need to increase its draw on Boondooma Dam, possibly by purchasing water allocations from Tarong Power Station.

1.2 Review of the strategic assessment (stage 1)

The SBC was completed and approved in April 2020, with this options analysis (stage 2) commencing immediately thereafter. Consequently, the service need and targeted benefits identified in the SBC remain valid. No new information has arisen that would require an update or reconfirmation. During the development of this options analysis, further analysis was, however, undertaken to strengthen and refine the evidence supporting the identified service need.

Some refinement to the options longlist developed in the SBC has also occurred as a consequence of ongoing analysis, and stakeholder engagement and consultation having taken place parallel to the finalisation and approval of the SBC (discussed in Chapter 5).

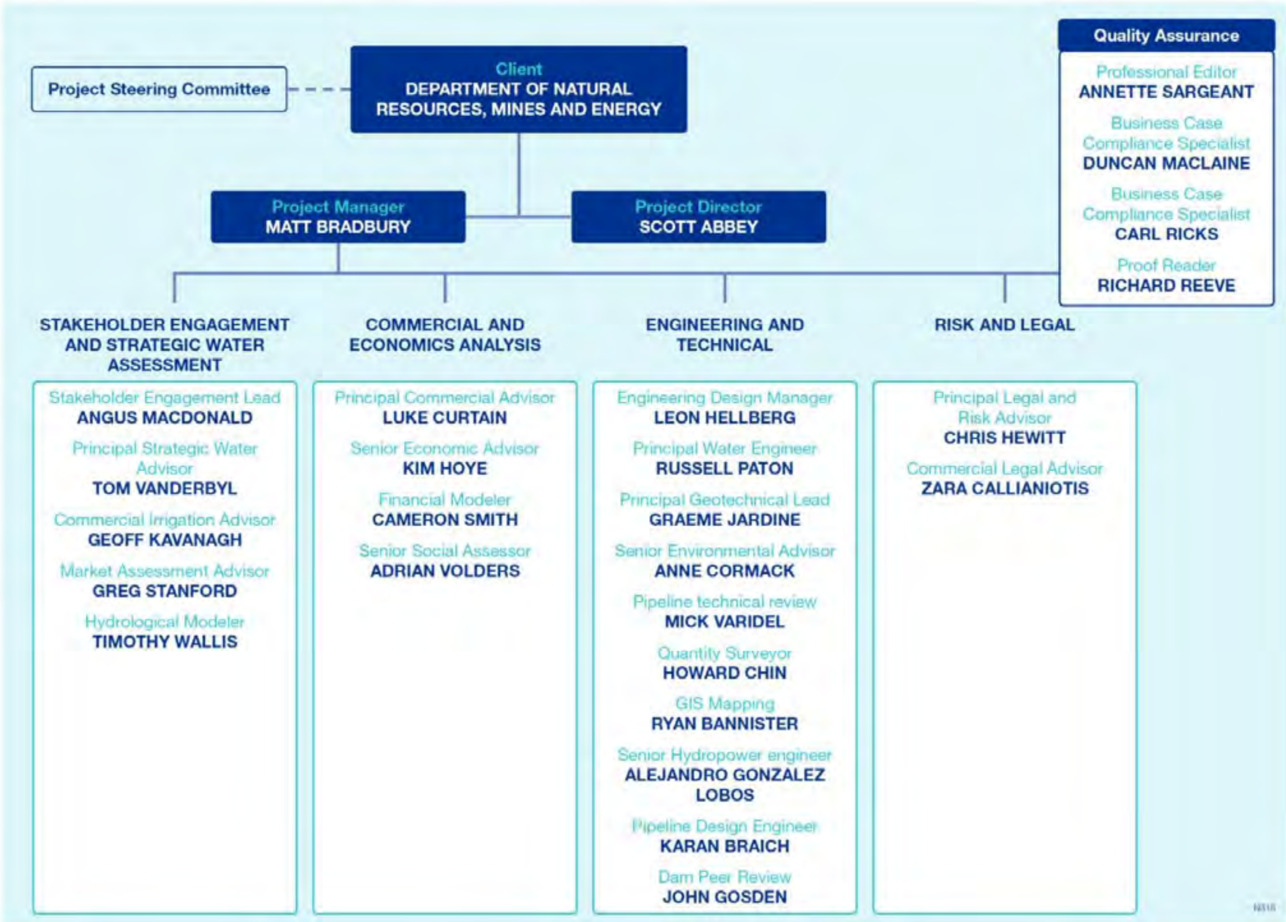
[4] Manufactured water is a broad term that includes both purified recycled water (PRW) and desalinated water.

2. Governance, assurance and risk

2.1 Governance

The governance structure for the project is shown in **Figure 2-1**.

Figure 2-1 Governance structure



The proposal owner is the Queensland Department of Natural Resources Mines and Energy (DNRME). DNRME is taking a coordinating role in the delivery of this study and is facilitating and overseeing the assessments on behalf of the North Burnett Regional Council (NBRC) and South Burnett Regional Council (SBRC).

NBRC and SBRC are the joint proponents for the assessment and are responsible for agreeing to the scope. The contractor project team (contracted by DNRME) is led by Matt Bradbury (Project Manager) and Scott Abbey (Project Director). The full contractor project team is outlined in **Figure 2-1** above.

The governance of this project is focused on the robust oversight of the assessment activities for both the SBC and options analysis. In accordance with Building Queensland best practice, appropriate governance structures have been established, including a multi-agency Project Steering Committee (PSC). The membership for the PSC includes:

- Department of Natural Resources, Mines and Energy (DNRME)
- North Burnett Regional Council (councillors, officers and advisors)
- South Burnett Regional Council (councillors, officers and advisors)
- Sunwater
- Department of Department of State Development, Tourism and Innovation (DSDTI).

The PSC has met on multiple occasions during the development of the SBC and options analysis. The PSC is responsible for oversight of the assessment activities for both these stages.

2.2 Overall approach to the options analysis

The preparation of the options analysis is in accordance with Building Queensland Business Case Development Framework (BCDF) Release 3 (April 2020).

The BCDF aligns with best practice and meets state and Commonwealth requirements (e.g. the Queensland Government's Project Assessment Framework (PAF) and Infrastructure Australia's Assessment Framework).

2.3 Assurance

The assurance of this options analysis has been led by the PSC.

Subject matter experts from outside of the PSC have been engaged in the development and review of the options analysis to conduct further assurance activities. These assurance activities included assessment and review of project concepts, infrastructure design, infrastructure and engineering cost estimates and the options analysis report. The subject matter experts include Stanwell Corporation[5], the Energy Division of DNRME, and the Water Policy Division of DNRME.

2.4 Risk

2.4.1 Introduction

This section outlines the risk management methodology and approach utilised in the options analysis, and the outcome of the risk assessment conducted throughout the preparation of this study.

There are inherent risks in the options analysis process and in the identification, assessment and measurement of multiple options in order to identify the reference projects. The risk management process therefore focuses on the identification, assessment and management of risks related to the preparation of the options analysis and the achievement of the objectives and outcomes associated with the identification of the reference projects.

The Risk Register (at Appendix D) sets out the risk assessment and mitigation strategy for each identified risk. The risks were identified through comprehensive consultation with stakeholders.

2.4.2 Project uncertainty

The options analysis stage commenced at around the same time as the serious escalation of the Covid-19 pandemic that affected Australia and the world (including all the relevant export markets considered in this study). The impact of Covid-19 on the options analysis process, particularly the engagement with stakeholders, is outlined in the Risk Register and section 2.4.5.

At the time of writing this report, the medium- and long-term impacts of Covid-19 are unknown, in the context of North Burnett and South Burnett, water infrastructure, and domestic and international markets for agricultural produce.

It is however reasonable to assume that some or all the following effects may occur:

- an economic contraction across Australian markets, including a medium-term recession (at the time of writing this options analysis, the national economy had just entered a technical recession)
- a reduction in economic activity in the study area in the short and medium term
- a reduction in land value in the study area in the short and medium term
- provision of a Commonwealth and Queensland Government economic stimulus in the form of new grants and funding for infrastructure projects, including water infrastructure projects

[5] Stanwell Corporation is the owner of Tarong Power Station, which is located in South Burnett.

- the temporary removal or relaxation of approvals requirements for certain infrastructure projects and developments, including environmental and land development approvals processes
- an economic contraction in export markets impacting the demand for agricultural produce from the study area
- trade market and route disruption, resulting in increased barriers to trade for produce from the study area, including increases in tariffs, export limitation measures and protectionist measures by export markets.

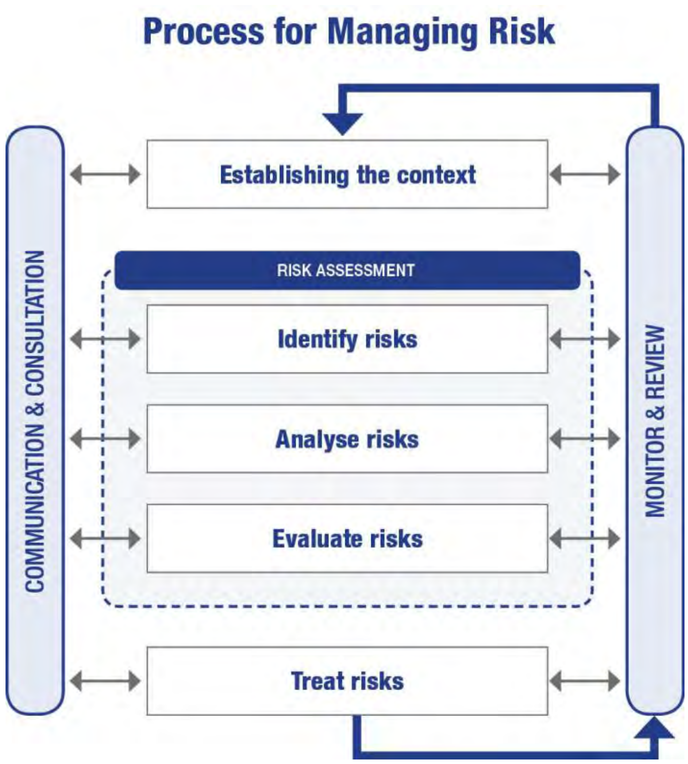
The individual and combined impact of these Covid-19-related effects are unknown and cannot be taken into account in the modelling undertaken in this options analysis. Some of the potential impacts identified in this section could have detrimental effects on prospective projects through the suppression of demand or an increase in construction costs due to supply chain limitations or a reduction in available service providers. Other impacts may have positive effects on prospective projects, such as the opportunity for increased or streamlined funding for infrastructure projects, or reduced requirements or delays in obtaining certain approvals.

It is recommended that future analysis in relation to any of the reference projects or the South Burnett Integrated Water Initiative include targeted analysis to assess the impacts of Covid-19 as more information becomes known.

2.4.3 Risk approach

The risk management approach in the options analysis is aligned with the DNRME risk matrix and methodology (see Figure 2-1). The process for the identification, assessment and management of risks conforms with the Building Queensland risk management framework and the relevant Australian Standard AS/NZS ISO 31000:2009 Risk Management—Principles and Guidelines.

Figure 2-1: DNRME risk management process adopted



Source: (Department of Natural Resources, Mines and Energy, 2017, p. 2).

2.4.4 Risk criteria

The criteria used in the risk assessment process were adopted and adapted from the DNRME risk assessment methodology and tools. The risk criteria were developed in consultation with stakeholders. The risk criteria are composed of three parts: likelihood; consequence; and analysis/scoring.

2.4.4.1 Risk likelihood

The risk criteria establish and assess the probability of a particular risk materialising. Table 2.1 provides the risk likelihood categories with examples to assist stakeholders to understand the application of this measurement. It is considered that the range from 'yearly' to 'every 100 years' is appropriate for water-infrastructure-related risks.

Table 2.1: DNRME risk likelihood categories

Likelihood	Description	Example to assist stakeholders
Almost certain	The event is expected to occur in most circumstances	May occur once a year or more
Likely	The event will probably occur in many circumstances	May occur once every 3 years
Possible	Identified factors indicate the event could occur at some time	May occur once every 10 years
Unlikely	The event could occur at some time but is not expected	May occur once every 30 years
Rare	The event may occur only in exceptional circumstances	May occur once every 100 years

Source: (Department of Natural Resources, Mines and Energy, 2017, p. 15).

2.4.4.2 Risk consequences

The risk consequences measure the impact of the occurrence of the risk on the realisation of the benefits of the options analysis. The risk consequences are set out in Table 2.2 and have been adapted from the DNRME risk management process.

Table 2.2: Risk consequences—impact on realisation of benefits

Insignificant	Minor	Moderate	Major	Catastrophic
Negligible impact on realisation of project benefits	Minor impact on realisation of project benefits	Moderate impact on realisation of project benefits	Major impact on realisation of project benefits	Catastrophic impact on realisation of project benefits—cannot be realised

Source: Adapted from (Department of Natural Resources, Mines and Energy, 2017).

2.4.4.3 Risk analysis/scoring

The Risk Analysis and Scoring Matrix (Table 2.3) has been developed in the context of the risk appetite of the PSC and stakeholders, and the scope of the options analysis. The Risk Analysis and Scoring Matrix provides a score for each risk on the basis of the likelihood of occurring and the consequence if it does occur.

Table 2.3: DNRME Risk Analysis and Scoring Matrix

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

Source: (Department of Natural Resources, Mines and Energy, 2017, p. 15)

2.4.5 Risk identification

Risk identification is the process of determining what risks may impact on the project outcome, and the circumstances under which each risk may materialise. The potential risks considered in this risk management process include:

- process risks—risks associated with the development of this options analysis, including risks in the collection and analysis of information related to the options
- proposal risks—risks associated with the proposals and recommendations developed in the options analysis.

The risk identification process was ongoing through the options analysis process.

The options analysis study was impacted by Covid-19, which had significant detrimental effects on the ability to engage with stakeholders in person and communicate effectively. The potential for disruption to the study by an unexpected event (such as a natural disaster) was originally considered, and as such, the control strategy for that potential risk could be adapted and implemented to successfully manage and mitigate the impacts of Covid-19 on the options analysis process.

The risks set out in the Risk Register (Appendix D) were identified through comprehensive consultation with relevant stakeholders.

2.4.6 Outcome of risk assessment

The Risk Register (Appendix D) sets out the findings of the risk identification and assessment, including the recommended control strategy for the mitigation and management of each risk.

The risk assessment identified that the most critical risks to the options analysis related to potential failures in communication and engagement with stakeholders in the study, particularly in relation to an unexpected event outside of the control of the stakeholders or consultants. The Risk Register identifies the effective control strategy for managing disruptions to communications and planned stakeholder engagement activities. The management of these risks required effective collaboration between the Project Working Group, consultants and other stakeholders.

3. Service need

3.1 Strategic business case service need assessment

A strategic business case (SBC) was prepared for the proposal using the Building Queensland SBC Template and Guide (Release 2). The SBC was completed and approved in April 2020, with the second stage, this options analysis, commencing immediately thereafter. Consequently, the service need identified in the SBC remains valid, with no new information arising that would require an update or reconfirmation. During the development of this options analysis, further analysis was, however, undertaken to strengthen and refine the evidence supporting the identified service need.

3.2 Service need statement

The service need for this proposal is the real and present need to improve the reliability and security of water in the North Burnett and South Burnett regions to protect, strengthen and expand agricultural and industrial activity as well as ensure water security for urban users. Improvements to the reliability and security of water can generate material social and economic benefits for present and future residents in the Burnett region and the State of Queensland.

Investment Logic Mapping (ILM) was adopted to develop a shared understanding of, and agreement on, the problems and targeted benefits that underpin the service need. Two ILM workshops were held during the development of the SBC with relevant stakeholders and technical experts. The data and information outlined in sections 3.3 and 3.4.1–3.4.4 were provided to workshop participants to ensure informed discussions and decisions.

The ILM results are presented in Figures 3.1 and 3.2.

Figure 3-1: Investment Logic Mapping—North Burnett

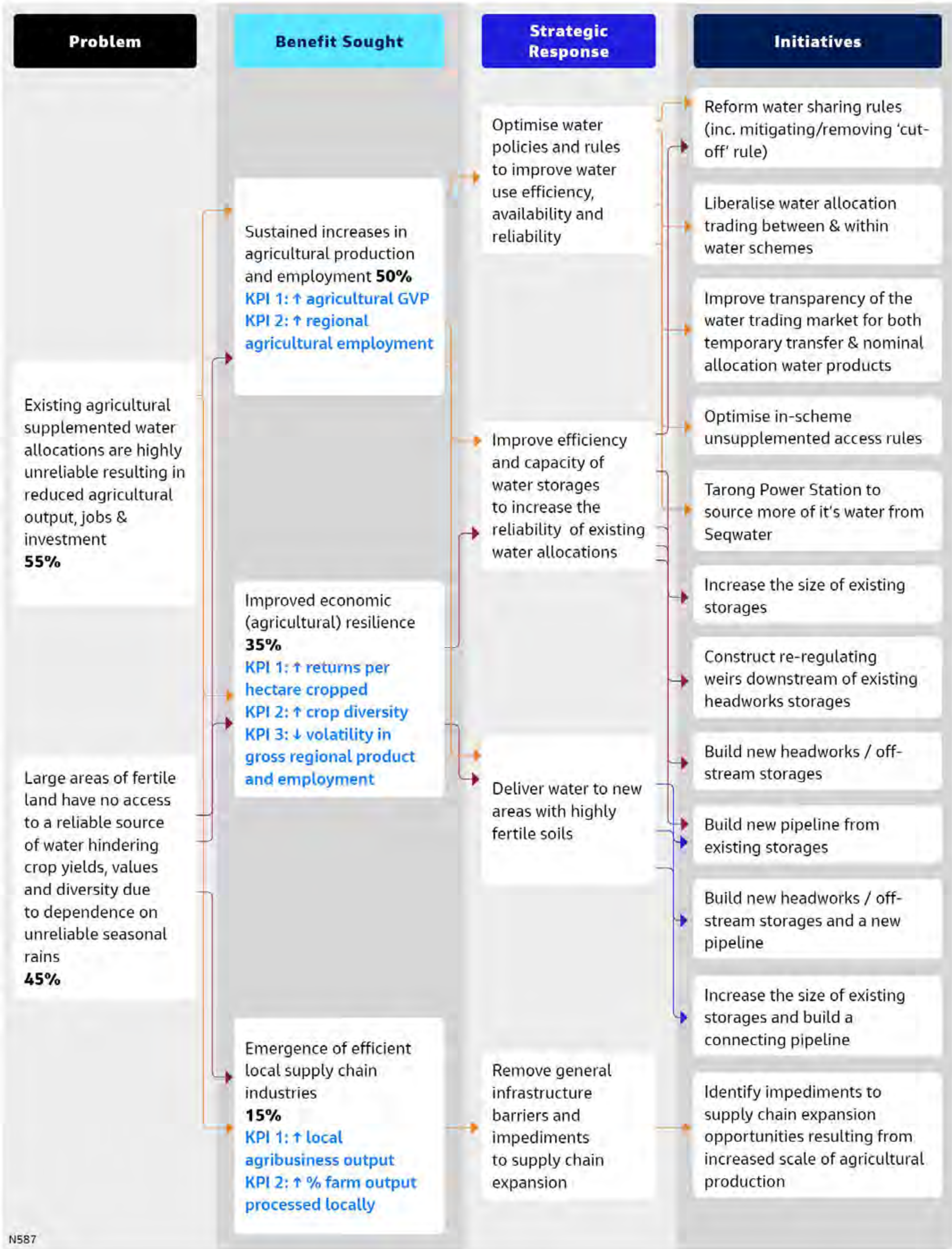
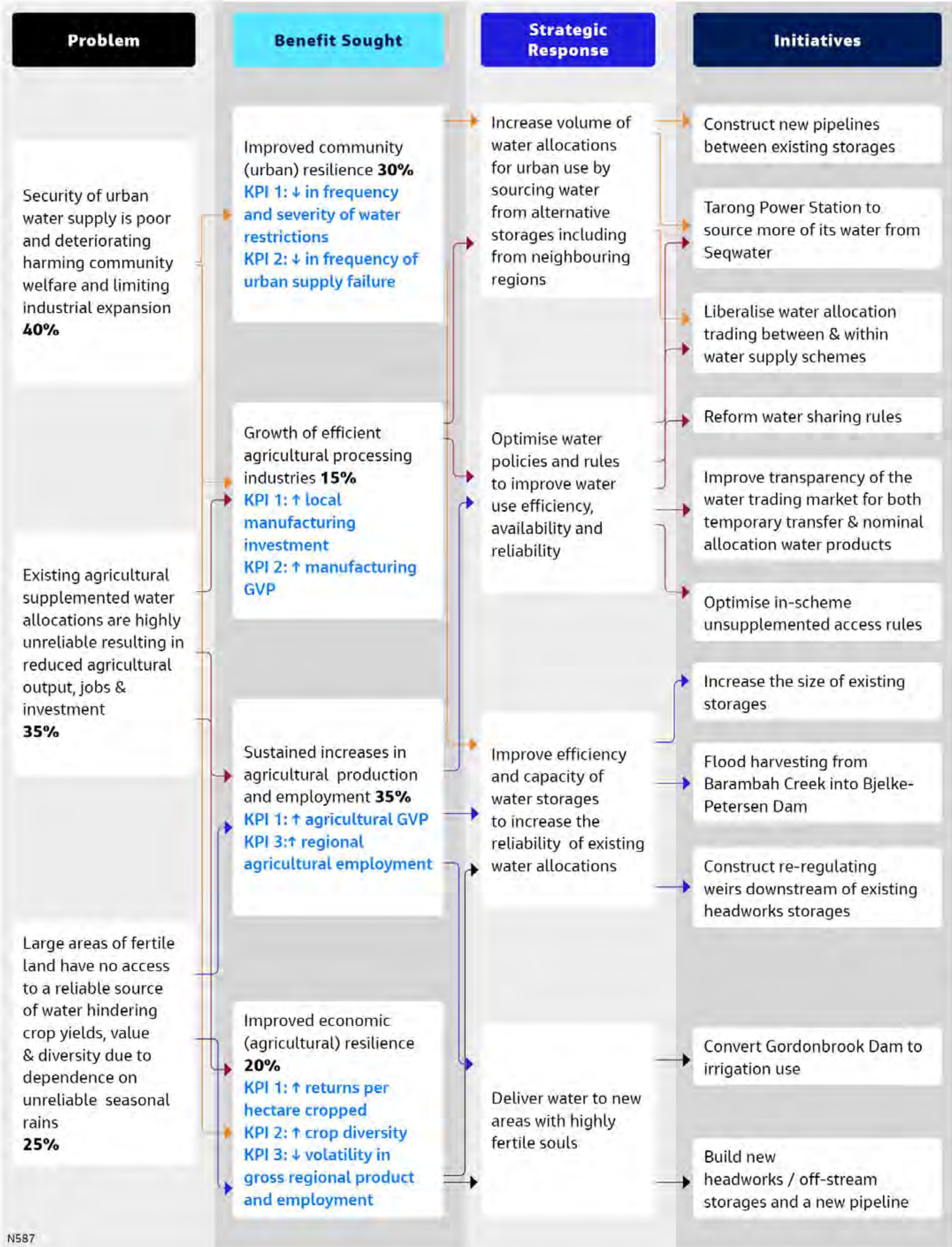


Figure 3-2: Investment Logic Mapping—South Burnett



Additional information supporting the problem statements is provided below, including details of the root cause/s of the problems and supporting evidence. The evidence documented in **Table 3.1–Table 3.3** has been updated since the completion of the SBC to reflect additional information gathering and analysis undertaken during the preparation of the options analysis.

Table 3.1: **Statement of service need: problem 1**

Problem 1: Security of urban water supply is poor and deteriorating, thereby harming community welfare and limiting industrial expansion	
Region	South Burnett only
Description	Water *security* relates to the levels of service that might be expected from a water supply scheme when its surface water reserves become critically low. It is usually specified in terms of the frequency, duration and intensity of water restrictions that might be expected as a result of the long-term hydrologic risk of drought conditions occurring. Security is a concept applied particularly to urban and industrial water during periods of extreme drought. The concept of water security is used in planning for the water infrastructure requirements of urban centres and high priority water users (high-value permanent plantings in agriculture may also be focused on water security). Kingaroy currently has a low level of urban water reliability and an increasing demand for water. Without increasing supply, there is a one in four probability that urban water needs cannot be met in any given year. Regular water restrictions impose welfare costs on households and damage costs, including loss of income to businesses that rely on customer demands related to water consumption. Poor water reliability also limits the capacity for industrial users to expand their operations.
Root cause	▪ High urban demand growth, particularly from industrial users ▪ Reliability of Gordonbrook Dam is poor—exacerbated by poor water quality when levels are low ▪ Insufficient high priority allocation from Boondooma held by the council ▪ Limited number of raw water source options ▪ Climate change
Evidence	Currently, Kingaroy's total demand is 1,400 ML per annum, with level 3 water restrictions. In 2019, the Queensland Government DNRME undertook a Regional Water Supply Security Assessment (RWSSA) for Kingaroy. This assessment, which is yet to be approved by South Burnet Regional Council, concluded that current annual demand of 1,400 ML for Kingaroy had a supply failure of 1 in 13 years (7.7%). The forecast demand in 2020–21 of 1,600 ML for Kingaroy had an expected failure rate of approximately 1 in 8 years (13%).

Table 3.2: **Statement of service need: problem 2**

Problem 2: Existing agricultural supplemented water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment	
Region	North Burnett and South Burnett
Description	Water *reliability* refers to the portion of time that water demands can be met. It is usually specified in terms of the percentage of months (or, alternatively, years) of a defined historical period (usually 100 or more years) that a specific volume of monthly (or annual) customer water demands that are likely to be fully met by the volume of water available to that customer through the relevant water sharing rules (e.g. through distinguishing between medium and high priority announced allocations). **The agricultural sector needs a more reliable water source in order to grow.**
Root cause	▪ Too much water allocated relative to storage capacity, limited by hydrology ▪ Risk management rules that suspend medium priority water supply to protect high priority supply for energy generation ▪ Inefficient sharing rules that do not incentivise forward planning (e.g. a system of announced allocations rather than 'continuous sharing' limits flexibility and choice in allowing water users to select their desired long-term reliability) ▪ High transmission losses (beyond that originally envisaged) given the distance from dam walls to the first irrigator ▪ Sub-optimal historical planning and infrastructure investment decisions (optimistic hydrology performance assumptions) ▪ Climate change ▪ Some crops currently being grown are not suitable given known water reliability
Evidence	▪ Supplemented schemes are unreliable and can go several years without supplying irrigation water

Problem 2: Existing agricultural supplemented water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment	
	▪ Agricultural output has not grown in 20 years ▪ Unemployment is high/unemployed people leave the area The role of water reliability has been invested in multiple historical documents and is a theme across the studies conducted throughout North Burnett and South Burnett. For example: ▪ Reliable water supplies are critical for sustaining economic growth and the wellbeing of the community (Appendix A, document 16: *Regional Water Supply Security Assessment*, 2016). ▪ Reliability concerns are a cause of low utilisation of water allocations (Appendix A, document 7**:** *Water for Economic Development*, 2018). In particular, water supplied from the Boondooma Dam within the Boyne and Tarong Water Supply Scheme is highly unreliable. Irrigators are not able to be supplied with water from the Boondooma Dam once the volume of the dam falls below 70,000 ML, irrespective of their announced allocation. This has occurred once every five years on average since 2002. Various commercial projects proposals for North Burnett and South Burnett identified the central importance of water reliability to generating economic activity and positive returns on the development of water storage and delivery infrastructure (*Getting Water for Peanuts*, 2018: Appendix A, document 26; *Barambah Creek Proposal*, 2018: Appendix A, document 28). The consultations regarding the irrigation options on the Boyne River gave considerable attention to the issue of water reliability, including identifying water reliability as a primary benefit of the Cooranga Weir and Boondooma Dam Raising proposals (Appendix A, document 34). Most users surveyed on the Boyne River were concerned about water reliability (Appendix A, document 38). *Irrigation on the Boyne River,* 2019 (Appendix A, document 42) concluded that improved water reliability would have positive impacts for the region, including improved efficiency, production improvements, expansion of the production area; and increases in the value to the regional economy.

Table 3.3: **Statement of service need: problem 3**

Problem 3: Large areas of fertile land have no access to a reliable source of water hindering crop yields, value and diversity due to dependence on unreliable seasonal rains	
Region	North Burnett and South Burnett
Description	Large areas of fertile land have no access to a reliable source of supplemented water for irrigation. This hinders crop yields, values and diversity due to dependence on unreliable seasonal rains.
Root cause	▪ The infrastructure has not yet been constructed. ▪ There are topography constraints.
Evidence	▪ The Burnett region has good quality soil. 14,000 ha of class 1 soil have been identified from studies of specific areas (surrounding Kingaroy, Gayndah to Munduberra and Coalstoun Lakes). ▪ The North Burnett has 195,406 ha of class 2 and 152,900 ha of class 3 soil. The good quality soil is clustered around Coalstoun Lakes, Boyne / Mundubbera and St John Creek. The South Burnett has 245,819 ha of class 2 and 87,971 ha of class 3 soil. There is a long stretch of class 2 soil that runs along the West of Barker and Barambah creeks. Across the region, approximately 14,000–36,000 hectares are currently used for irrigation, leaving over 600,000 ha of class 2 and 3 soil available for irrigation.

3.3 Stakeholders and stakeholder engagement

Key stakeholders identified for engagement include relevant government departments and representatives at all levels, impacted landholders, potential customers and suppliers, environmental and community groups, regional businesses, peak bodies, utility providers and traditional owners.

Stakeholders provide:

- assistance in identification of the problem, the needs of the region and available opportunities
- collaboration in development of a longlist of options to solve the identified problem or opportunity

- a source of primary data and lived experience for market insight, refinement of the service need and determination of demand
- refinement of selection criteria relevant to commercial irrigators, the environment, the community, Sunwater, government and regulators
- support for the solution.

3.3.1 Identified stakeholders

The following table provides a summary of identified stakeholders and their interests in the project.

Table 3.4: Key project stakeholders

Stakeholder category	Stakeholder	Interest/s
Internal stakeholders		
Project partners	Department of Natural Resources, Mines and Energy	• Administrative proponent for the feasibility study
	North and South Burnett Regional Councils	• Recipients of the NWIDF funding
	Jacobs	• Lead consultant for feasibility study
Australian Government		
Departmental Ministers	Minister for Agriculture and Water Resources Minister for the Environment and Energy Minister for Infrastructure and Transport	• Alignment with federal objectives and plans • Infrastructure that is properly planned and timed • Investment decision/approval of any further investigations and any resulting project outcomes • Environmental approvals/requirements
Elected representatives	Queensland Senators and Federal Members representing study areas—Maranoa, Flynn and Wide Bay.	• Alignment with federal objectives and plans • Infrastructure that is properly planned and timed • State, regional and local economic, social and environmental impacts
Australian Government departments and authorities	Department of Infrastructure, Regional Development and Cities Department of the Agriculture, Water and the Environment Infrastructure Australia	• Administration of the NWIDF • Administration of funding for renewable energy projects • Review of business cases • Alignment with federal objectives and plans
Queensland Government		
Premier and departmental Ministers	Premier and Minister for Trade Queensland Treasurer Minister for Natural Resources, Mines and Energy Minister for State Development, Tourism and Innovation Minister for Agricultural Industry Development and Fisheries Minister for Environment and the Great Barrier Reef	• Investment decision/approval • Alignment with other Queensland Government department objectives and plans • Infrastructure investment that is properly planned and timed
Elected representatives	State Members for Callide and Nanango	• Alignment with state objectives and plans • Infrastructure that is properly planned and timed • Local economic, social and environmental impacts
	Queensland Treasury	

Queensland Government departments, authorities and corporations	Department of Natural Resources, Mines and Energy Department of State Development, Tourism and Innovation (including the Office of the Coordinator-General) Department of Agriculture and Fisheries Department of Environment and Science Stanwell Corporation Building Queensland Sunwater	• Alignment with other Queensland Government department objectives and plans • Infrastructure investment that is properly planned and timed • Review, input and feedback on the SBC and PBC • Alignment of parallel water studies in the region • Ongoing management and delivery activities—in particular, coordination of overlapping project stakeholder management activities
Local government		
Councils	North Burnett Regional Council and South Burnett Regional Council	• Feasibility study proponents • Urban water supply security • Agricultural and industrial water supply security • Job creation in the region • Impact on environment • Advancing the area's status as an attractive place to invest • Infrastructure location and planning • Increasing agricultural and related industry production
Community and business		
Community groups		• Local regional advocates for water supply security
Landholders		• Impact on existing water supply and environment • Access to property
Potential customers	Parties that could receive water from the project	• Solutions to water supply issues • Access to secure water • Business growth and profitability
Environmental groups		• Minimisation and/or mitigation of environmental impacts • Monitoring and reporting activities
Traditional owners/Aboriginal cultural heritage		• Any native title or cultural implications
Business	Coalstoun Lakes Development Group Kingaroy Chamber of Commerce and Industry Gayndah Chamber of Commerce Burnett Inland Economic Development Organisation Barker Barambah IAC Boyne River and Tarong IAC Three Moon Creek IAC Upper Burnett IAC Large agricultural and industrial water users, including Stanwell, Bega, Crumptons, Swickers	• Removing impediments to business growth and regional economic prosperity • Improved conditions for local residents, industry and other sectors • Advancing growth • Job creation in the region • Power generation and supply
Industry peak bodies		• Improved conditions for industry sectors • Advancing the region's status as an attractive place to invest

Potential suppliers		• Scope of proposed initiatives as potential business generation

3.3.2 Stakeholder engagement and findings

Over 45 different stakeholder entities (individuals and groups) were engaged during the development of the SBC and this options analysis.

The project team conducted multiple field trips to the region (November–December 2019, February 2020, May 2020 and July 2020), during which they talked to key stakeholders and visited farms and potential infrastructure sites. This includes visits to Munduberra, Gayndah, Nanango, Kingaroy, Tarong Power Station, Gordonbrook Dam, Coalstoun Lakes, Blackbutt and the Boyne and Barker Barambah schemes. Due to travel restrictions related to Covid-19, field trips were not possible in March and April 2020. In response to this restriction, strategic and extensive use of video conferencing and telecommunications allowed the project team to engage with a large and diverse range of stakeholders during this period.

The Stakeholder Engagement Register (SER) in Appendix D contains records of all stakeholders, contacts and dates of engagement, along with comments and summarised key findings.

Commercial growth and investment opportunities in North Burnett and South Burnett were identified through intensive engagement with stakeholders within the region and with representatives of the Department of State Development, Tourism and Innovation (discussed in section 11.8.2).

Key comments and findings arising from stakeholder engagement activities informing the service need include:

- Many agricultural stakeholders discussed the low reliability issues within the Boyne and Barker Barambah schemes. Many irrigators have been cut off for over nine months now. Water available at the start of the year is more valuable to irrigators in the region than water available at the end of the year.
- Farmers in the Coalstoun Lakes area expressed a desire for more water to further expand and develop high-value enterprises, which require a greater level of water security. Water for Coalstoun Lakes could come from Paradise Dam or the Barker Barambah scheme (or Wivenhoe).
- The region is well placed to take advantage of rising agricultural demand overseas. It is within a few hours' drive from major ports and airports. It also has great opportunities with the rising population of South East Queensland, with distance to market being no issue.
- The Tarong Power Station operates within the South Burnett region and is a significant employer and user of water. It currently sources high priority water from Boondooma Dam. It also has access to the Wivenhoe to Tarong pipeline (known as the Wivenhoe pipeline, which is owned and operated by Stanwell), which sources water from Wivenhoe Dam. Water security is critical to Tarong Power Station and its ability to meet power generation requirements. Stanwell indicated that under normal conditions its preference is to maintain Boondooma Dam as its primary water source to minimise the cost of power generation at the station. There is an estimated 17 years left of operation at this site.
- South Burnett Regional Council is most worried about urban water security for Wondai and Murgon; and the supply for Proston, Kingaroy and Blackbutt is also very stretched. Kingaroy has Gordonbrook Dam to fall back on when the pipeline is offline. However, once Gordonbrook falls below 50 per cent storage capacity, it becomes almost unusable due to contaminants in the water. Swickers (which does industrial processing) sources its water from the council. It is waiting for additional water availability before expanding its operation in the region.
- There is approximately 8,360 ML of dead storage (water below the pipeline) in Boondooma Dam, and many stakeholders are unsure who is entitled to that in emergency situations.
- Many stakeholders are interested to see what happens with the future of Paradise Dam and the water currently stored in the dam. This may present an opportunity for the region to support growth with the potential water that could become available, subject to the outcome of further investigations on the future of Paradise Dam.

3.4 Current state

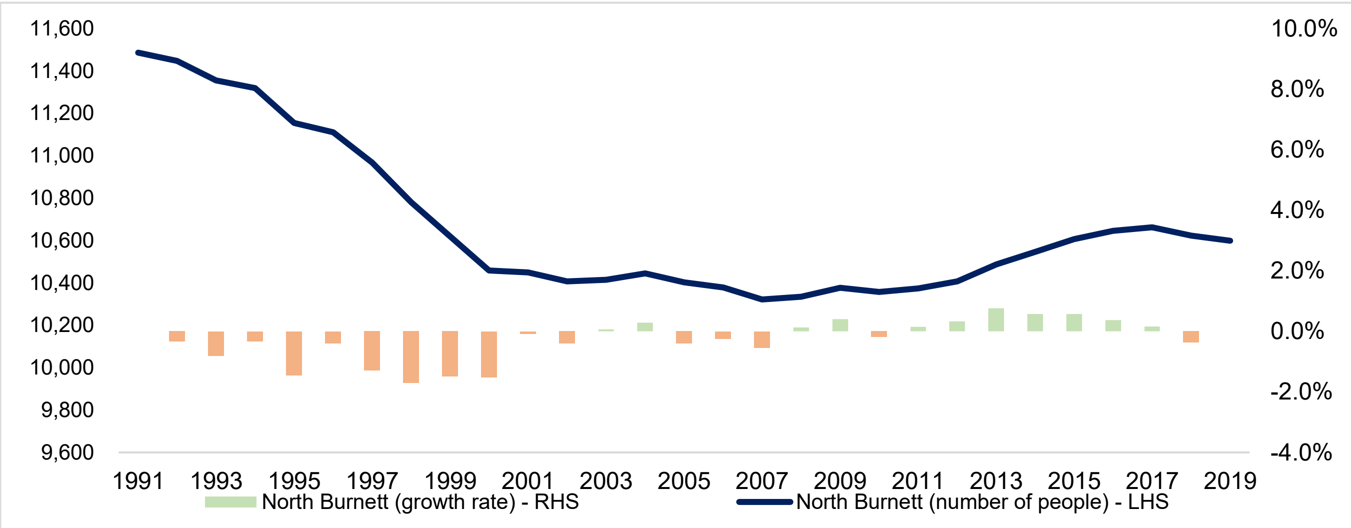
The current state describes the conditions influencing the service need and the current state of the study area with respect to its population, economy, infrastructure, climate, soil conditions and water supply.

3.4.1 Population, employment and socio-economic status

The population in the Burnett region is highly influenced by the available economic opportunities. The population across the Burnett region has increased by 17 per cent since 1991; however, the experience of the two council areas has differed.

The population of North Burnett decreased by 10 per cent in the 20 years to 2011 (**Figure 3-3**). However, since that time, the population has increased by 225 people (2.2 per cent). This turnaround is believed to be caused by the increase in blueberry production, which has employed an additional 400–500 people.

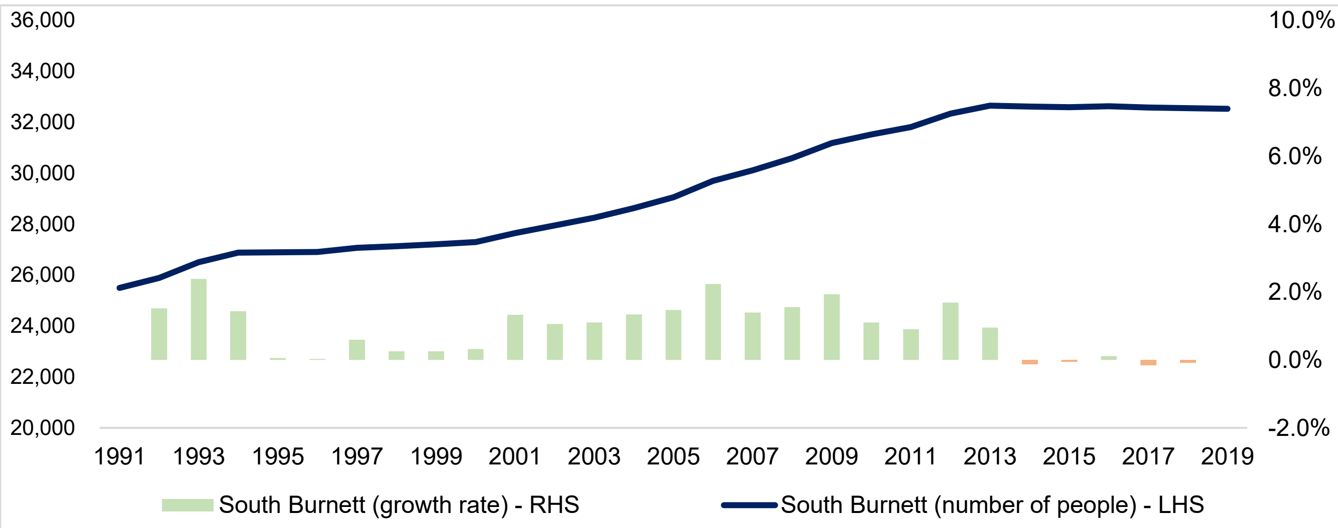
Figure 3-3: Population in North Burnett



Source: QGSO, Queensland—North Burnett.

The population of South Burnett grew strongly in the early 1990s, due partly to the second stage of the expansion of Tarong Power Station. Population growth has been flat since 2013, which could be due to the 2012 shutdown of two generating units, which have since been restarted.

Figure 3-4: Population in South Burnett

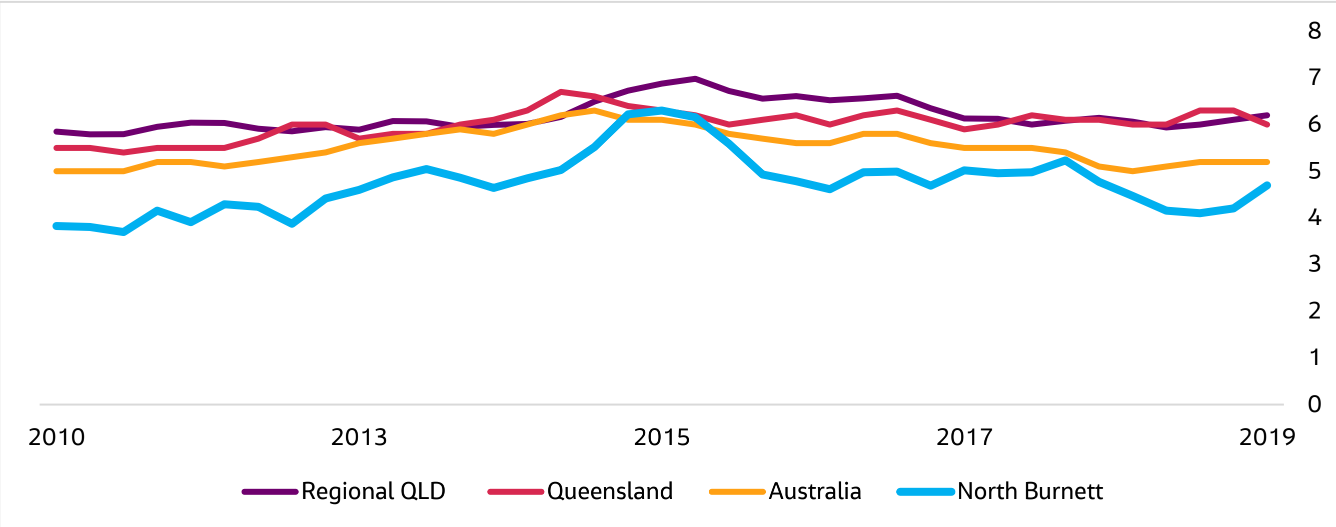


Source: QGSO, Queensland—South Burnett.

There is a high level of social disadvantage in both North Burnett and South Burnett. Several towns, such as Nanango and Kingaroy North, are ranked in the top quartile of Queensland's 513 Statistical Local Areas (SLAs) for socio-economic disadvantage as measured by Socio-Economic Indexes for Areas (SEIFA)—an index that considers income, education, employment, occupation and housing.[6]

The Wide Bay Burnett region has historically had high levels of unemployment. The unemployment rate for this area was the fifth-highest of all 19 SA4s[7] within Queensland in December 2019.[8] In the North Burnett, the unemployment rate has historically been low, relative to other areas. This low rate is driven by itinerant workers who come to the area for work and leave when work is not available. Also, unemployed residents tend to leave the area to find work elsewhere, or be unemployed elsewhere, causing the declining population.

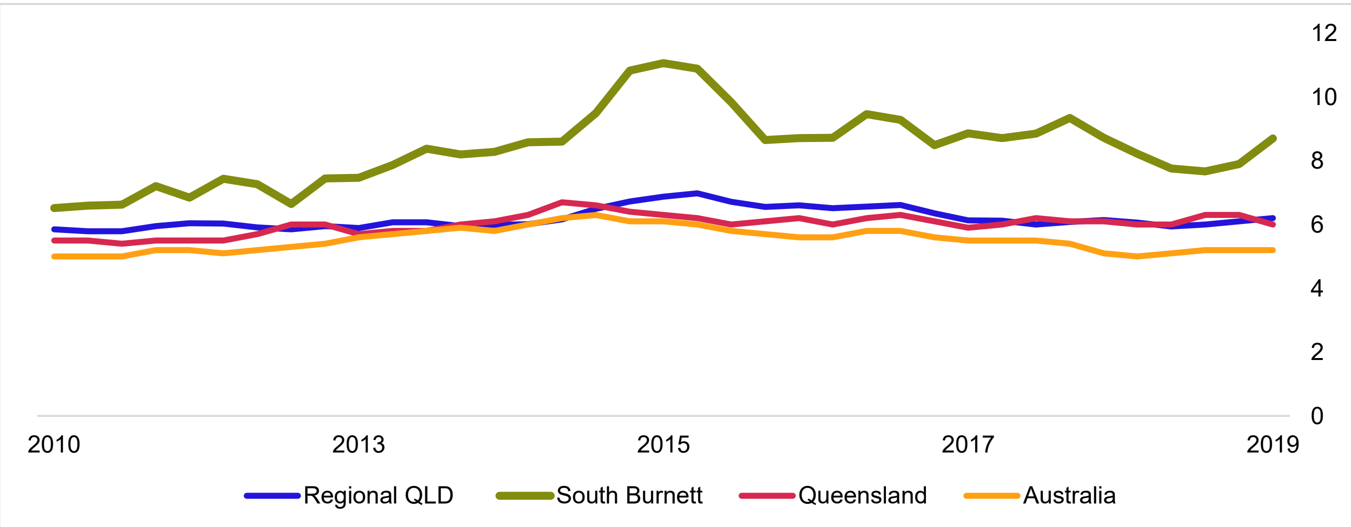
Figure 3-5: Unemployment rate in North Burnett (%)



Source: QGSO, Queensland—North Burnett.

South Burnett has a high unemployment rate caused by a shrinking employment base of key sectors.

Figure 3-6: Unemployment rate in South Burnett (%)



Source: QGSO, Queensland—South Burnett.

6 See https://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa.
7 Statistical Level 4.
8 https://www.qgso.qld.gov.au/issues/3426/regional-labour-force-201912-wide-bay-sa4.pdf.

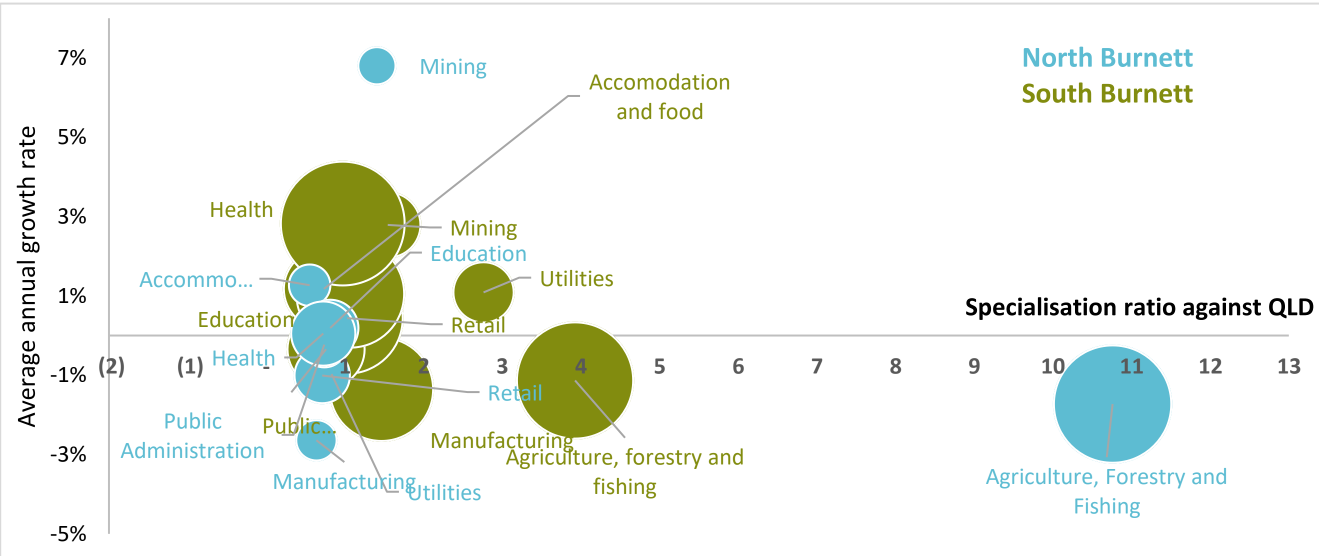
The agricultural sector is the dominant employer in the Burnett region. The three figures below show the specialisation ratio of employment in each region. Each major industry is plotted on the graph:

- The average annual growth rate over the past 10 years is shown on the vertical x-axis. The higher the bubble, the higher than average annual growth rate.
- The specialisation ratio is shown on the horizontal y-axis. The further to the right, the greater the specialisation relative to Queensland as a whole. For example, in the figure below, employed people in the North Burnett are 11 times more likely to be employed in agriculture, forestry and fishing than Queensland as a whole.
- The size of the bubble indicates the relative current size of employment. The bigger the bubble, the more people are employed.

The figure below shows North Burnett and South Burnett together. The following two figures show each individually for additional clarity.

When shown together, agriculture employs a similar amount of people in each region, due to the size of the bubble, but the (blue) North Burnett bubble is much further to the right. This indicates that more people are employed in agriculture, relative to the rest of Queensland, in North Burnett than South Burnett. South Burnett has several large employment industries, whereas North Burnett has a single large employment industry.

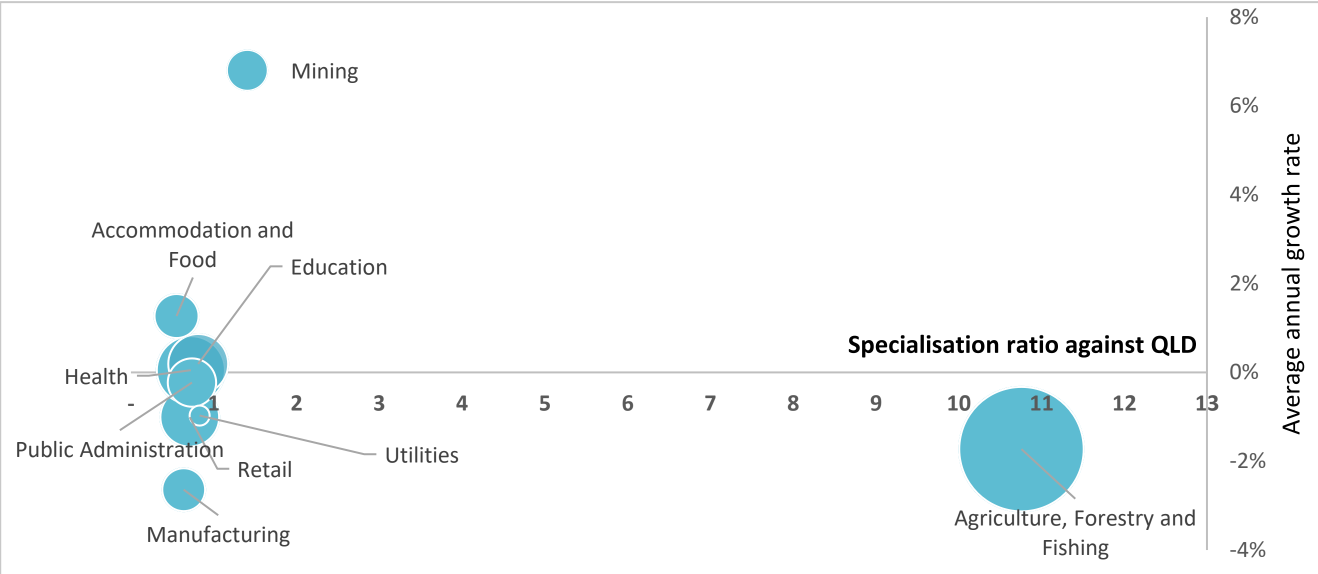
Figure 3-7: Specialisation ratio in North Burnett and South Burnett (%)



Source: ABS Census of Population and Housing (2016).

In North Burnett, agriculture is a dominant employer, with employed people 11 times more likely to be employed in agriculture, forestry and fishing than Queensland as a whole. However, between 2006 and 2016, the number of employed people has been decreasing by 1.7 per cent per year. Most other industries are clustered, with a specialisation ratio just below 1.0, with relatively stable employment growth. However, mining employment has increased from 87 to 149, an average annual increase of 6.8 per cent.

Figure 3-8 Specialisation ratio in North Burnett



Source: ABS Census of Population and Housing (2016).

South Burnett has several large employment industries in addition to agriculture, including utilities, retail, manufacturing (which includes abattoir workers) and health.

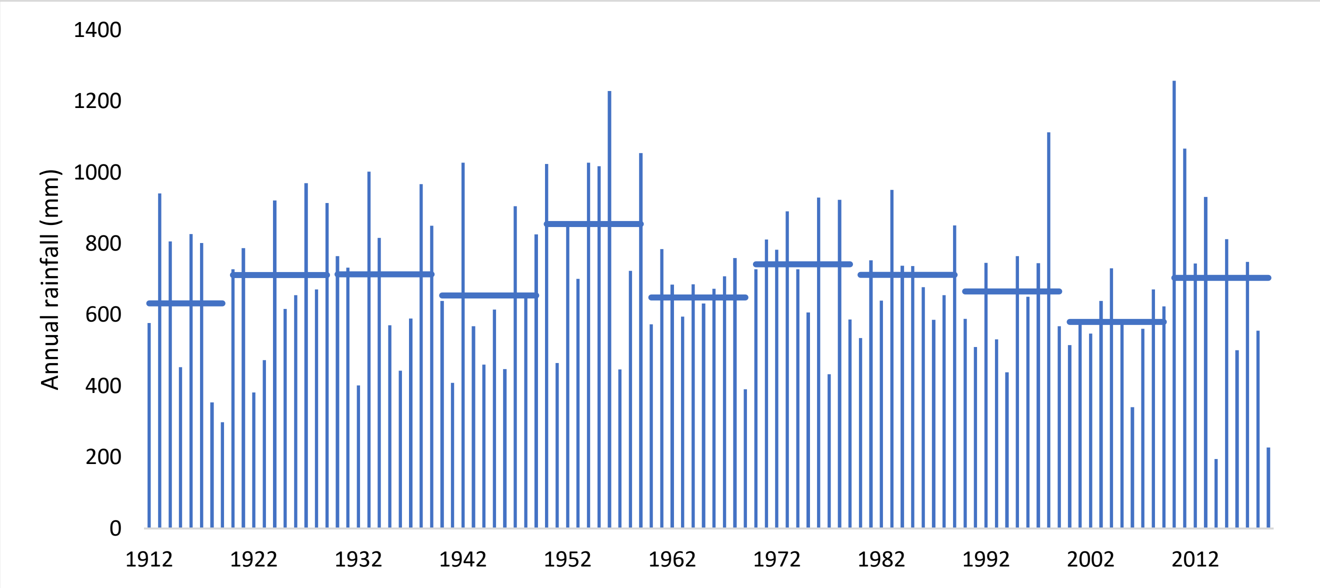
Figure 3-9 Specialisation ratio in South Burnett (%)

Source: ABS Census of Population and Housing (2016).

3.4.2 Climate

North Burnett experiences approximately 635 mm of rainfall per year. In 90 per cent of years, rainfall exceeds 441 mm; and in 10 per cent of years it exceeds 968 mm. However, the maximum rainfall (1,257 mm in 2010) and minimum rainfall (195 mm in 2014) have occurred in the most recent decade.

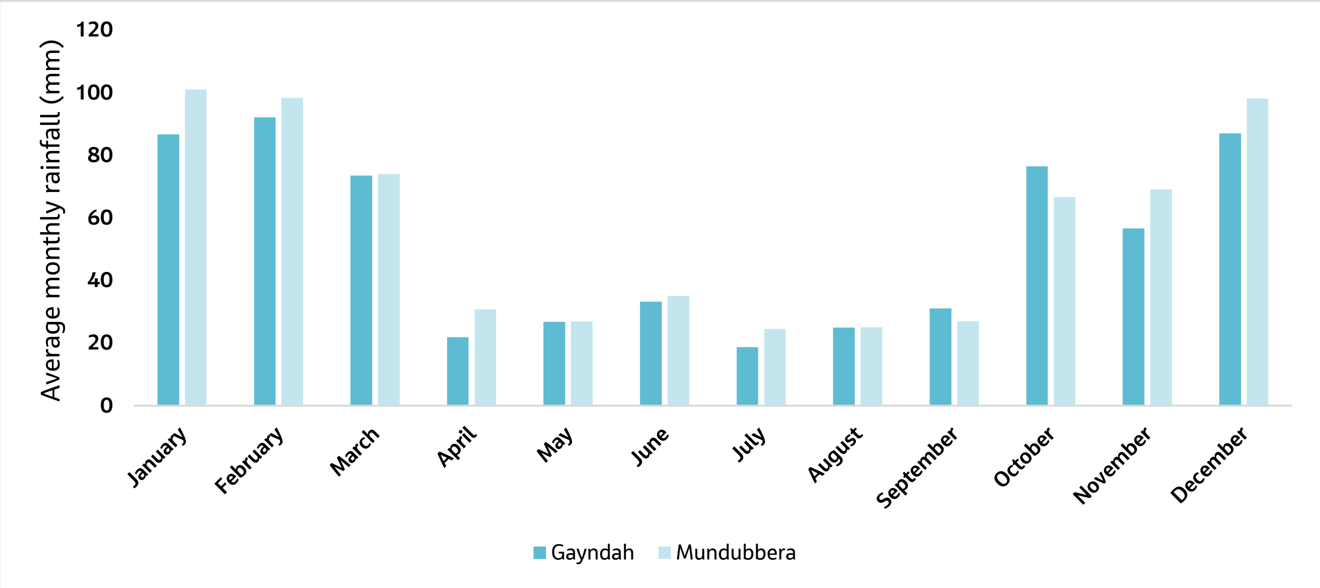
Figure 3-10: Annual rainfall in the North Burnett (mm)



Source: BoM, station number 39073.

There is a distinct wet period (October to March)—when 75 per cent of rain falls—and a dry period (April to September).

Figure 3-11 : Average monthly rainfall (mm)

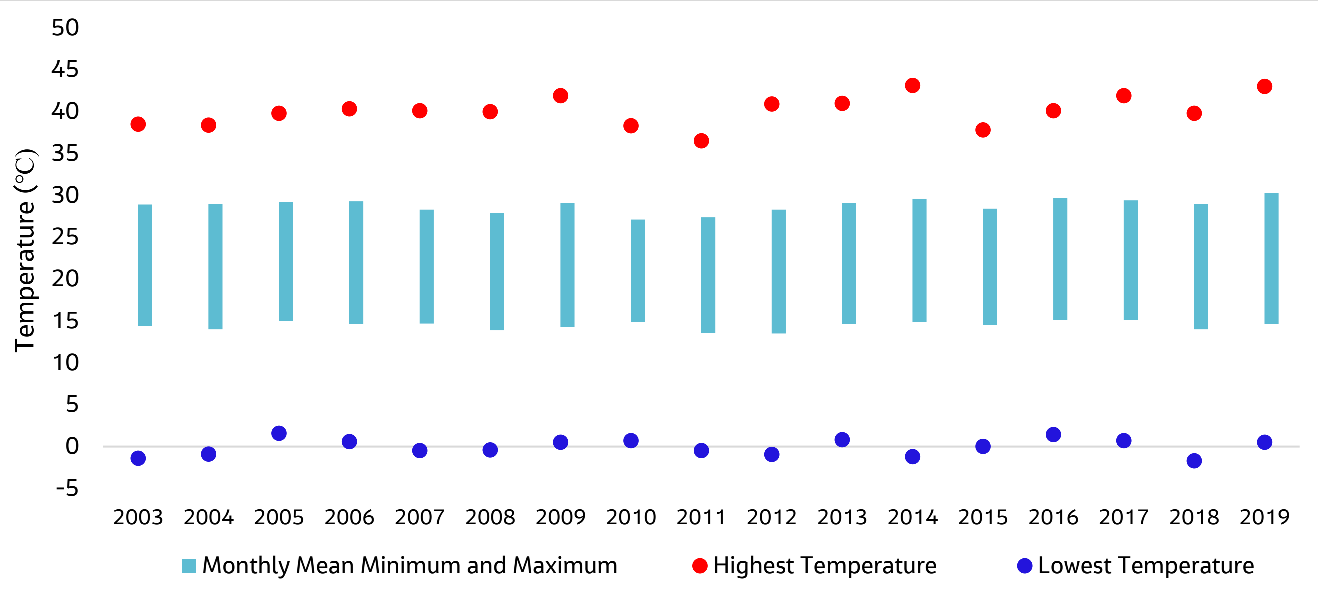


Source: BoM—station numbers 039066 (Gayndah Airport) and 39073 (Mundubbera).

There are several microclimates across North Burnett, each of which can be suitable for different crops at different times. Citrus, which is a common crop, will tolerate high temperatures if the trees are well supplied with soil moisture. Trees are sensitive to frost, but this varies with variety, tree age and health, and can be mitigated by wind generators.

A young tree or a tree with a recent growth flush will be damaged by even very light frosts. A mature tree that has hardened off may tolerate temperatures down to –5°C for a short time without being seriously affected. Leaf, branch and fruit damage can occur. The minimum temperate can drop below freezing, in most years, although only marginally, and only for a short time (Figure 3-12).

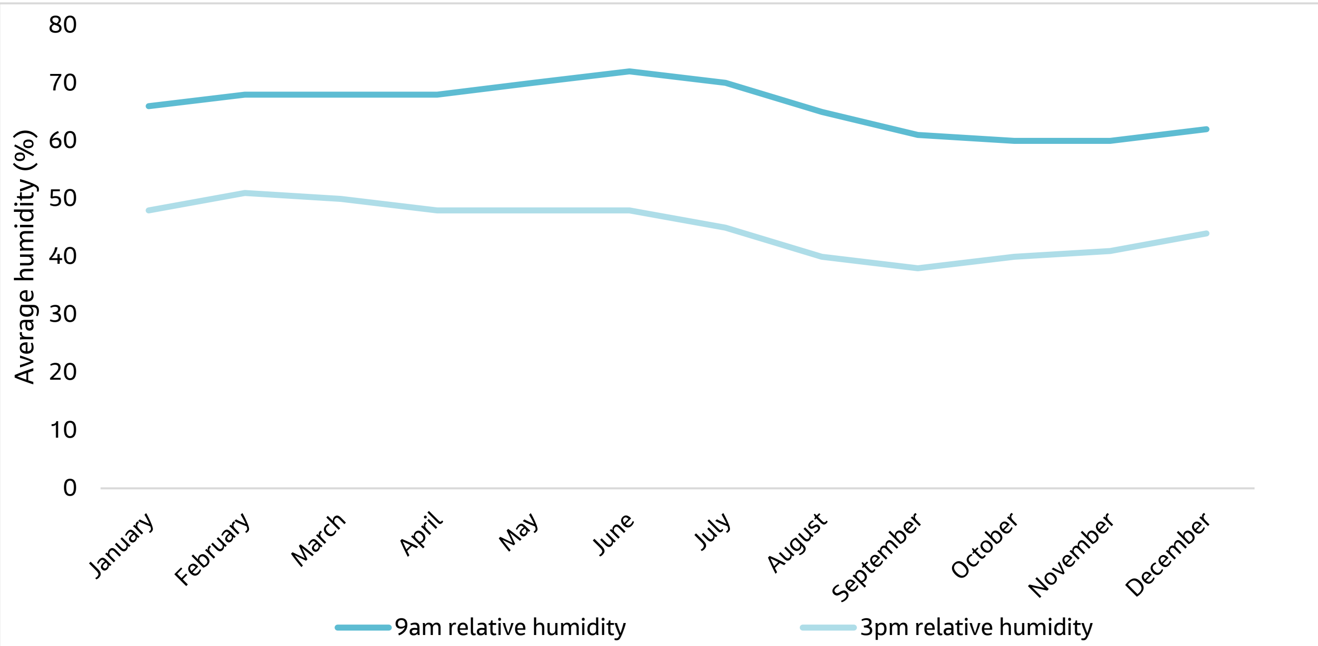
Figure 3-12 : North Burnett historical temperature (degrees Celsius)



Source: BoM—station number 039066 (Gayndah Airport).

Relative humidity greatly affects evaporation rates. When relative humidity is high, it slows evaporation; when it reaches 100 per cent, it reduces evaporation to zero (no evaporation at all).

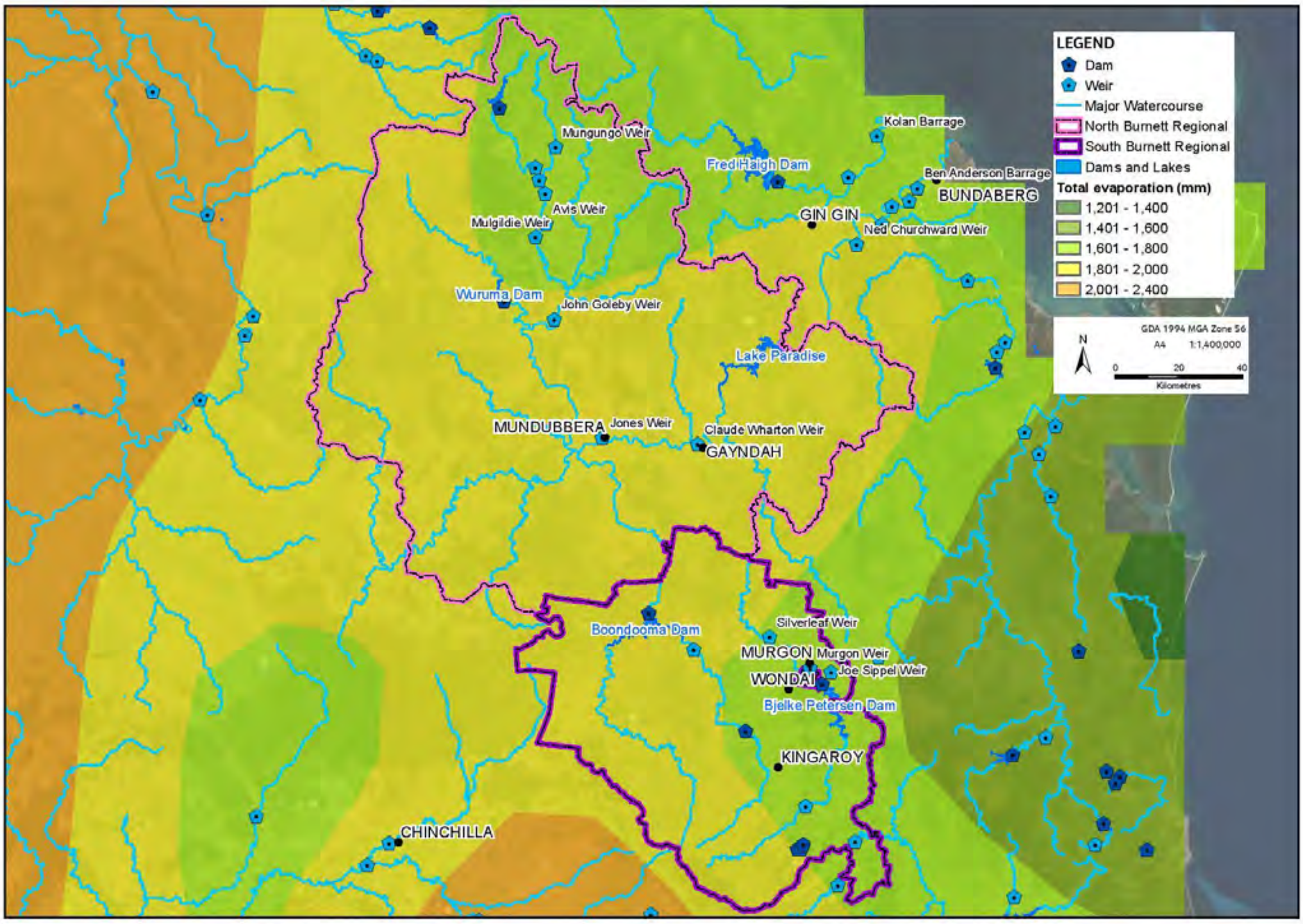
Figure 3-13 : North Burnett relative humidity



Source: BoM—station number 039066 (Gayndah Airport).

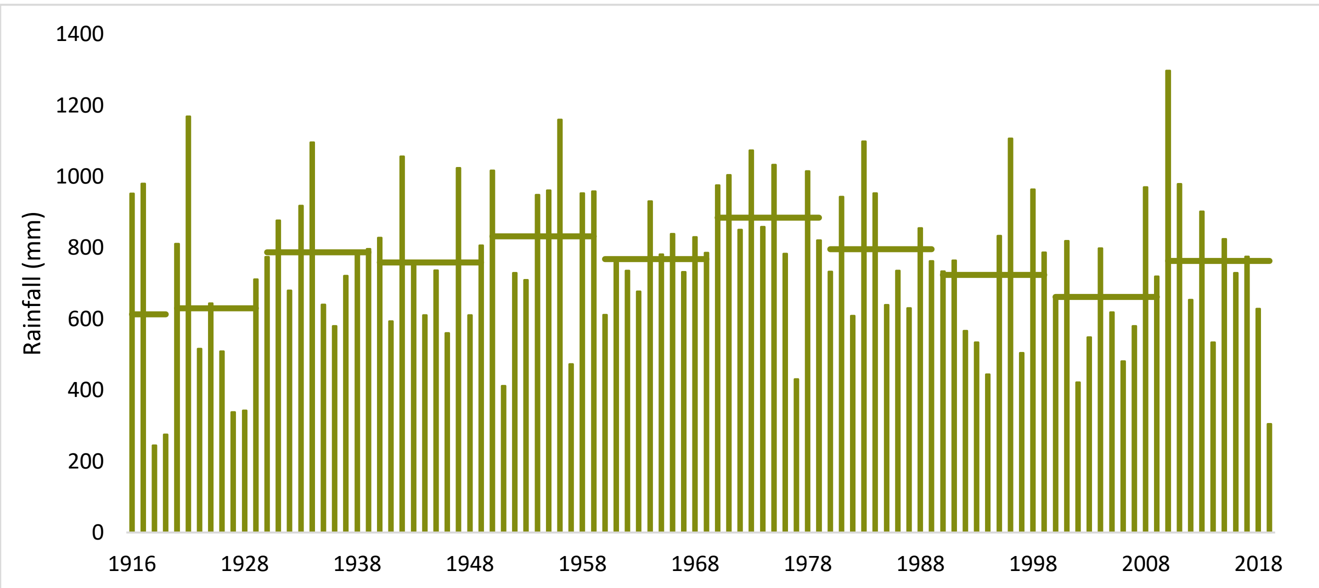
The Burnett region experiences moderate rates of evaporation, up to 1,800 mm over most of the region.

Figure 3-14 : Evaporation in the Burnett region



South Burnett experiences rainfall of approximately 757 mm per year. In 90 per cent of years rainfall exceeds 483 mm and exceeds 1,016 mm in 10 per cent of years. The maximum rainfall of 1,297 mm occurred in 2010 and minimum rainfall of 244 mm occurred in 1918).

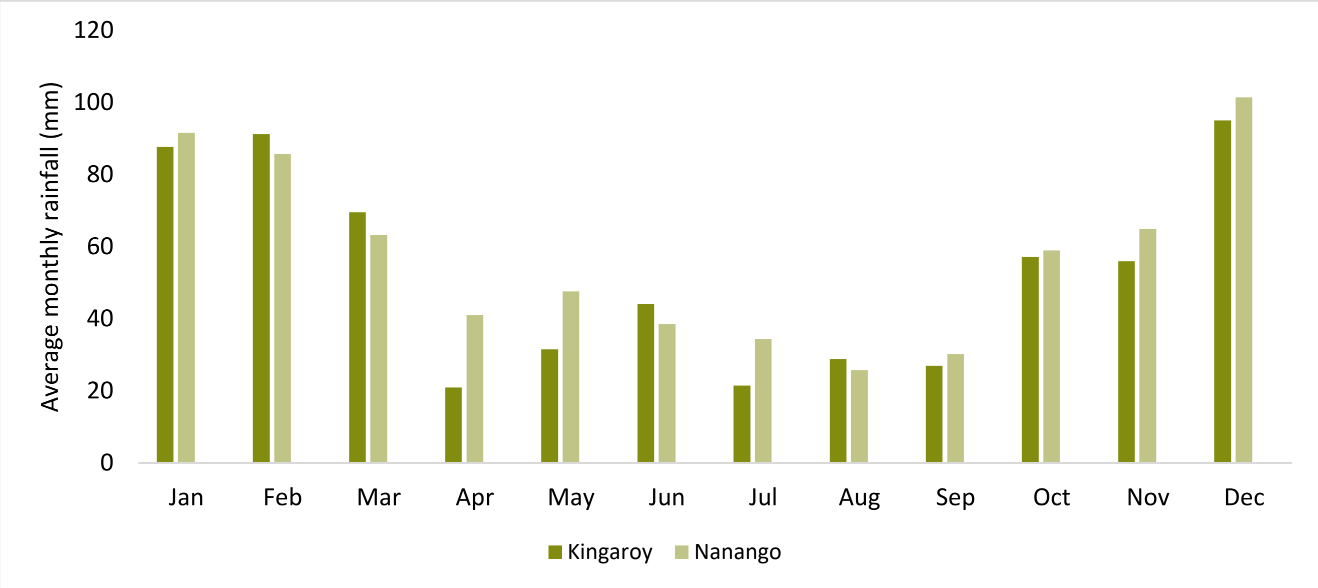
Figure 3-15 : Recorded annual rainfall in the South Burnett (mm)



Source: BoM—station number 40113 (Kumbia).

There is a distinct wet period (October to March)—when 70 per cent of rain falls—and a dry period (April to September) (Figure 3-16).

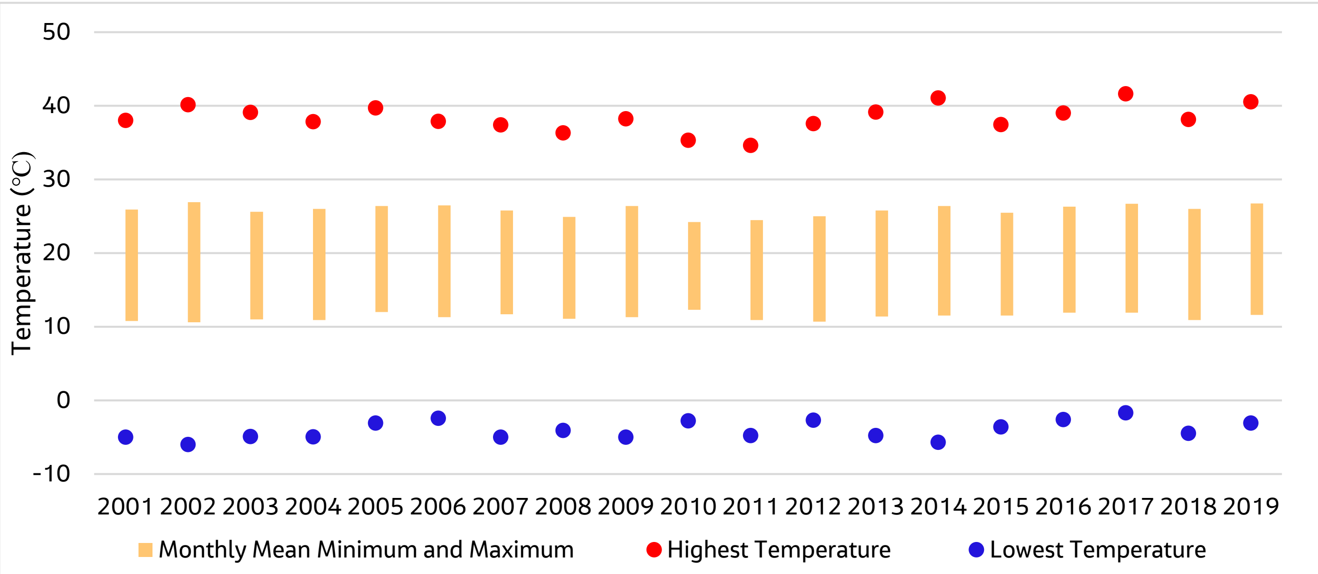
Figure 3-16 : Average monthly rainfall (mm)



Source: BoM—station numbers 040922 (Kingaroy Airport) and 040158 (Nanango, Wills St).

There are a number of microclimates across South Burnett, each of which can be suitable for different crops at different times. However, the incidence of sub-zero degree days indicates that citrus is less likely to be suitable—nevertheless, locations other than Kingaroy may be more suitable.

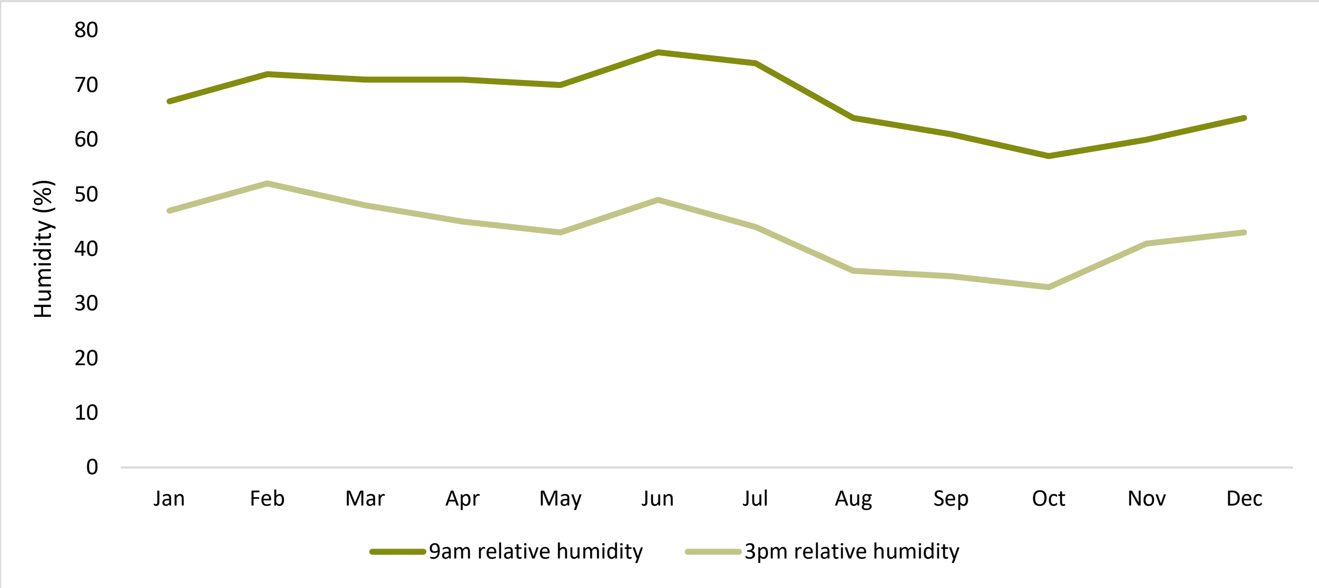
Figure 3-17 : South Burnett historical temperature (degrees Celsius)



Source: BoM—station numbers 040922 (Kingaroy Airport).

Relative humidity greatly affects evaporation rates. When relative humidity is high, it slows evaporation.

Figure 3-18 : South Burnett relative humidity



Source: BoM—station numbers 040922 (Kingaroy Airport).

3.4.3 Soil suitability

The Burnett region has good and very good quality soil for agriculture. Individual soil types are assigned to one of five suitability classes for agriculture, ranging from class 1 (highly suitable) to class 5 (unsuitable), depending on the extent to which limitations are present. Because of the coarse nature of this mapping, most classified areas contain a mix of classes the specific extent and location of which is unknown until further on ground assessment.

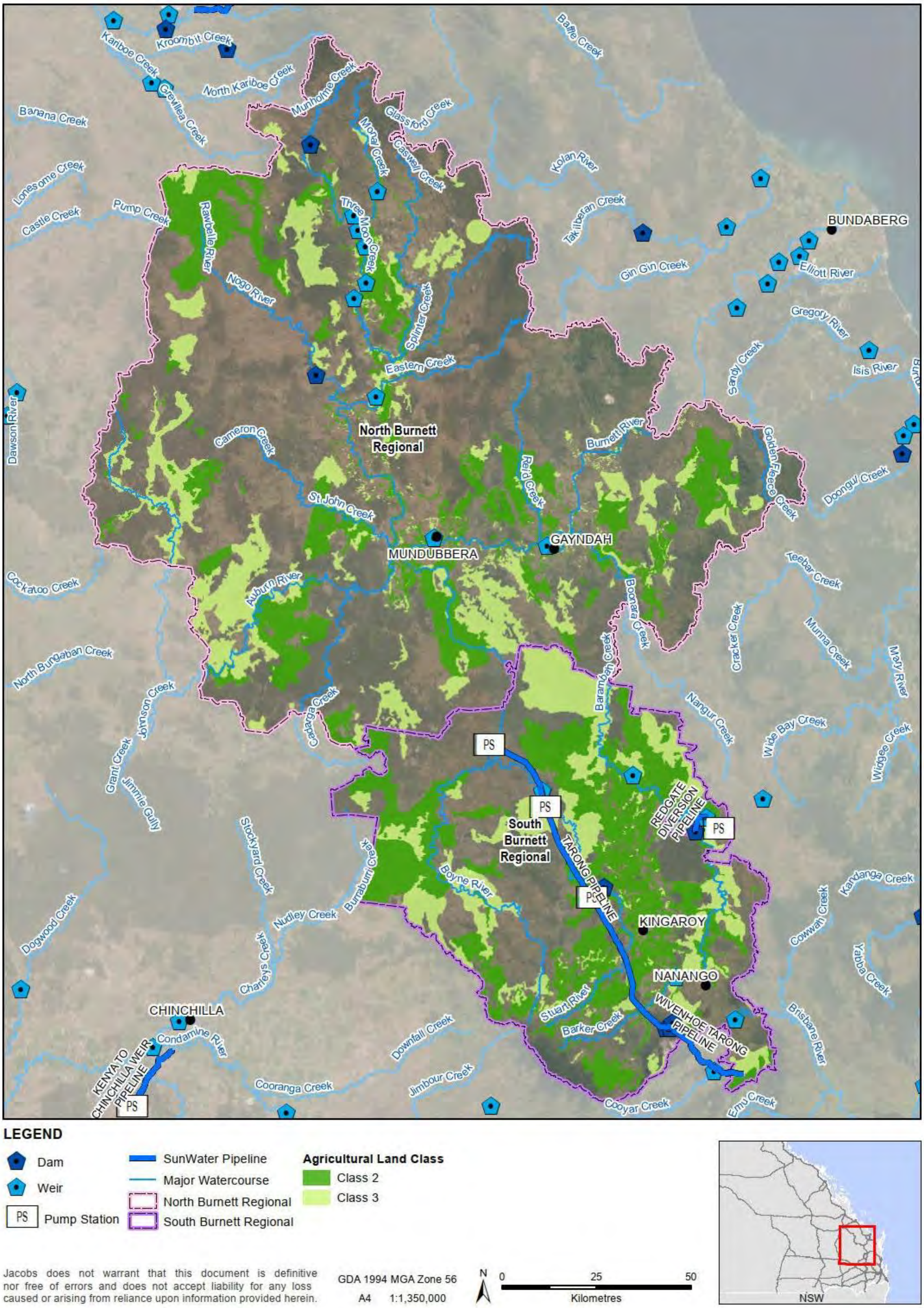
- North Burnett has 195,406 ha of at least class 2 and 152,900 ha of class 3 soil. The very good quality (potentially class 1) soil is around Coalstoun Lakes, Boyne/Mundubbera and St John Creek.
- South Burnett has 245,819 ha of at least class 2 and 87,971 ha of class 3 soil.[9] There is a long stretch of at least class 2 soil that runs along the West of Barker and Barambah creeks.

Across the region, approximately 14,000–36,000 ha are currently used for irrigation, leaving over 600,000 ha of at least class 2 (incl. some class 1) and class 3 soil available for irrigation. Funding would be required to map this with higher certainty, including to identify the areas of class 1 soils within those mapped as class 2.

The estimate for current irrigation area is taken from ABS water use and Queensland Government spatial data. The Queensland Government spatial data looks at past and present land use, which includes a greater parcel of land, whereas the ABS data only accounts for an area under irrigation at a certain point in time (e.g. at the last agricultural census, 2016).

[9] Class 1 is suitable land with negligible limitations. This is highly productive land requiring only simple management practices to maintain economic production. Class 2 is suitable land with minor limitations, and class 3 is suitable land with moderate limitations.

Figure 3-19: Soil suitability and water infrastructure in the Burnett region



Several small specific studies have been undertaken to identify class 1 soil, which requires more detailed mapping. These studies identified 3,800 ha around Kingaroy, 6,000 ha between Munduberra and Gayndah and 4,000 ha in Coalstoun Lakes (50 per cent of the studied soil). This describes total land. Most of this land is not irrigated, but a small portion may be.

Table 3-5: Identification of class 1 soils

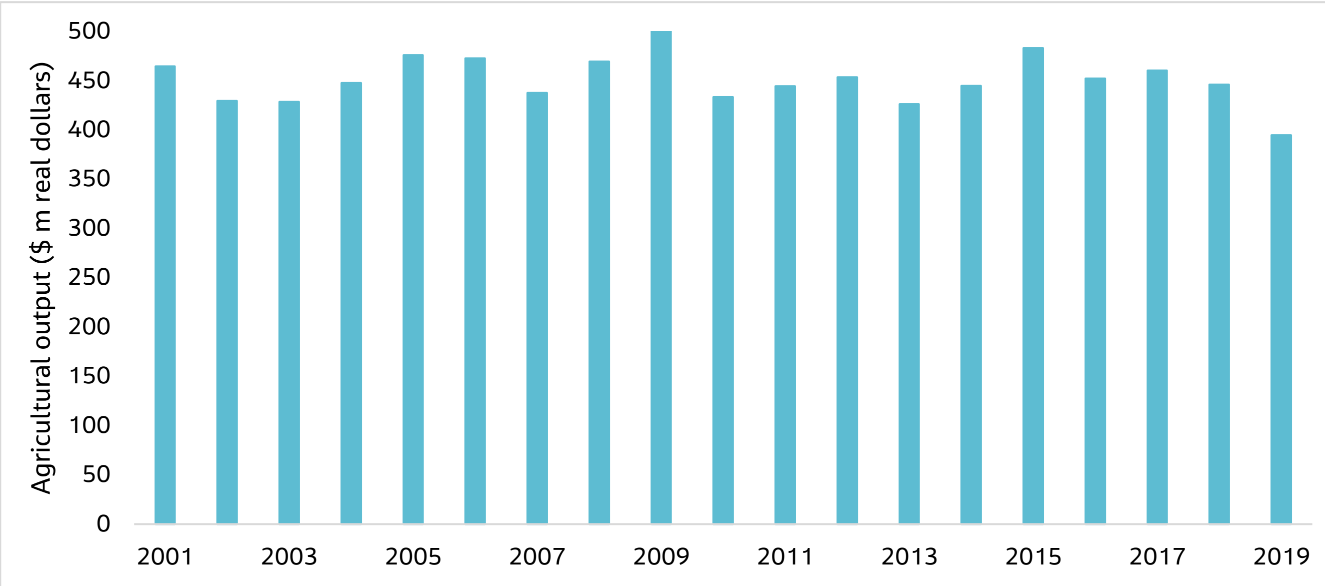
Publication	Study area	Key findings
Soils and Agricultural Suitability of the South Burnett Agricultural Lands, Queensland (2001)	Soils were examined in an area of 126 600 ha, centred around Kingaroy, north to Mondure and south-west to Mannuem Creek.	This study found 3,795 ha of class 1 soil across the study area. Overall, 53% of the survey area is considered suitable for dryland cropping, 73% is suitable for dryland sown pastures, and 48% is suitable for tree and vine crops. Approximately 80% of the study area has been cultivated at some stage. Very little of the original vegetation remains intact. Soils derived from the deeply weathered basaltic material, predominantly the red soils, account for about 50% of the land suitable for intensive development.
Soils of the Riparian Lands of the Burnett River between Mundubbera and Gayndah, Queensland (1996)	Soils were examined up to 5 km north and south from the general course of the Burnett River between Mundubbera and Gayndah. The survey covered 38 890 ha.	In total, 6,000 ha were found to be class 1 soil. The principal uniform sandy soil is the Burnett soil, which occurs on levees of the Burnett River. This soil is well drained, has a good water holding capacity and is suited to most crops. The Burnett shallow phase is a moderately deep fine sand overlying clay and is also an important soil for horticulture. A high proportion of land close to the river is suitable for irrigated cropping.
Agricultural Land Resource Assessment of Coalstoun Lakes (2000)	Coalstoun Lakes area, 7,655 ha	A total of 3,900 ha of class 1 soil was identified within the study area. Over 50% of the area mapped (3,995 ha) are Ferrosols developed on basalt. These soils are suited to a wide range of agricultural and horticultural crops. In the remaining area, 25% of the area are soils developed on alluvium and colluvium (1,996 ha), soils formed on Biggenden Beds (775 ha) or on a range of geologies with slopes greater than 8%.

3.4.4 Current agricultural production

In North Burnett, agricultural production has remained relatively constant over the past 10 years, with some variation over time. The decrease in production in 2013 was due to widespread flooding impacting Monto, which has a large mung bean production area. Other areas also had reductions in citrus and fodder.

In 2015, the North Burnett received significant rain, which led to increased production levels. The 2017 to 2019 decline coincides with the onset of the current drought.

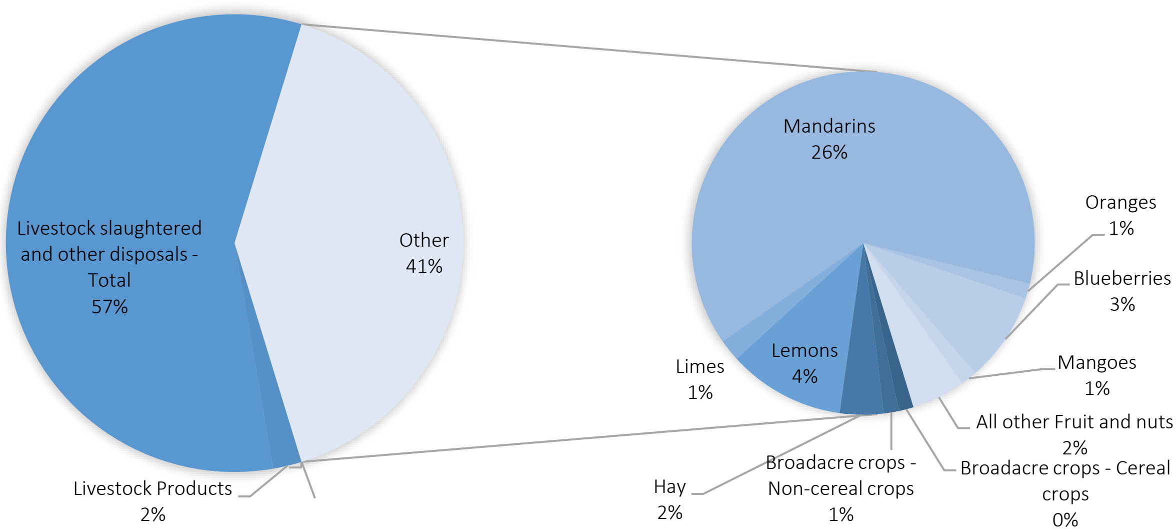
Figure 3-20 : North Burnett agricultural output ($ million)



Source: economy.id, Queensland—North Burnett.

The majority of agricultural value is produced from livestock. However, mandarins are the dominant irrigated crop. Since 2016, there has been significant expansion in blueberry production.

Figure 3-21: Percentage of gross value of agricultural commodities produced by crop—North Burnett LGA

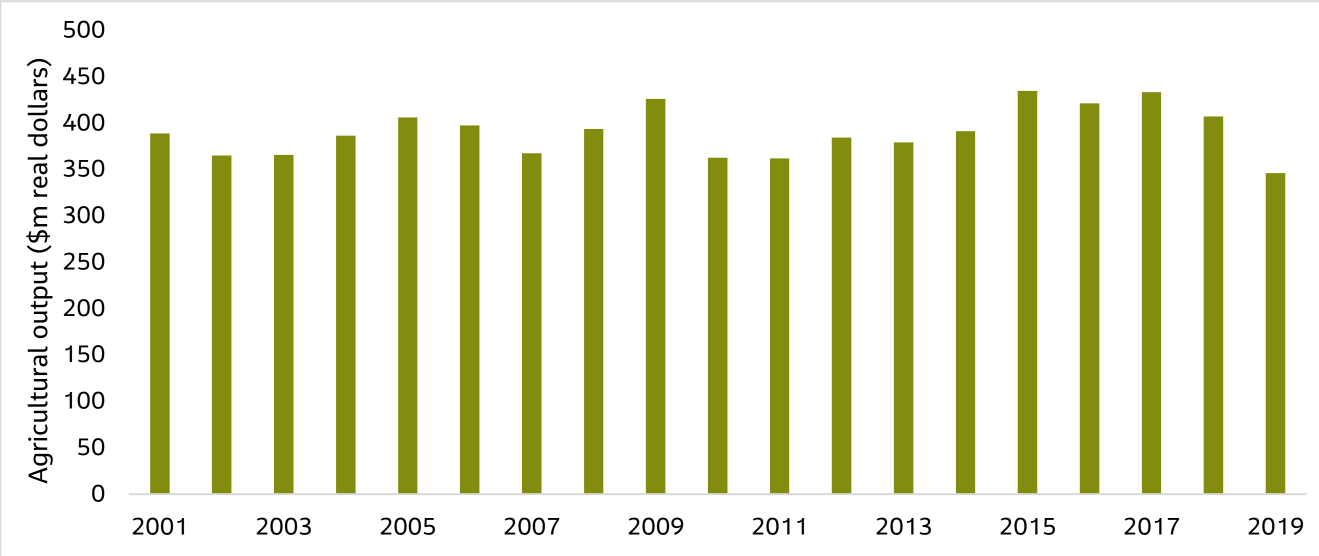


Source: Agricultural census (2016).

Within livestock is intensive livestock production, which is high-value and has a need for relatively small volumes of reliable water. In South Burnett, cattle and calves contribute $186 million. However, feeding this stock requires a high-protein crop, possibly irrigated pasture.

Agricultural production in South Burnett has fluctuated over the past 10 years. There was good rainfall in 2014 to 2016, which resulted in higher levels of production. However, the Boxing Day storms affected areas of high value (tree crop) production, which had an impact on production. Likewise, the current drought has affected production in recent years.

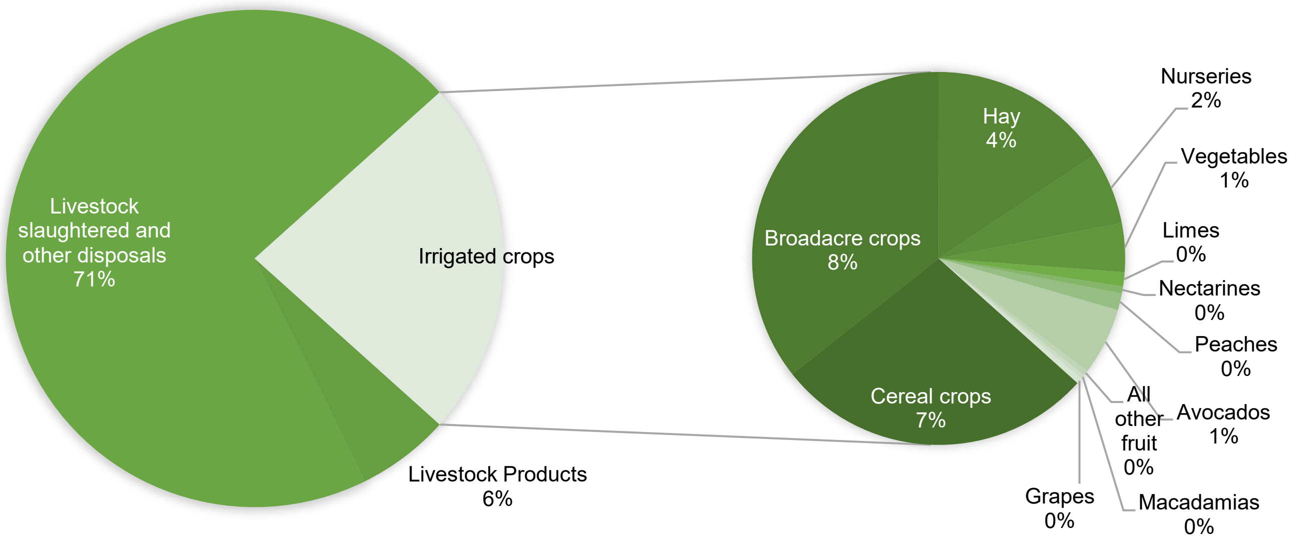
Figure 3-22 : South Burnett agricultural output ($ million)



Source: economy.id Queensland—South Burnett.

Similar to the North Burnett, the majority of agricultural production in the South Burnett relates to livestock. Approximately one quarter of cropping relates to relatively high-value fruit, vegetables and nuts.

Figure 3-23: Percentage of gross value of agricultural commodities produced—South Burnett LGA



Source: Agricultural census (2016).

Within livestock is intensive livestock production, which is high-value and has a need for relatively small volumes of reliable water. In South Burnett, cattle and calves contribute $77 million and pigs $58 million.

3.4.5 Existing transport infrastructure

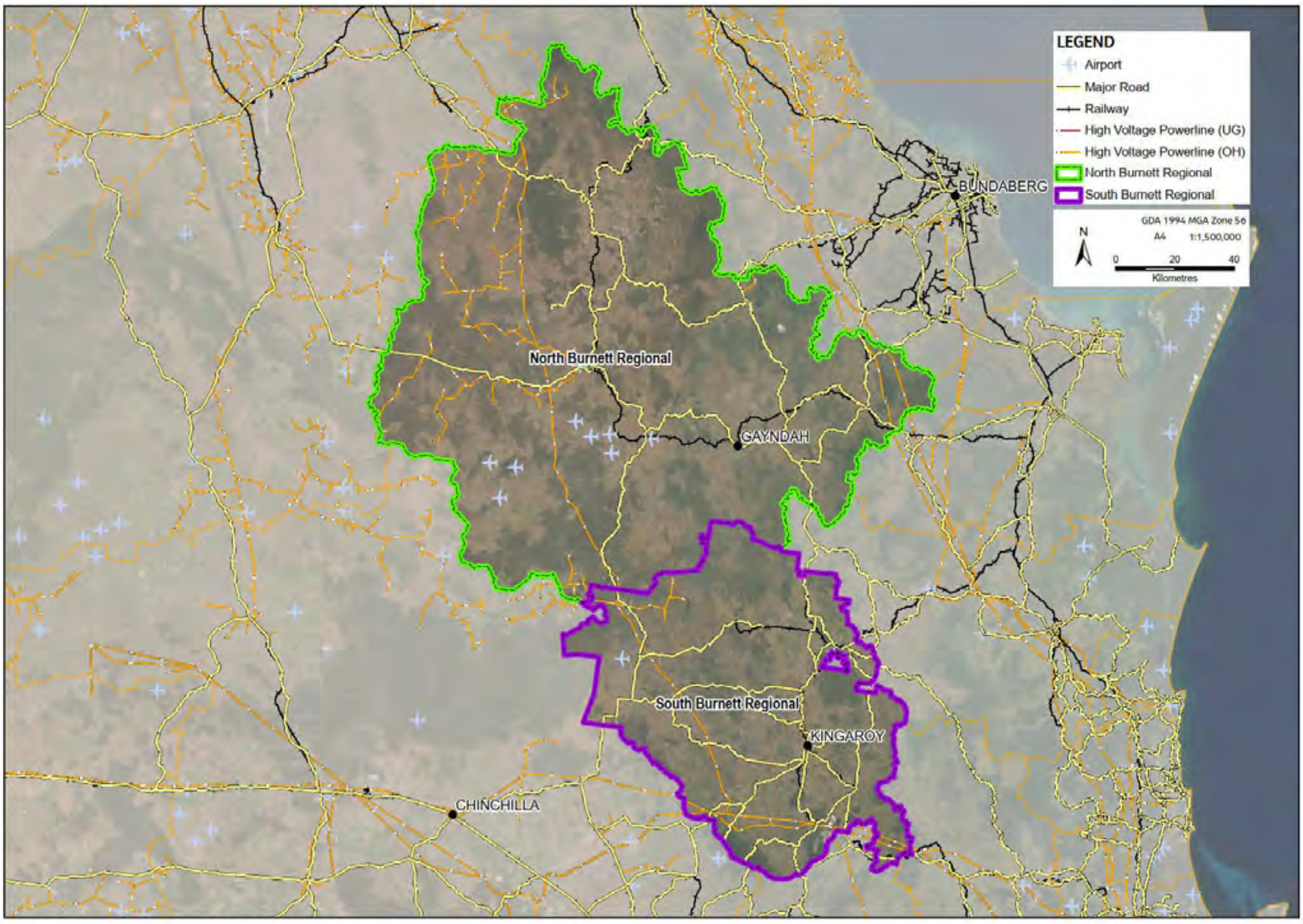
The Burnett region is located adjacent to South East Queensland and has good access to major markets and logistical hubs. Travel time from within the Burnett to logistical hubs is generally between two and four hours.

Table 3-6 : Road travel time

	Brisbane (Rocklea)	Bundaberg Port	Wellcamp
Gayndah	332 km / 4 hours	168 km / 2 hours	295 km / 4 hours 20 mins
Mundubbera	369 km / 4 hours 20 mins	205 km / 2 hours 30 mins	386 km / 3 hours
Nanango	192 km / 2 hours 15 mins	288 km / 3 hours 15 mins	132 km / 1 hour 30 mins
Kingaroy	217 km / 2 hours 30 mins	266 km / 3 hours	147 km / 2 hours

There are major roads leading to the Brisbane markets at Rocklea, ports in Brisbane and Bundaberg, and major airports in Brisbane, Bundaberg and Wellcamp. Export opportunities from Wellcamp are increasing, with one refrigerated plane leaving for Asia each week.

Figure 3-24 : Existing infrastructure



3.4.6 Electricity network capacity

Some industries require access to electricity distribution capacity. It can be expensive to increase capacity, so understanding the capacity in the network can reduce the costs of delivering water and/or processing the resulting product. There is available capacity in Monto, Mount Perry, Gayndah and Mundubbera (**Figure 3-25**).

Figure 3-25 : Electricity network capacity (MVA)

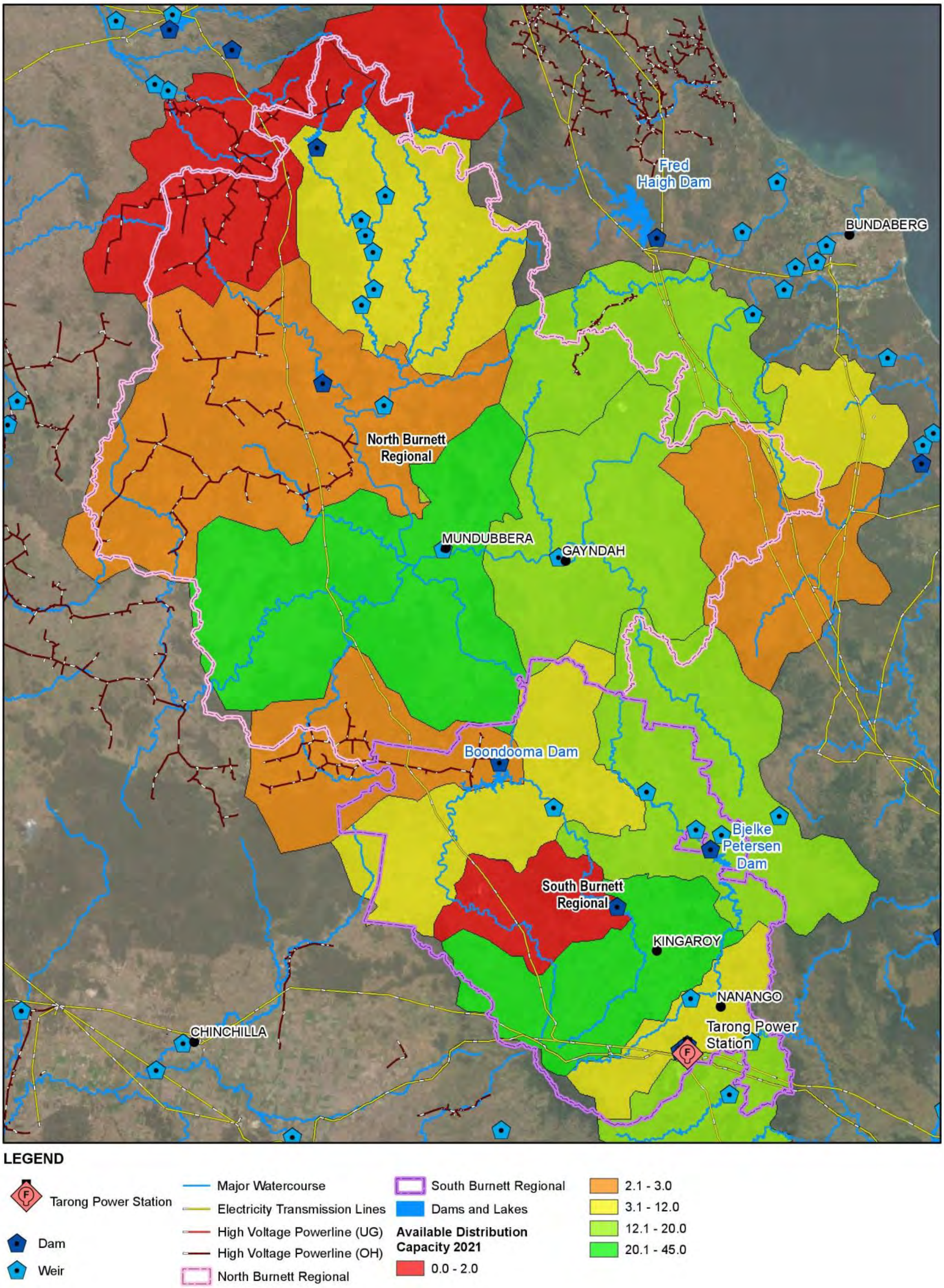
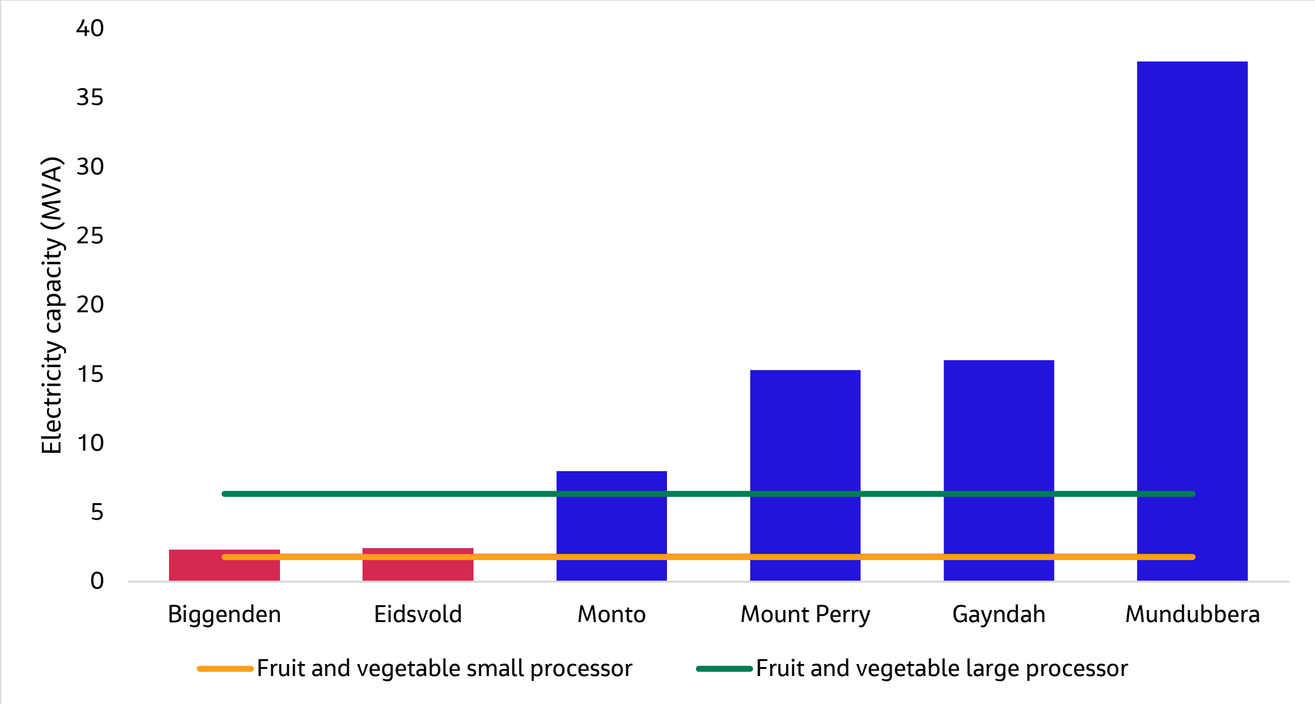


Figure 3-26 : Electricity capacity (MVA)



3.4.7 Existing water supply allocation and management

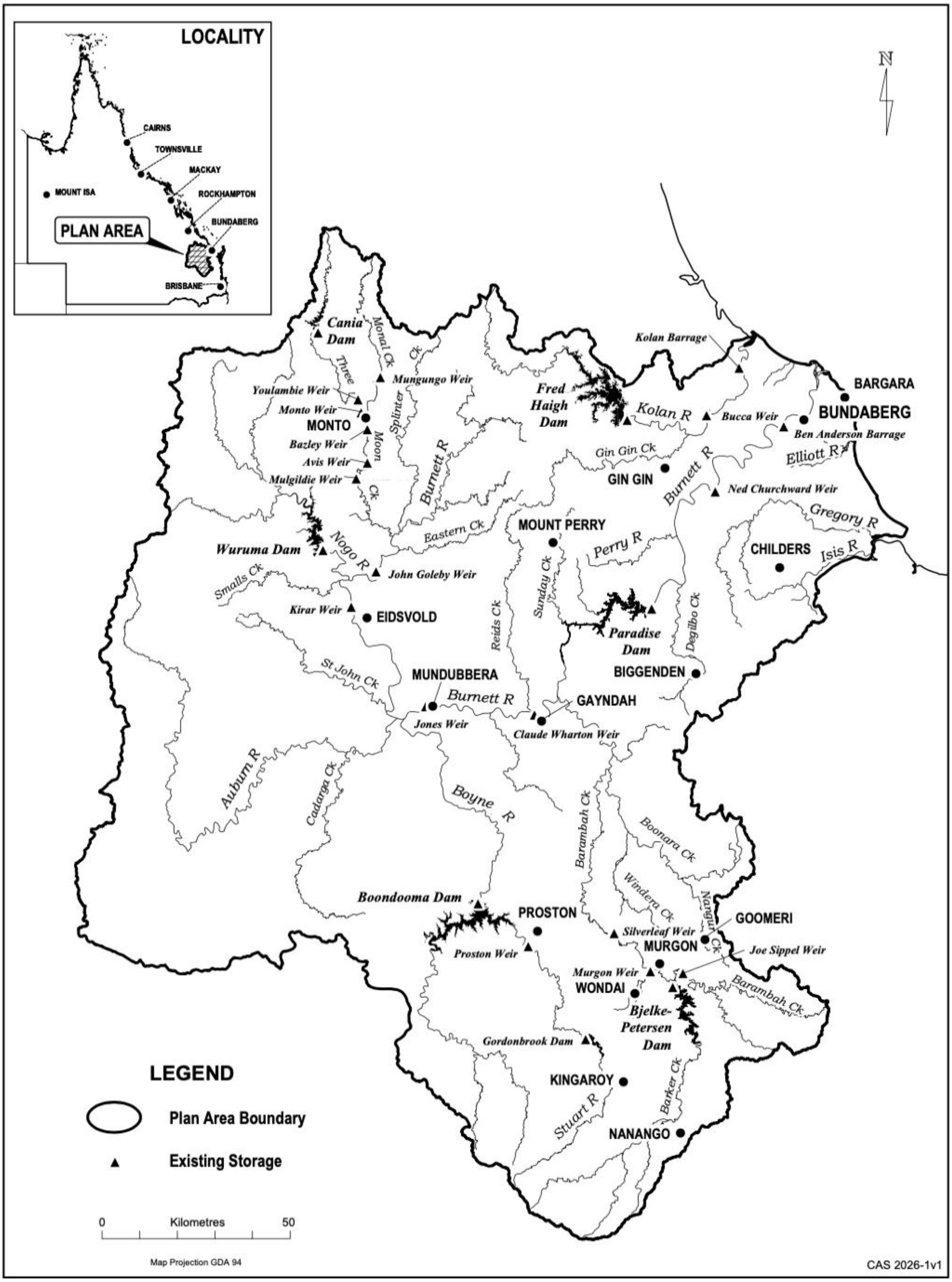
Surface water and groundwater in the Burnett River Basin is allocated and managed under the Water Plan (Burnett Basin) 2014. **Figure 3-27** shows the area for the water plan.

The plan was last replaced in 2014 and is due to expire on 1 September 2024. A five-year assessment of the water plan was completed in 2019, which identified a number of emerging issues[10] including:

- the interest in accommodating potential new water infrastructure developments within the plan area to address agricultural water demands and water security including Cooranga Weir, Claude Wharton Weir (where a bag was decommissioned) as well as NWIDF projects including Gayndah regional infrastructure development (GRID)
- the implications of progressing the Paradise Dam Improvement Program with Building Queensland
- the implications of long-term climate change projections for 2030, which predict an increase in evaporation across the plan area as well as a small decrease in rainfall mainly during the spring months, and a small increase in rainfall mainly during the autumn months.

[10] DNRME, *Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014*, assessment report, November 2019.

Figure 3-27 : Burnett water plan area



Source: Replicated from the water plan area map presented on the Business Queensland website.

3.4.7.1 Existing water entitlements

Water users have access to water taken under a water entitlement, using authorised overland flow and groundwater works or under a statutory authorisation through the Water Act (e.g. low-risk or prescribed activities such as stock and domestic use). These are summarised in **Table 3-7**. Note that the take of water under the category of statutory authorisations—such as stock and domestic take, overland flow water interference, and various prescribed activities—is typically not measured in the Burnett Basin. Departmental monitoring suggests that the quantum of take of overland flow water in the basin is considered to be small, and the rate of the development of new offstream storages is considered a low risk to the outcomes of the water plan.

Table 3-7 : Existing water entitlements in the Burnett Basin

Entitlement type	Entitlement numbers				Entitlement	
	All	Volumetric	Area	Other	Volume (ML)	Area (ha)
Surface Water Licences	775	184	352	239	25,467	0
Underground Water Licences	270	259	0	11	35,274	0
Supplemented Surface Water Allocations	4633	4633	0	0	493,848	0
Unsupplemented Surface Water Allocations	439	439	0	0	48,344	0
Unsupplemented Underground Water Allocations	758	758	0	0	62,326	0
Interim Water Allocation	127	127	0	0	14,586	0

Source: Replicated from DNRME, Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014, Nov 2019, Appendix B, Table 7.

Sunwater operates five water supply schemes in the region. There is a large amount of uncommitted water in the Bundaberg scheme. However, the current safety review of Paradise Dam may reduce this amount and result in no water being available for transfer outside of the Bundaberg Scheme.

Table 3-8 : Availability of water allocations

Water supply scheme	Total water storage capacity (ML)	Water allocations held by customers (ML)	Uncommitted water allocations (ML)
Barker Barambah	136,190	33,512	803
Boyne River and Tarong	204,200	41,785	0
Bundaberg[1]	937,420	209,978	128,831
Three Moon Creek	89,328	14,734	0
Upper Burnett	188,439	40,985	7,565

1 This is subject to an ongoing investigation regarding Paradise Dam and is currently subject to 399B notice under Water Supply Safety and Reliability Act. Refer section 2.1.10.2.

Source: QBWOS (2018).

3.4.8 Availability of supplemented water

The availability of water is of critical importance to water users in each scheme. The reliability of a product—as described below—relates to a water entitlement's long-term access to available water supplies and has a bearing on what the water is actually used for. For example, an urban water user will require a high-reliability product to minimise the risk of an interruption to urban water deliveries.

Within the irrigation industry, different customers will require different levels of reliability to manage their risk. For example, an orchard is likely to require a high-reliability product to ensure that permanent planting survives. Alternatively, some irrigators can manage the risk of a lower-reliability product, which has greater variability.

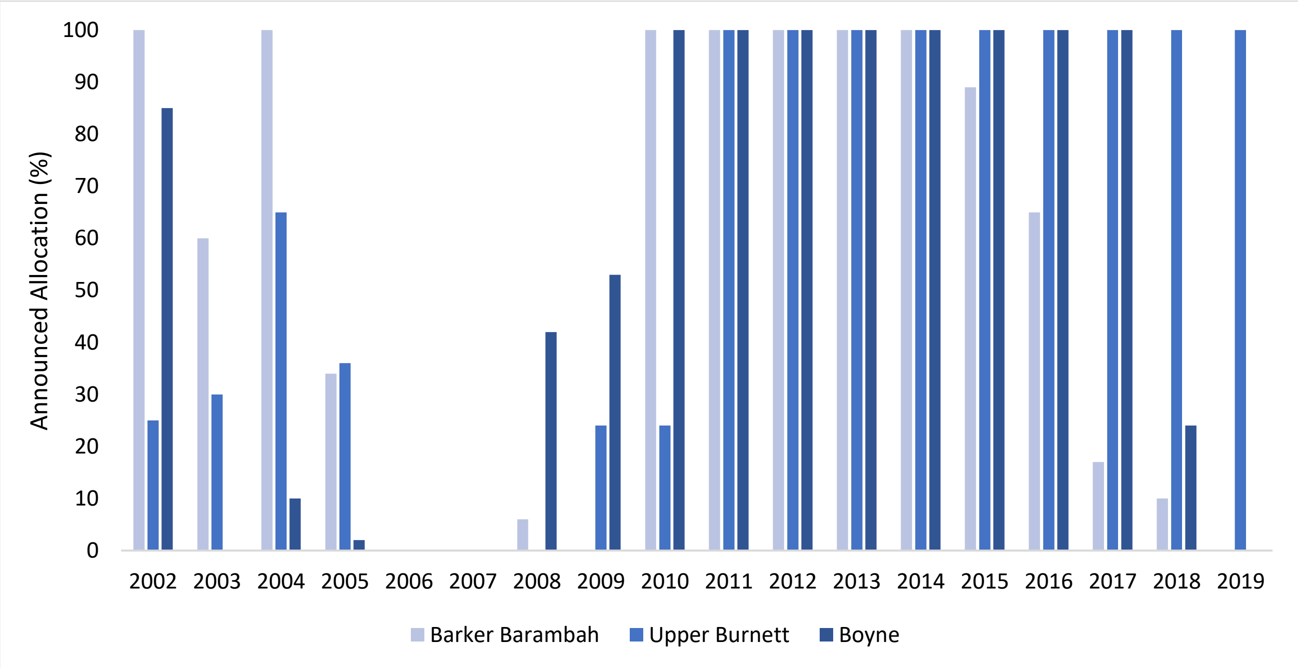
The data on the historical availability of Sunwater schemes within and near the region show reasonable access to water in each scheme since 2010. However, there was a prolonged period during which the announced allocation was substantially reduced.

Within the North Burnett and South Burnett, there are four key Sunwater-run water supply schemes that support agricultural development and irrigation.

- Boyne River and Tarong Water Supply Scheme
- Barker Barambah Water Supply Scheme
- Upper Burnett Water Supply Scheme
- Three Moon Creek Water Supply Scheme.

The announced allocations in the region are shown in the figure below.

Figure 3-28 : Announced allocation (start of year) for water supply schemes with a resource operations licence



Note: Announced allocation shown for 1 July in each year. It may have increased during the year.

The Boyne River and Tarong scheme and the Barker Barambah schemes have the lowest average announced allocation over the past 20 years.

3.4.8.1 Boyne and Tarong Water Supply Scheme

The Boyne River and Tarong Water Supply Scheme is supplied by the 204,000 ML concrete-faced rockfill Boondooma Dam. The dam, which was purpose-built in 1982 to provide water to the Tarong Power Station, is located on the Boyne River near the town of Proston in the South Burnett region. The Tarong pipeline, which is owned and operated by Sunwater, links the dam to Tarong Power Station.

The dam supplies water to industrial, irrigation, urban and other users.

Table 3-9: Boyne River and Tarong water allocations

Customer type	High priority water allocation (ML)	Medium priority water allocation (ML)	Total water allocation (ML)
Tarong pipeline	29,990	0	29,990
Other industrial		343	343
Irrigation		9,142	9,142
Urban	1,825		1,825
Other	480		480
Sunwater	1,625		1,625
Total	**33,920**	**9,485**	**43,405**

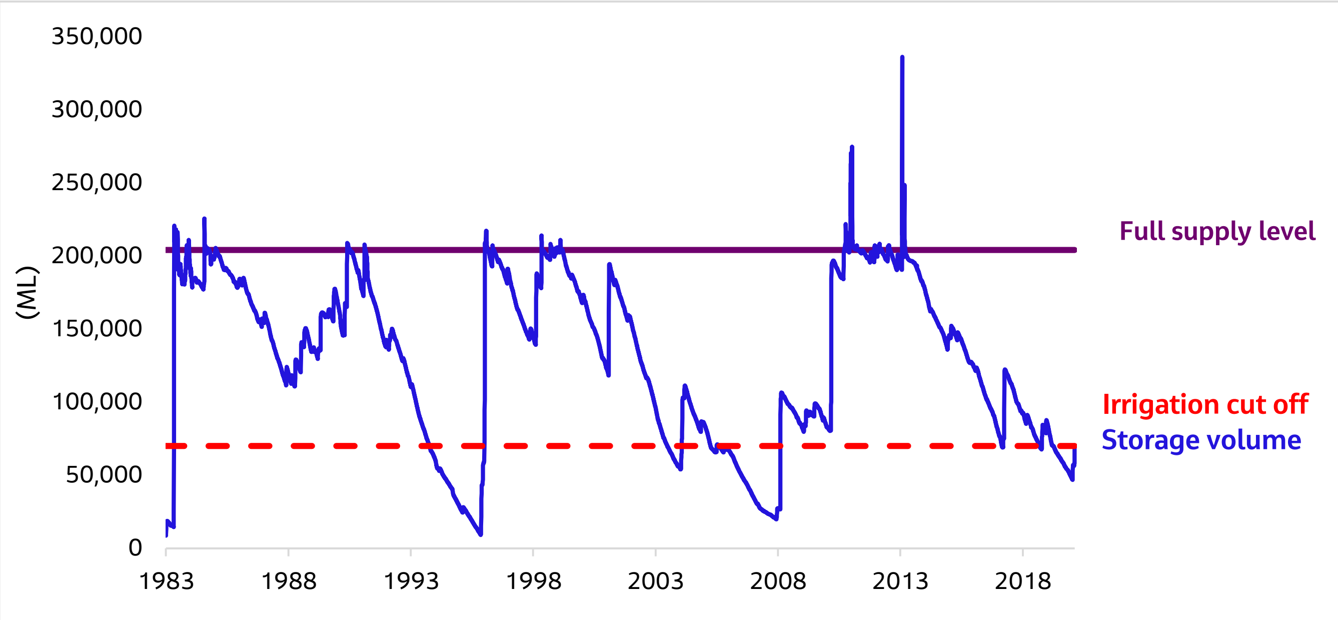
Source: Sunwater Boyne River and Tarong Network Service Plan, 2018.

Releases are made from Boondooma Dam to meet demands for medium priority water allocation holders downstream of the dam only if the storage level is above 268.67 m Australian Height Datum (AHD) which equates to approximately 70,000 ML in storage capacity. No releases may be made below this to protect high priority water allocations for town water supplies and power generation. This rule was designed to give priority to maintaining the performance of urban and industrial users over irrigation customers when supplies in the dam are low.

This means that irrigators are not able to be supplied with water from the dam once the volume of the dam falls below 70,000 ML, irrespective of their announced allocation (although during these periods limited access is provided to irrigators to take water from downstream bedsands and water holes).

The stored volume has fallen below 70,000 ML several times since the completion of the dam (Figure 3-29).

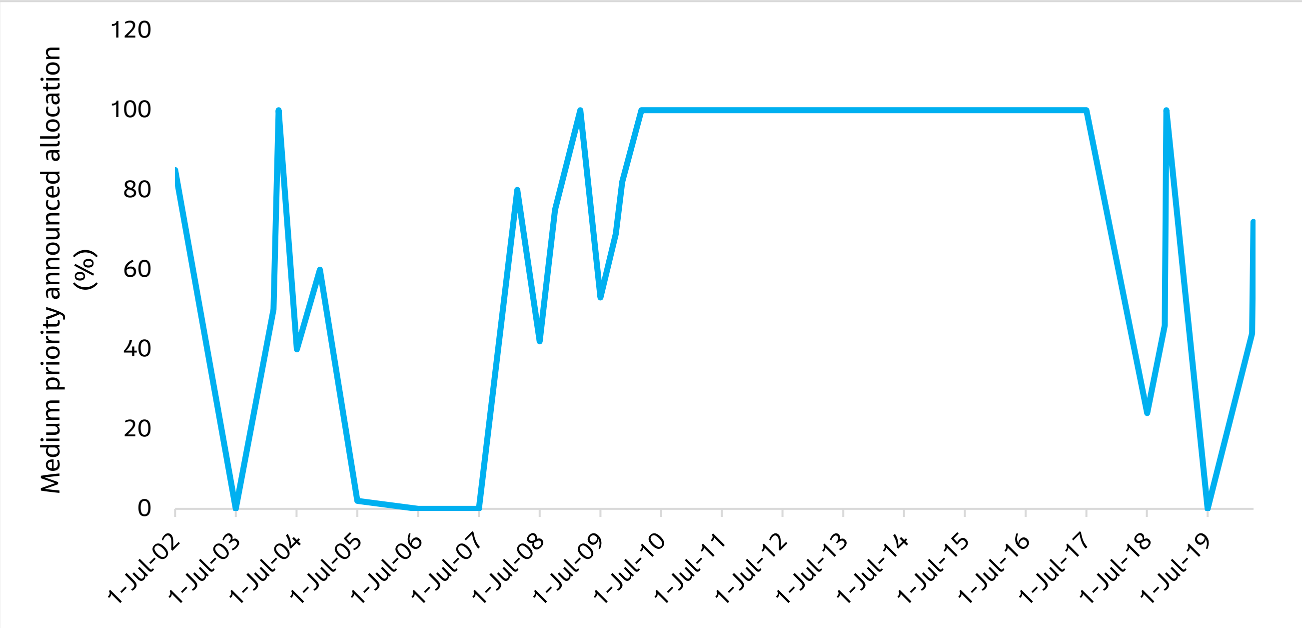
Figure 3-29 : Boondooma Dam volume (ML)



Source: BoM, Water Data Online, http://www.bom.gov.au/waterdata/.

Since 2002, the dam has been below 70,000 ML 19 per cent of the time. In years where the dam level is near or below the cut-off at the start of the water year, this has resulted in prolonged periods where the announced allocation for irrigators is zero, or very close to zero. High priority water allocation holders have had 100 per cent announced allocation in every year.

Figure 3-30 : Boyne River and Tarong medium priority announced allocations



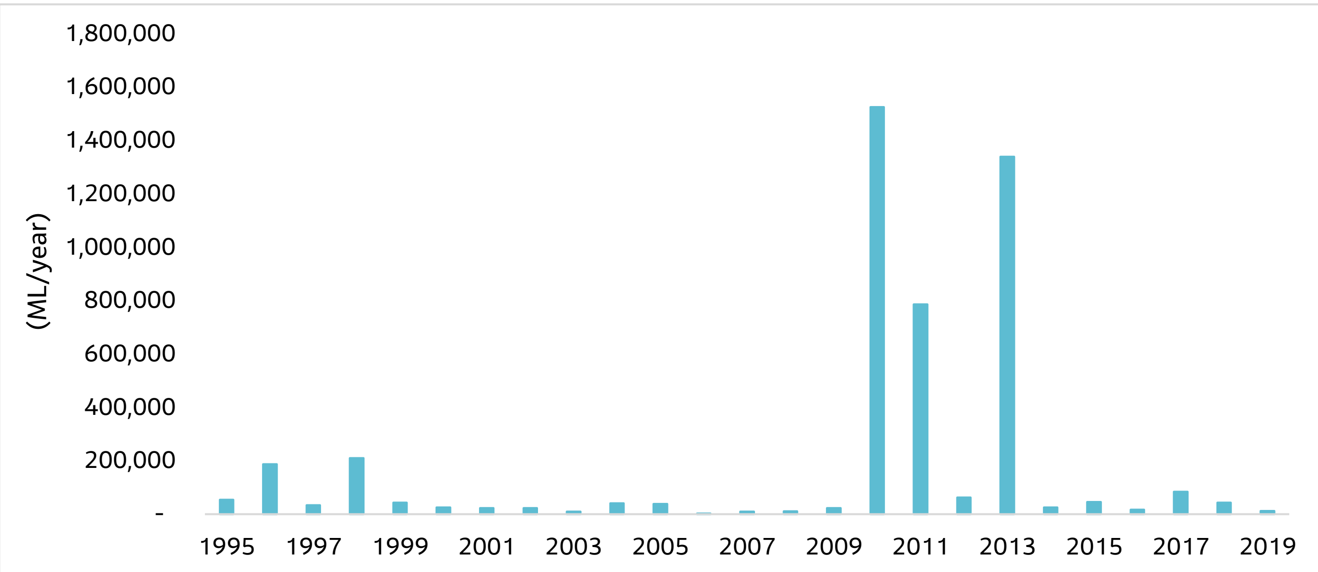
Source: Sunwater, Boyne River and Tarong Scheme, https://www.sunwater.com.au/schemes/Boyne-River-and-Tarong/

The dam is towards the top of the Boyne River catchment and it can take five to eight days for water to travel from the dam to the irrigators. This travel time is due to the 40 km distance between the dam and the first customer. This distance and time results in high transmission losses and cancelled orders (as it can rain between ordering and delivery). There have been discussions between Sunwater and the Irrigation Advisory Committee to improve ordering protocols. However, there are contradictory reports on the success of implementation.

There are several inflows downstream of the dam that are not captured in the Boyne River, which then flow into the Burnett River. A re-regulating weir on the Boyne River could capture these flows, which would result in less water flowing out of the Boyne River into the Burnett River.

The average volume is 187,000 ML per annum. However, if the three largest years are excluded, then the average volume is 47,000 ML per annum, with a minimum of 2,272 ML in 2006. It should be noted that these flows are influenced by dam releases and irrigators taking water.

Figure 3-31: Historical river flows (ML/year)—Boyne River at Cooranga



Source: Queensland Government, Water Monitoring Information Portal, water-monitoring.information.qld.gov.au.

3.4.8.2 Barker Barambah Water Supply Scheme

The Barker Barambah Scheme is supplied by the Bjelke-Petersen Dam, near Moffatdale in the South Burnett, which captures the flows of Barker Creek, Four Mile Creek, Six Mile Creek, Frickey Creek and Cattle Creek to create Lake Barambah. Water is supplied primarily for irrigation, with some urban supply.

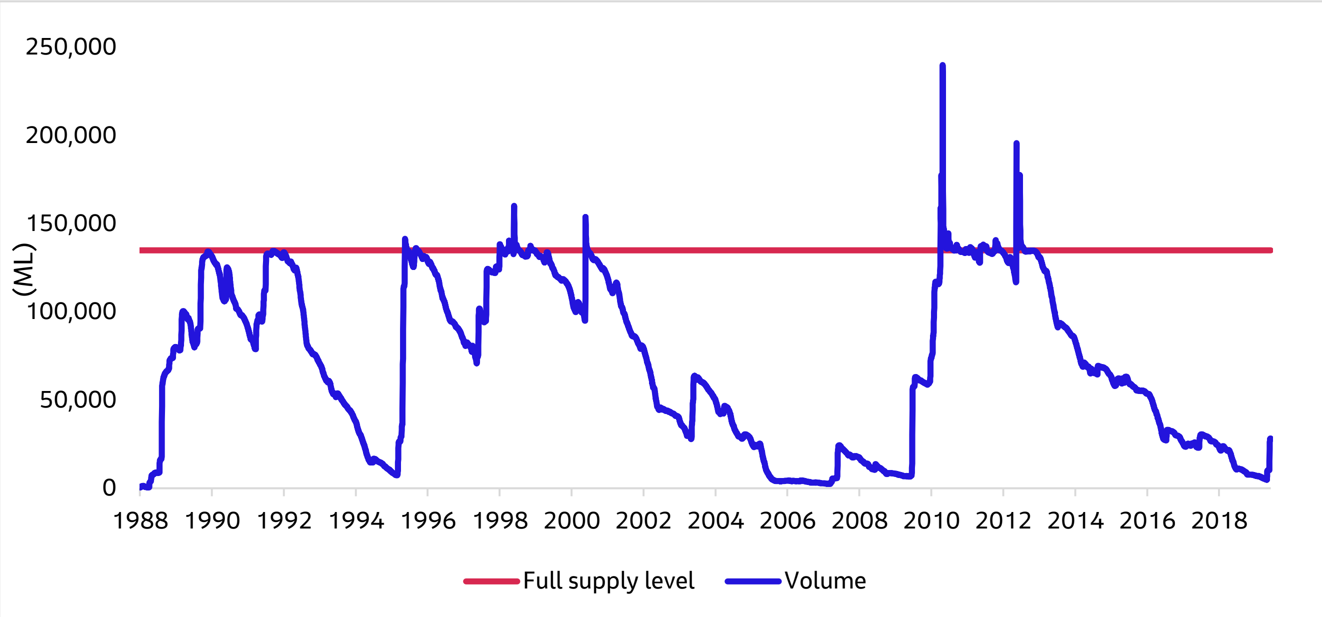
Table 3-10: Barker Barambah water allocations

Customer type	Priority	Water allocation (ML)
Urban	High	2,115
Irrigation	Medium	31,361
Sunwater	High	839
Total		**34,315**

Source: Sunwater, 2018–19 annual report.

The water made available for consumptive use depends on the volume of water stored in the dam (Figure 3-32).

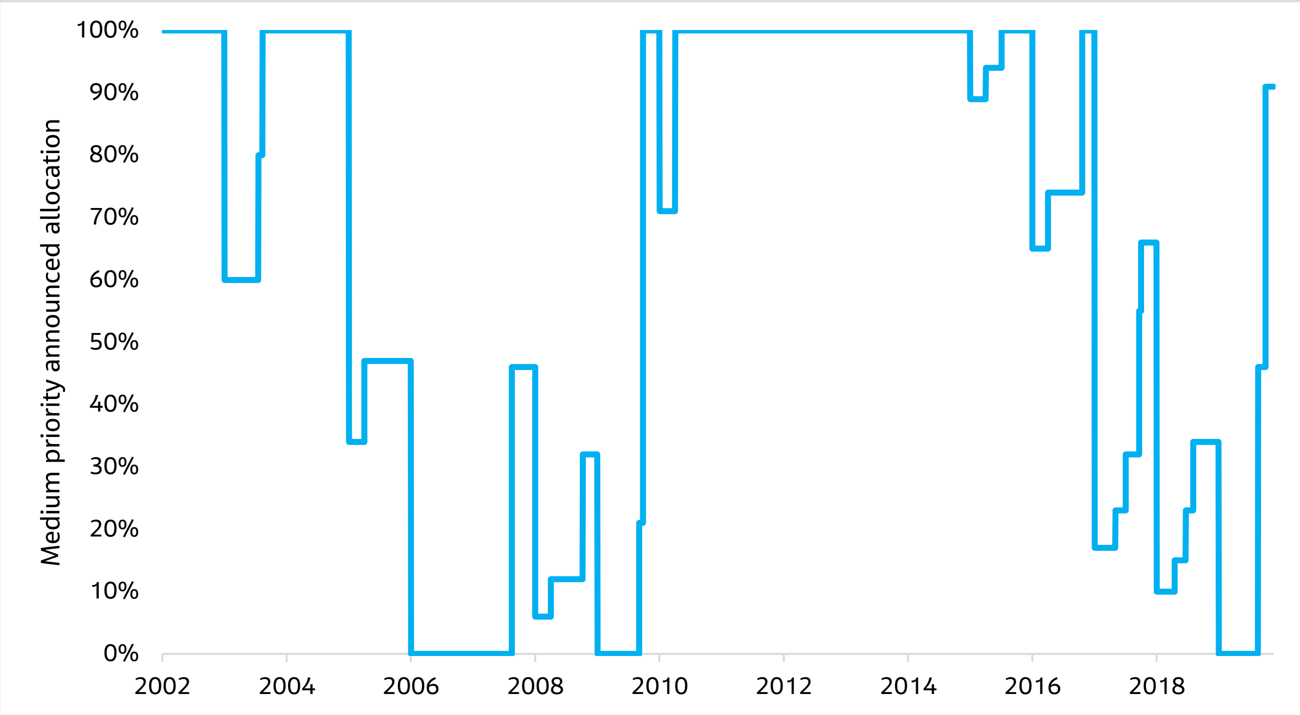
Figure 3-32 : Bjelke-Petersen Dam volume (ML)



Source: BoM, Water Data Online, http://www.bom.gov.au/waterdata/.

Medium priority (irrigation) announced allocations have been unreliable, with several periods of very low, or no, water available.

Figure 3-33: Barker Barambah—medium priority announced allocation history



3.4.8.3 Upper Burnett Water Supply Scheme

The Upper Burnett Water Supply Scheme is supplied by the 165,000 ML Wuruma Dam located on the Nogo River, a tributary of the Burnett River. Other main storages in the scheme include:

- John Goleby Weir
- Jones Weir
- Claude Wharton Weir.

The scheme supplies water to irrigate some 4,450 ha of land along 165 km of the Burnett River and delivers urban water to the towns of Eidsvold, Mundubbera and Gayndah. There are also small industrial water users within the scheme.

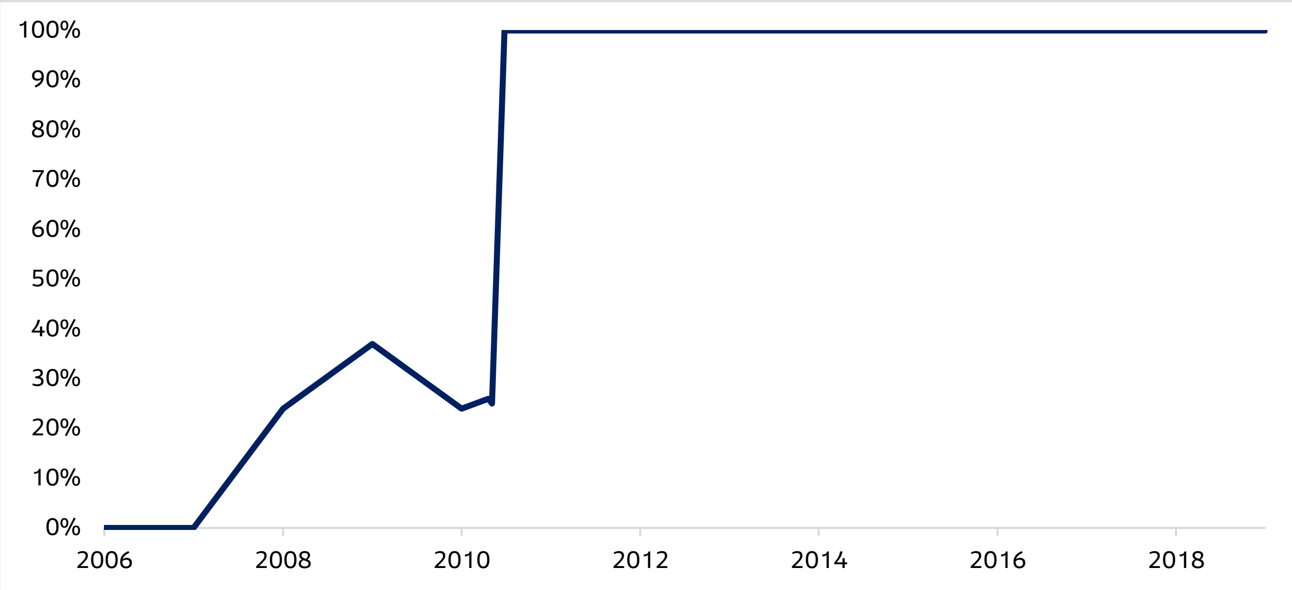
Table 3-11: Upper Burnett water allocations

Customer type	Priority	Water allocation (ML)
Urban	High	1,630
Irrigation	Medium	28,769
Industrial	Medium	119
Sunwater	Medium	18,032
Total		**48,550**

Source: Sunwater, 2018—19 annual report.

Medium priority (irrigation) announced allocations have been relatively reliable. However, there was a period between 2006 and 2010 where the announced allocation was very low, with small periods of no water available.

Figure 3-34: Upper Burnett—medium priority announced allocation history



3.4.8.4 Three Moon Creek Water Supply Scheme

The Three Moon Creek Water Supply Scheme is supplied by the 89,000 ML Cania Dam, 37 km north-west of Monto. Releases from the dam are made to recharge groundwater reserves which supply the majority of customers in the scheme. Other main infrastructure in the scheme includes:

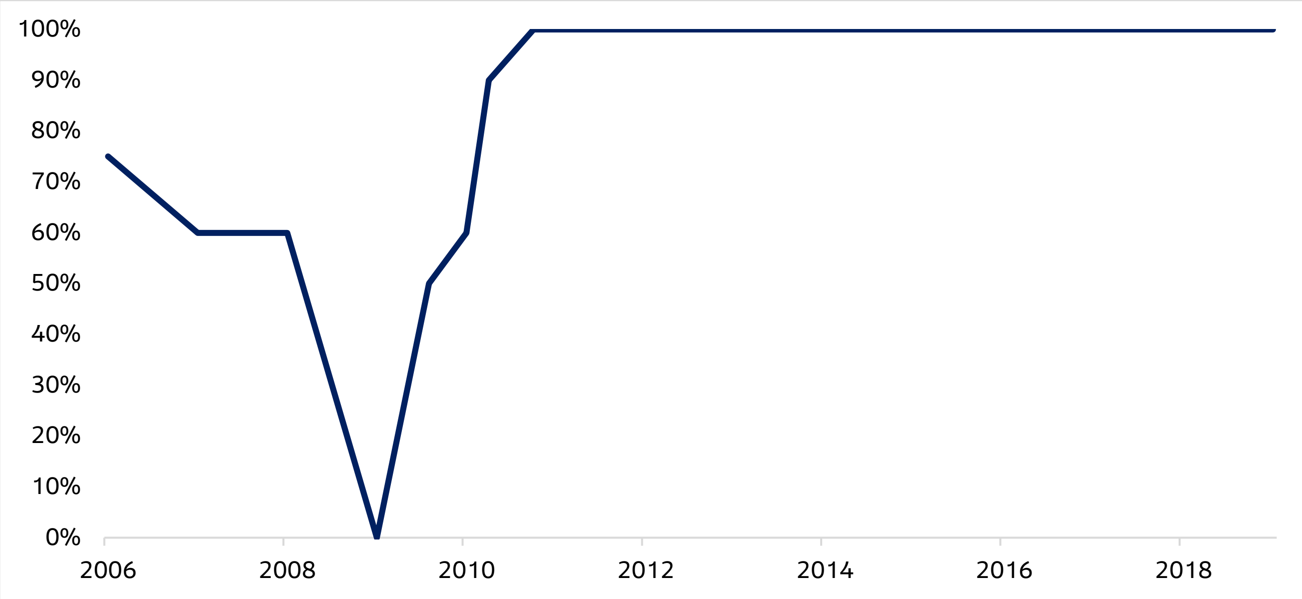
- Avis Weir
- Bazley Weir
- Monto Weir
- Mulgildie Weir
- Youlambie Anabranch Weir
- Youlambie Weir.

Table 3-12: Three Moon Creek water allocations

Customer type	Priority	Water allocation (ML)
Urban	High	410
Irrigation	Medium	14,124
Government	Medium	200
Total		**14,734**

Medium priority (irrigation) announced allocations have been relatively reliable. However, there was a period between 2006 and 2011 when the announced allocation was very low, with small periods of no water available.

Figure 3-35: Three Moon Creek—medium priority announced allocation history



3.4.9 Irrigation water efficiency

There have been several programs to improve water use efficiency. These programs tend to focus on specific industries, rather than regions. However, two relevant programs are shown below.

Table 3-13: Summary of water use efficiency programs

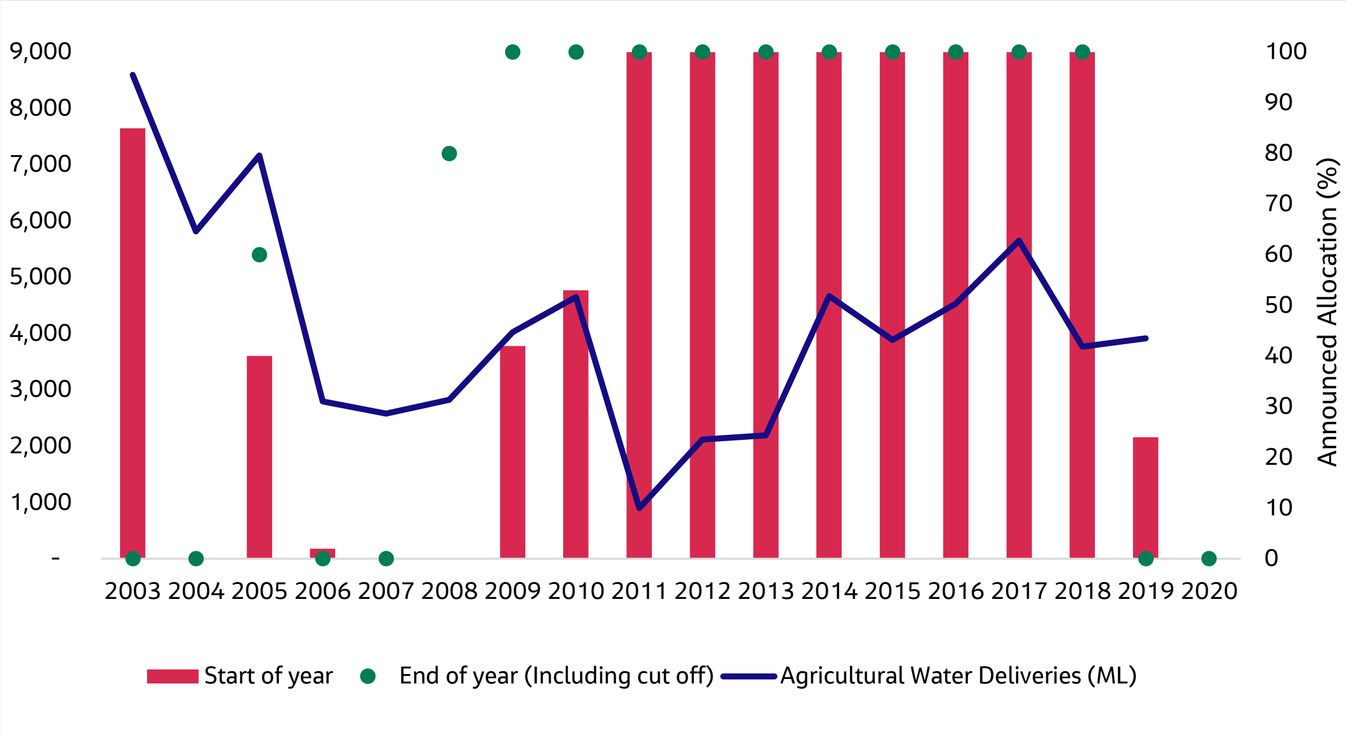
Project	Description	Source
Rural Water Use Efficiency Phase 4 2010–2013	RWUE4 has been a successful intervention program. The participation rate was high, and in many cases, all known irrigators were contacted about taking part in the program. Whilst the data is not exhaustive, there is evidence that the industry has made ground in achieving more efficient irrigation systems.	Rural Water Use Efficiency Program, Department of Natural Resources and Mines, 2016
Rural Water Use Efficiency for Irrigation Futures	Growcom was provided with $1.2 million to improve productivity and sustainability through irrigation system evaluations, irrigation scheduling and fertigation techniques.	Progress report 2013–16

These programs provide some evidence that irrigation practices continue to improve. On-the-ground farm-specific investigations found that the scarcity of water has encouraged irrigators to implement water efficiency measures. While further efficiency may be possible in the future, the conclusion reached was that current water use practices are appropriate, and that water is currently being used efficiently. However, as irrigation techniques and crop types continue to improve, this area will likewise experience an improvement in water efficiency.

For example, within the Boyne River and Tarong Water Supply Scheme, there are large areas of high-value tree and perennial crops such as mandarins and blueberries—which require significant upfront investment and have high ongoing fixed costs. As they are permanent crops, they cannot tolerate periods without water. Accordingly, in these circumstances, irrigators plan to never to use their full water allocation. Irrigators will forgo expansion, rather than risk losing the investment required for new plantings. This means investment decisions within the scheme are based on the worst year rather than the typical average year.

This can be seen in the data. Between 2014 and 2018, when full water allocations were available and rainfall was typical, irrigators used approximately half of their announced allocation. This is not a sign of underutilisation, but of a cautious approach, as they know that dry times will come and if they plant too much, plants will die during the dry times.

Figure 3-36: Boyne River medium priority announced allocation



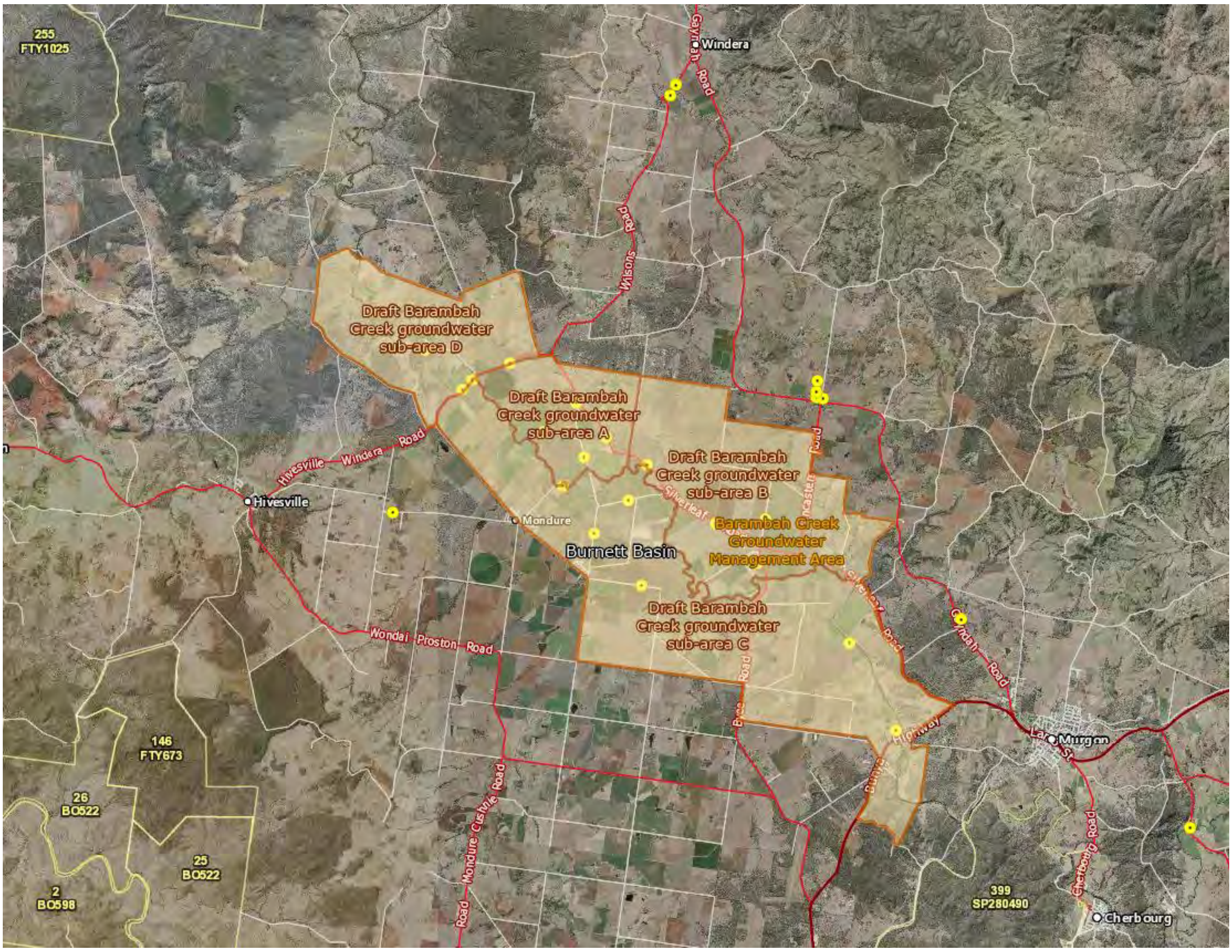
Therefore, underutilised entitlements can often be a function of water scarcity within the scheme and the way in which irrigators are responding to this. The more volatile the supply, the more conservative irrigators will be. It does not always mean that irrigators are simply not using all their water.

3.4.10 Burnett Basin water plan: consultation on the Barambah Creek groundwater management area

DNRME is proposing to implement the Burnett Basin water plan in the Barambah Creek groundwater management area.

There is a proposed amendment to the Water Management Protocol plus a Water Entitlement Notice to implement the Burnett Basin water plan in the Barambah Creek groundwater management area by converting existing groundwater entitlements to water allocations and introducing water sharing rules and monitoring requirements for them. The submission period has closed and submissions were being considered at the time of finalising this document.

Figure 3.37: Boundaries of the Barambah Creek groundwater management sub-areas



3.4.11 Current and future urban water security

Urban water security in North Burnett is generally acceptable, although there are short-term water restrictions in place in the townships of Biggenden and Mt Perry. Urban water security in South Burnett is of significant concern, with water restrictions in place across South Burnett since March 2017. The water restrictions materially impact the availability of water for residents and businesses in South Burnett.

Table 3-14: Current water restrictions[11]

Town	Region	Water supply	Restriction	When introduced	Link to restriction description
Biggenden	North	Two groundwater bores with DNRME 200 ML license (not good quality and becoming less reliable) Surface water from Degilbo Creek (not permanent and not good quality) as a second priority source	Level 1	Reduced from level 3 to level 1 on 10 March 2020 (Level 3 introduced on 20/1/20; level 2 introduced on 16/12/19; level 1 introduced on 28/08/19)	Urban Water Drought Management Plan—NBRC

[11] Table 2.10 identifies the current and recent water restrictions in North and South Burnett. Further analysis will be done to identify the trends in water restrictions over time and how they coincide water shortages across the study area.

Town	Region	Water supply	Restriction	When introduced	Link to restriction description
Eidsvold	North	Burnett River—200 ML high priority water allocation from Sunwater—Zone OC (two river bores below Kirrar Weir)	Level 0 (no restriction)	–	Urban Water Drought Management Plan—NBRC
Gayndah	North	Burnett River—850 ML high priority water allocation from Sunwater—Zone NB (Claude Wharton Weir)	Level 0 (no restriction)	–	Urban Water Drought Management Plan—NBRC
Monto	North	Three Moons Creek—380 ML high priority water allocation from Sunwater (bores from aquifer fed by Cania Dam)	Level 0 (no restriction)	–	Urban Water Drought Management Plan—NBRC
Mt Perry	North	Two groundwater bores at Wolca Reserve	Level 1	Level 1 introduced on 4 May 2020. (Level 2 introduced 16 /12/19)	Urban Water Drought Management Plan—NBRC Level 2— NBRC
Mulgildie	North	90 ML GAB license from DNRME (680 m artesian bore)	Level 0 (no restriction)	–	Urban Water Drought Management Plan—NBRC
Mundubbera	North	Burnett River—320 ML high priority water allocation from Sunwater—Zone OA (Jones Weir)	MO—permanent conservation measures level	Permanent	Urban Water Drought Management Plan—NBRC
Kingaroy	South	Boondooma Dam in the Boyne River and Tarong Water Supply Scheme (70% of supply) Gordonbrook Dam in the Boyne and Stuart Rivers Water Management Area (30% of supply)	Level 3	15 March 2017	Level 3 Restrictions —Commercial—SBRC Level 3 Restrictions—Residential—SBRC
Kumbia	South	Kumbia Reedy Creek borefield	Level 3	15 March 2017	Level 3 Restrictions - Commercial—SBRC Level 3 Restriction—Residential—SBRC
Wooroolin	South	Wooroolin borefield	Level 3	15 March 2017	Level 3 Restrictions—Commercial—SBRC Level 3 Restrictions—Residential—SBRC
Nanango	South	Nanango bores A, B, C and rising main	Level 3	15 March 2017	Level 3 Restrictions—Commercial—SBRC Level 3 Restrictions—Residential—SBRC

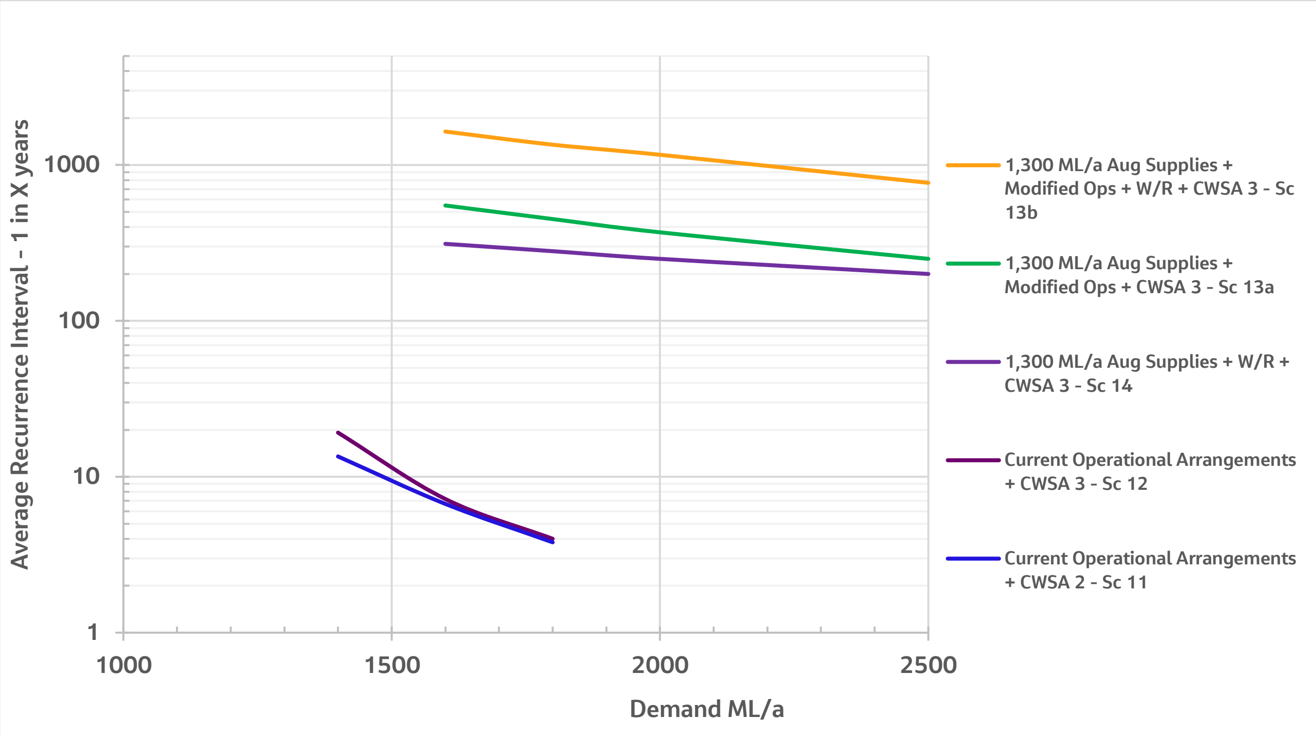
Town	Region	Water supply	Restriction	When introduced	Link to restriction description
Blackbutt	South	Boondooma Dam via the Nukku pipeline from Tarong pump station and header tank (primary supply for Blackbutt and Yarraman) Boobir Dam (backup supply)	Level 3	15 March 2017	Level 3 Restrictions—Commercial—SBRC Level 3 Restrictions—Residential—SBRC
Wondai Tingoora	South	Wondai Raw Water pump station and rising main out of Ficks crossing (primary supply) Releases from Bjelke-Petersen Dam via Murgon Weir (backup supply)	Level 3	15 March 2017	Level 3 Restrictions—Commercial— SBRC Level 3 Restrictions—Residential—SBRC
Proston/ Proston Rural	South	Boondooma Dam—Proston Raw Water pump station and rising main offtake from Boondooma pipeline	Level 3	15 March 2017	Level 3 Restrictions—Commercia—SBRC Level 3 Restrictions—Residential—SBRC
Murgon	South	Barambah Creek —Murgon Raw Water pump station and rising main (primary source) Releases from Bjelke-Petersen Dam	Level 3	15 March 2017	Level 3 Restrictions—Commercial—SBRC Level 3 Restrictions—Residential—SBRC
Boondooma Dam Rec Area	South	Boondooma Dam Raw water supply (Boyne River and Tarong Water Supply Scheme)	Level 3	15 March 2017	Level 3 Restriction—Commercial—SBRC Level 3 Restrictions—Residential—SBRC

Community consultations and analysis by the South Burnett Regional Council identified concerns regarding the quality and suitability of water for residential uses in Murgon and Kingaroy.[12] The townships in North Burnett and South Burnett draw water from multiple different primary water sources that have varying water security and reliability (Table 2.10). Multiple townships rely on allocations from Boondooma Dam, which contributes to the stress on that water storage. The primary water source for Kingaroy is Boondooma Dam (70% of Kingaroy's supply) and Gordonbrook Dam (30% of Kingaroy's supply), which has substantive urban water quality issues when the dam level is low.

In 2019, the Queensland Government DNRME undertook a Regional Water Supply Security Assessment (RWSSA) for Kingaroy. This assessment, which is yet to approved by South Burnet Regional Council, concluded that current annual demand of 1,400 ML for Kingaroy had a supply failure of 1 in 13 years (7.7%). The forecast demand in 2020–21 of 1,600 ML for Kingaroy had an expected failure rate of approximately 1 in 8 years (13%). Without an increase in supply, Kingaroy has a modelled recurrence interval of been able to meet demand of one year in four.

[12] South Burnett Regional Council, *Drinking Water Quality Management Plan (DWQMP) report 2018–2019*, 2019.

Figure 3-38: Average recurrence interval of Kingaroy water supply



Currently, Kingaroy's total demand is 1,400 ML per annum, with level 3 water restrictions in place.

3.4.12 Future water supply availability

The Water Plan (Burnett Basin) 2014, outlines the volume and conditions associated with the general reserve, strategic reserve and strategic water infrastructure reserve. On 17 July 2019, amendments to the Water Act 2000 came into effect that allow temporary access to unallocated water held as strategic water infrastructure reserves under a temporary water license for up to three years.

3.4.13 Future agricultural water demand

Several historical assessments have been undertaken that have included an agricultural demand assessment as a component. Some of the studies identified future demand based on available soils. However, as demand for water is linked directly to price, these studies can provide an upper limit of potential demand, but a more detailed assessment is required to establish the demand at the relevant price.

A summary of all existing relevant demand reports and studies is provided below.

Table 3-15 Historical demand reports and studies

Study	Details
Soils of the Riparian Lands of the Burnett River between Mundubbera and Gayndah, Queensland (1996) [(a)]	The principal uniform sandy soil is the Burnett soil, which occurs on levees of the Burnett River. This soil is well drained, has a good water holding capacity and is suited to most crops under sprinkler irrigation. The Burnett shallow phase is a moderately deep fine sand overlying clay and is also an important soil for horticulture. Cracking clays occur on relict alluvia, basalt and sedimentary rocks. Most of these soils are suited to a wide range of field crops, with some areas suited to vegetable crops. Extensive areas are suitable for irrigation include (some soils have suitability for several crops): A total of 7,990 ha is suitable for asparagus, 950 ha for avocado, 2,035 ha for chickpea, 3,553 ha for citrus, 7,990 ha for cruciferae and cucurbits, 7,338 ha for grapes, 3,433 ha for lucerne, 950 ha for mango, 2,112 ha for mungbean, 4,192 ha for navybean, 14,861 ha for pastures, 2,262 ha for peanut, 3,689 ha for pecan, 2,269 ha for potato, 5,539 ha for safflower, 4,976 ha for soybean,

Study	Details
	3,689 ha for stone fruits, 8,237 ha for summer grains, 5,523 ha for sunflower, 8,037 ha for vegetables and 8,075 ha for winter grains.
Agricultural land resource assessment of Coalstoun Lakes (2000) [(b)]	A total of 15 different soils were identified, and their distribution mapped. The dominant soils are black and grey cracking clays (Vertosols) and non-cracking red clay soils (Ferrosols), red and brown structured gradational soils (Dermosols) and sodic texture contrast soils (Sodosols). Extensive areas are suitable for irrigation (some soils have suitability for several crops): A total of 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land.
Bundaberg Channel Capacity Upgrade feasibility study (2018) [(c)]	The Bundaberg Channel Capacity Upgrade feasibility study examined demands across the Burnett – Wide Bay region, focusing mainly on areas potentially serviceable by Paradise Dam water. Sunwater Limited as agent for Burnett Water Pty Ltd issued an invitation to tender (ITT) to the market on 14 September 2018 for the purpose of calling for tenders to purchase water allocations, water supply services and the taking of water distribution services. At the time of the ITT there was 111,215 ML of medium priority water available, and this was offered to buyers at a fixed price of $550 per ML (ex GST) – the previous shelf price was $955 per ML. The total volume of water allocations purchased was 11,401 ML at $550 per ML, well short of the 111,215 ML made available to market. Sunwater received 51 offers. Low volumes were sought compared to the total available allocation.
Gayndah Regional Irrigation Development (GRID) project detailed business case (2018)	Several of the new demand areas are within the Burnett region. This includes Coalstoun Lakes, which is being developed by a group of Coalstoun Lakes farmers presently growing broadacre crops such as peanuts and maize. The area may be prospective for tree crops. The GRID project detailed business case explored developing new cane lands in the Gayndah region to leverage suitable soils and underutilised water resources. The GRID project would involve: ▪ the transfer downstream of unused water allocations from further upstream on the Burnett River ▪ accessing the existing Strategic Water Infrastructure Reserve assigned to the Upper Burnett system as a new water harvesting product ▪ reinstating the previous 1.5 m raising of the Claude Wharton Weir full supply level by installing crest gates ▪ installation of a major pump station adjacent to the Burnett River at AMTD 184 km (approximately) and pumped main delivering water to a 10,000 ML (approximately) off-stream storage ▪ installation of 42 km of pipeline and associated infrastructure to supply water to irrigated cropping ▪ making available approximately 24,000 ML for irrigated crop production ▪ development of over 5,000 ha of annual irrigated sugar cane production ▪ development of over 1,200 ha of irrigated rotation cropping (including 50% fallow). To be financially viable and offer sustainable water prices for irrigators (in terms of their capacity and willingness to pay), the project will require significant non-recoverable government grant funding—that is, in the order of $170 million.
Draft Wide Bay Burnett Regional Organisation of Councils (WBBROC) Regional Water Position Paper (2018)	The volume of water required to irrigate under reduced rainfall and increased evaporation could increase by 23% and more than double current usage within 50 years if the current 90,000 ha irrigated is increased to 120,000 ha.

Sources: (a) McCarroll, SM & Brough, DM, Agricultural land resource assessment of Coalstoun Lakes, Land Resources Bulletin no. DNRQ00096, Department of Natural Resources, 2000; (b) Tucker, RJ & Sorby, P, Soils of the Riparian Lands of the Burnett River between Mundubbera and Gayndah, Queensland: Suitability for Irrigated Agriculture, Land Resources Bulletin no. DNRQ 96049, Department of Natural Resources, 1996; (c) Sunwater, Bundaberg Channel Capacity Upgrade Feasibility Study, 2018.

The demand assessment undertaken for this study is detailed in Chapter 10.

3.4.14 Economic opportunity of additional water

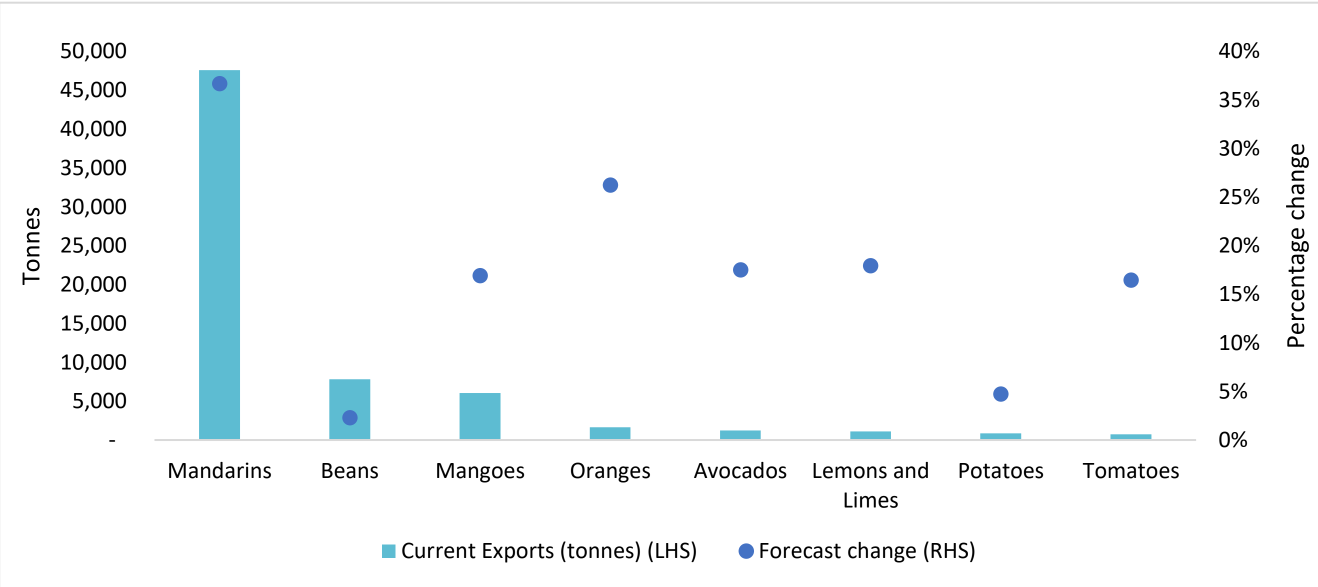
Many historical studies have examined the economic, environmental and climatological features and advantages of the North Burnett and South Burnett. The highly fertile soils of the region are described in multiple documents. *Soils of the Riparian Lands of the Burnett River, 1996* identified a high proportion of land close to the river that is suitable for irrigated cropping, and extensive areas suitable for irrigation some distance from the Burnett River. *Agricultural Land Resource Assessment of Coalstoun Lakes, 2000* identified significant areas suitable for expanded agricultural production based on soil quality and rainfall around the Coalstoun Lakes area. Multiple studies considered the economic advantages of the region, including proximity to domestic and international markets, existing transport infrastructure and human resources (*Economic Development and Innovation Strategy*; *Queensland Regional Profile: South and North Burnett, 2019*; *Water Transfer and Hydro Storage Study, 2018*; *Barambah Creek Proposal*).

The crops grown in the region are suitable for export. This means that additional production will not simply displace other domestic production but can be exported to international markets. In North Burnett, mandarins are a valuable crop. A number of recent free-trade arrangements have come into effect, which have provided access into lucrative Asian markets. As a result, some farmers are exporting up to 90 per cent of their produce.

The figure below shows the crops grown in the North Burnett region and the amount of exports as well as the forecast growth in exports. Mandarins are the dominant export and are expected to continue to grow strongly. In North Burnett the key constraint to meeting this growth is access to reliable water.

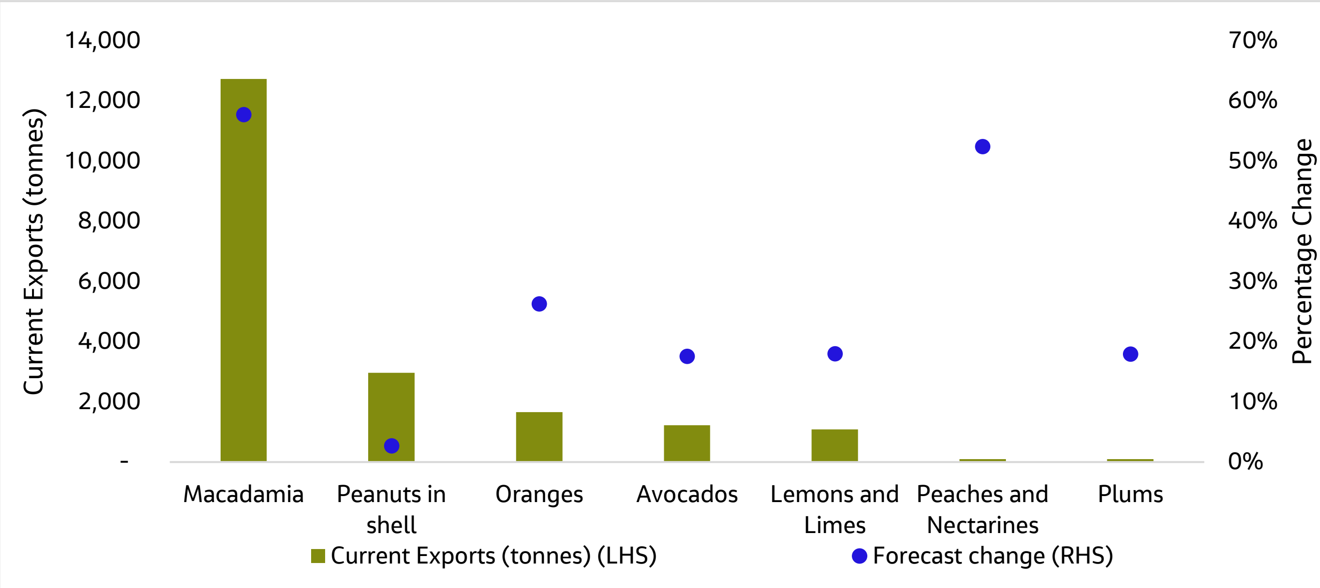
The figure shows exports from across all of Queensland, focusing on crops common in North Burnett.

Figure 3-39: Queensland actual exports and forecast exports—North Burnett crops



South Burnett has fewer exports. However, while a small volume of peanuts is exported, Bega imports 80 per cent of the peanuts it needs to make peanut butter. An increase in the number of local peanuts could satisfy this demand, reduce imports and not change the domestic price for peanuts.

Figure 3-40: Queensland actual exports and forecast exports—South Bunett crops



Given the favourable conditions in the study area, many studies have been undertaken that estimate the economic benefits of increased agricultural production due to an increase in water availability. Several of these studies use gross value of production and/or multipliers to estimate the total impact on the region and the state. While these approaches have significant merit from a local perspective, they are not consistent with the requirements of Building Queensland and Infrastructure Australia. These bodies require the estimation of agricultural benefits to be measured using net margins, which is total revenue net of all costs. It is the profit obtained through an additional megalitre of water.

A recent study[13] undertaken by the Rural Economies Centre of Excellence and Burnett Inland Economic Development Organisation Irrigation in 2019 found that:

> Increasing irrigation water reliability from the current 73% to a future 88% would have a major economic impact, not just in the Boyne area, but in the whole North Burnett Regional Council area. The multipliers of increased agricultural output (2.32), income (0.54) and employment (0.01) are considerable. The output multiplier means that for every additional dollar of agricultural output in the North Burnett Region (excluding livestock), $1.32 of additional economic output is produced in other economic sectors. Each dollar of increased output from agriculture (excluding livestock), an additional 54c of income is generated across the regional economy. For every $10,000 of additional agricultural sector output (excluding livestock), 1 full time equivalent job is created in the North Burnett economy.
>
> The agriculture (horticulture) industry generates the highest net industry support effects in value added terms out of all industry sectors in the region. For each unit of initial employment in the agriculture sector, caused by increased output, the associated first round employment coefficient is 4.629, which is relatively high. These considerable multiplier effects reflect the close economic linkages between agriculture and other sectors in the regional economy.

Multipliers are typically not favoured for direct project-based assessment and comparison. This options analysis has estimated the benefits of each shortlisted project option using accepted project assessment methods such as net margins per megalitre of agricultural production (see Chapter 10). The potential wider economic benefits have also been assessed.

[13] West, J, Cavaye, J & Frahm, K, *Irrigation from the Boyne River: The Value of Improved Water Security*, version 2, June 2019.

3.4.15 Tarong Power Station

The Tarong Power Station (TPS) consists of two coal-fired power stations located 45 km south-east of Kingaroy in the South Burnett region. TPS consists of the original Tarong Power Station and Tarong North Power Station. The original Tarong Power Station is a 1400 megawatt (MW) sub-critical facility that is made up of four 350 MW units. Tarong North Power Station is a single 443 MW coal-fired unit that utilises supercritical boiler technology.

TPS is water-cooled and requires a reliable and consistent supply of water for operations. Water is used for cooling in the production process, cleaning and in general operations of the facilities at the power station and Meandu mine. Under normal operating conditions, TPS uses up to 32,000 ML of water each year, although there is some variation in this total water usage due to fluctuations in the operation of the stations, weather conditions and environmental discharge requirements.

The water used by TPS is sourced from Boondooma Dam in the Boyne River and Tarong Water Supply Scheme, Wivenhoe Dam in the Brisbane River catchment and potentially the Western Corridor Recycled Water Scheme[14] if it is recommissioned. Under normal operating conditions, TPS seeks to maximise its supply from Boondooma Dam—its lowest cost source—and uses water from Wivenhoe Dam to supplement water from Boondooma Dam.

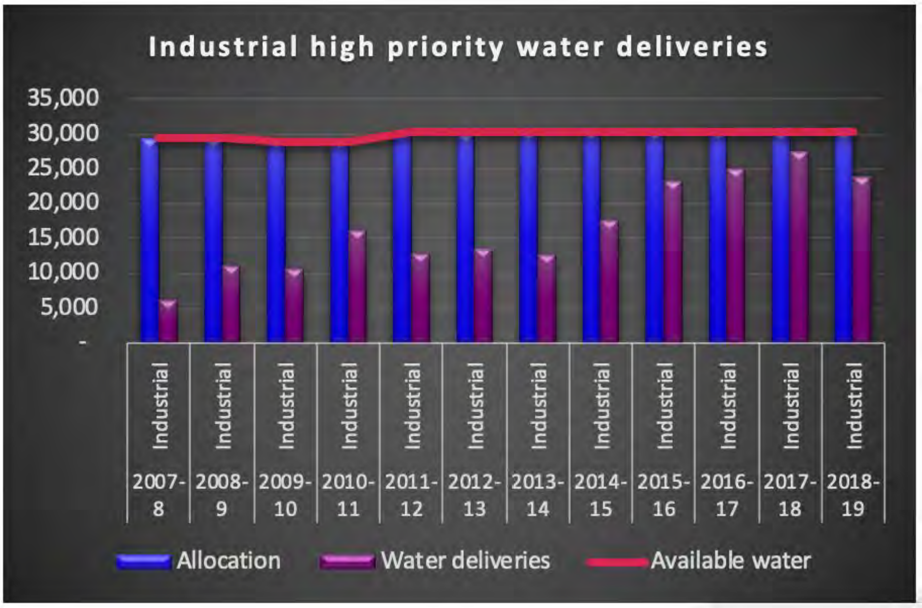
The Boyne River and Tarong Scheme presently has an allocation of 30,333 ML per year for industrial (high priority) water. Presently, 29,270 ML of that industrial (high priority) water allocation is owned by TPS. Since 2007–08, the actual industrial water deliveries in the Boyne River and Tarong Scheme have averaged 55 per cent of the available allocation, with some more recent years reaching as high as 90 per cent usage. Figure 3-41 and Figure 3-42 show industrial water deliveries reported by Sunwater in each year since 2007–08. It should be noted that 2009–10 to 2011–12 have been estimated on the basis of available information due to a change in reporting structure in those years.

Table 3-41: Industrial water deliveries 2007–2019 in the Boyne River and Tarong Scheme[15]

Year	Customer segment	Allocation (ML)	Water deliveries (ML)	Available water (ML)
2007–08	Industrial	29,374	6,177	29,345
2008–09	Industrial	29,374	11,087	29,374
2009–10	Industrial	29,226	10,722	28,934
2010–11	Industrial	29,226	16,120	28,934
2011–12	Industrial	30,558	12,873	30,252
2012–13	Industrial	30,134	13,567	30,453
2013–14	Industrial	30,455	12,716	30,453
2014–15	Industrial	30,453	17,695	30,453
2015–16	Industrial	30,453	23,254	30,453
2016–17	Industrial	30,453	25,071	30,453
2017–18	Industrial	30,333	27,443	30,333
2018–19	Industrial	30,333	23,814	30,333

[14] Which produces purified recycled water.
[15] Data in Table 3-41 is sourced from Sunwater's annual reports from 2007 to 2019.

Figure 3-42: Industrial water deliveries Boyne River and Tarong Scheme[16]



Stanwell has indicated that as a result of the current drought conditions, TPS has been taking an increased volume of water from Wivenhoe Dam in order to preserve drinking water supplies for the South Burnett region. However, this should not be considered to be the status quo.

The majority of the water used by TPS is evaporated through cooling towers, and up to 6,000 ML per year is discharged into Meandu Creek for use by local irrigators.

TPS has substantial water infrastructure including pipelines, pumping stations and multiple dams for the storage and treatment of water.

- Pipelines—water from Boondooma Dam is supplied through the Tarong pipeline (owned by Sunwater). Water from Wivenhoe Dam (and potentially the Western Corridor Recycled Water Scheme) is supplied through the Wivenhoe pipeline (owned by Stanwell). Both pipelines flow into the cooling water dam. The Wivenhoe pipeline also has a direct tie-in to the Tarong North Power Station.

- Storage—the primary water storage at TPS is the cooling water dam, although TPS has multiple other water storages that are used to transition, temporarily store and treat water.

TPS is scheduled to close and be decommissioned in 2036–37[17], although this scheduled date may be subject to change. At the time that TPS is decommissioned, there is potential for the extensive water infrastructure at the TPS site to be re-purposed for alternative urban, agricultural and industrial water uses.

3.5 Alignment of service need to strategic initiatives and plans

The identified service need aligns with the State Infrastructure Plan and other relevant strategic initiatives and regional and local plans (see the tables below).

Table 3-16 Service need alignment with the State Infrastructure Plan

SIP element	Overview	Project service need alignment
Challenges	The plan sets out the Queensland Government's strategic direction for the planning, investment and delivery of infrastructure in Queensland. The SIP identifies a series of 'challenges'. Of relevance to the project are:	The problems identified and benefits targeted align with SIP challenges 1 and 8 and objectives 1,2 and 3, specifically:

[16] Data in Table 3-42 is sourced from Sunwater's annual reports from 2007 to 2019.
[17] National Energy Market Operator.

SIP element	Overview	Project service need alignment
	▪ Challenge 1: Productivity (Queensland's future standard of living is at risk because of slower productivity and workforce participation) ▪ Challenge 8: Regional liveability (investment in regional infrastructure is a key priority to achieve future prosperity and to attract investment in high-value industries to rejuvenate regional economies)	▪ addressing poor reliability of water ▪ poor urban water security impacting community welfare ▪ increasing productivity, prosperity and liveability in the Burnett region through increased agricultural and industrial production, productivity, resilience and employment.
Objectives	The SIP identifies a series of 'objectives'. Of relevance to the project are: ▪ Objective 1: Improving prosperity and liveability ▪ Objective 2: Infrastructure that leads and supports growth and productivity ▪ Objective 3: Infrastructure that connects our communities and markets (including community access to a broad range of private and public services including secure, reliable and affordable access to energy, water and the internet)	
Water outcomes	The SIP includes the following relevant water outcomes related to the project service need: ▪ Water supply infrastructure is in place or in train where there is a sound business case and water resources are available. ▪ Appropriate solutions, including demand management, are evaluated and implemented after the water needs of local government have been assessed in partnership with the state. ▪ Greater use of recycled water has been encouraged by state policies, where it is fit for purpose and economically viable.	The service need is aligned with the SIP, as it is underpinned by an evidence-based problem statement able to be addressed by drawing on available water resources.

Table 3-17 Service need alignment with government strategies and plans

Plan/Strategy	Overview	Project service need alignment
Growing for Queensland	The initiatives under Growing for Queensland set out how the Queensland Government plans to enable the agricultural, fisheries and forestry sector to be innovative, responsive and sustainable in the face of extraordinary opportunities and challenges. A key element of the initiatives is to continue to build the capability of rural and regional economies by reducing financial pressures and improving business sustainability for future generations.	The project identifies the need to provide a reliable and accessible water supply that can deliver sustained increases in agricultural production and increased economic resilience in the Burnett region.
Queensland bulk water opportunities statement (QBWOS)	The QBWOS sets out a framework for the Queensland Government to support and contribute to sustainable regional economic development through a hierarchy including policy changes (first), better use of existing water entitlements (second), improvements to existing bulk water infrastructure (third) and investment in new infrastructure (fourth)— consistent with the SIP.	The benefits targeted from addressing the service need will contribute to sustainable economic development in the Burnett region. The problem statements underpinning the service need have been carefully framed to ensure they allow for non-infrastructure solutions. This options analysis will ensure that the identification and evaluation of options to address the service need are consistent with the QBWOS hierarchy.
Queensland Agricultural Land Audit	The audit identifies land important to current and future production and the constraints to development, highlighting the diversity and importance of Queensland's agricultural industries across the state, including Wide Bay Burnett.	The audit identifies opportunities for growth in broadacre cropping and expansion of horticulture. The service need acknowledges there are opportunities by identifying problems with unreliable water allocations and a lack of access to supplemented water that are acting as a barrier to growth.
Water Plan (Burnett Basin) 2014	Water in the Burnett River Basin is allocated and managed under the Water Plan (Burnett Basin) 2014. The water plan defines the long-term availability of water for different purposes including environmental and consumptive water uses and includes outcomes	The service need is consistent with the water plan as it:

Plan/Strategy	Overview	Project service need alignment
	or aspirational targets, including for water security. There is a substantial amount of unallocated water within the water plan. A 2019 assessment of the water plan (Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014, DNRME, 2019) acknowledged the unmet agricultural water demands in the area and water security.	▪ can be addressed by utilising the significant volume of unallocated water available within the water plan ▪ targets improvements in the security of water supply (consistent with the water plan's specified water allocation security objectives).
Wide Bay Burnett Regional Plan (2011)	The plan establishes a 20-year vision and direction for the region. The plan includes a number of 'desired regional outcomes' including that '[t]he region's rural community is strong and resilient, with a sustainable economy that contributes to the overall liveability of the region.' The 'rural futures' outcome is supported by a series of principles and policies including: ▪ The rural economy capitalises on the region's advantages. ▪ Rural communities benefit from growth and are serviced by appropriate levels of infrastructure and support services. ▪ Opportunities for economic activity related to the region's natural resources and primary production are investigated and maximised to support the viability of rural communities. ▪ Rural businesses and industries are strengthened through adaptability, productivity, diversification, value-adding and connectivity, including improved access to markets. ▪ Agriculture, agribusiness, aquaculture, and appropriate ecotourism and recreation opportunities are planned for and developed in rural areas. The plan contains a strong emphasis on the sustainable management of the environment and natural resources and its protection and enhancement.	The benefits targeted from addressing the service need will deliver on the plan's 'rural futures' outcomes by delivering a sustainable increase in agricultural production and ensuring a more productive and resilient regional economy.
Regional Water Strategy Water Synopsis (WBBROC)	The strategy reviews the current position of water security and reliability in WBB and identifies the costs and lost opportunity of the current under-utilisation of water reserves in the region. The strategy targets the under-utilised water and stresses the importance of proper allocation and distribution of the regions water resources.	The service need aligns with the strategy by targeting increased agricultural production and economic and community resilience through more efficient use of available water.
Australia Infrastructure Plan (2016)	The plan sets out the infrastructure challenges and opportunities Australia faces over the next 15 years. It provides a package of reforms focused on improving investment in, delivery of and use of Australia's infrastructure. The plan notes that successful irrigated agriculture is dependent on producers having access to reliable and secure water resources. The plan notes that regional water infrastructure that supports irrigated agriculture faces challenges because of the increasingly variable climate, growing demand and difference in the ability or willingness to pay.	The service need is aligned with the Australia Infrastructure Plan in that in identifies the need to increase access to a reliable source of water for agricultural production.
National Water Infrastructure Development Fund (NWIDF)	The Australian Government has partnered with state and territory governments to identify and build the water infrastructure through the $1.5 billion NWIDF. This project received funding for a feasibility study. The NWIDF has a feasibility component and a capital component. The strategic intent of the fund is to deliver new and reliable water to enhance water security and underpin regional economic growth, including irrigated agriculture and other primary industries. While the Australian Government has acknowledged water regulation, planning and management is generally the responsibility of the Queensland Government, the Australian Government, through targeted funding, seeks to play a role in supporting water infrastructure projects that are in the national interest and deliver net economic and social benefits and broader public benefits.	The service need aligns with the intent of the fund to 'deliver new and reliable water to enhance water security and underpin regional economic growth, including irrigated agriculture'.

Plan/Strategy	Overview	Project service need alignment
National Water Grid Authority	The objective of the Authority is to identify and plan the next generation of water infrastructure that will support regions by growing primary industries; increasing water security; and building resilience to a changing climate. The Authority's objectives are the following: ▪ Develop, in partnership with state and territory governments, a national framework for investment in water infrastructure to identify a pipeline of priority water infrastructure projects that will increase the capacity, connectivity and resilience of Australia's water storage and supply infrastructure. ▪ Use world best science to determine where and how Australia's water resources can be sustainably developed to increase security and reliability of supply. ▪ Deliver the government's $3.5 billion commitment to identify and build new water infrastructure through the $1.5 billion NWIDF and the $2 billion National Water Infrastructure Loan Facility.	The service need is aligned with the objectives outlined by the National Water Grid Authority. Addressing the identified problems underpinning the service need will support primary industries, increase water security and build resilience to climate change.
Australian Infrastructure Audit	The 2019 Australian Infrastructure Audit identified various challenges and opportunities relevant to water including ▪ Challenge 172: Regional and remote utilities face considerable challenges, including reliance on a single source of supply, limited resources, a lack of scale and unreliable information on services. Failing to adequately address regional water challenges could lead to heightened quality or reliability risks and a deterioration of liveability in regional and remote areas. ▪ Challenge 173: Many regional and remote utilities face mounting costs to maintain, renew or upgrade ageing water and wastewater assets, but have limited funding through grants or revenue. Where funding is provided, it is often inefficient or lacks transparency. ▪ Challenge 179: Changes in water demand over coming years could affect economic activity and infrastructure requirements in some regional areas. These changes may be exacerbated in drier years. In communities where there is a decline in economic activity, unemployment could rise and some assets may be underutilised or stranded, reducing productivity and growth. ▪ Opportunity 180: Water infrastructure could help to unlock economic opportunities, supported by evidence-based assessments that take into account potential benefits, costs and risks for industry, local communities and the environment. Further evidence on water-led opportunities could help to identify productive investments that can support growth, employment and broader public benefits.	The service need directly aligns with the challenges identified in the Australian Infrastructure Audit by: ▪ identifying the need to improve water supply reliability (reducing risks) and enhance local economies and liveability (Challenge 172) ▪ targeting sustained growth in agricultural production, productivity and jobs by meeting water demand (Challenge 179). Further, this options analysis includes a robust evidence-based assessment of the viability of water infrastructure to unlock economic opportunities (Opportunity 180)

The service need is strongly aligned to and contributes to the priorities of all levels of government as reflected in the multitude of local, state and Australian strategic initiatives and plans described above.

3.5.1 Infrastructure Australia

NWIDF funding for this study is predicated on the delivery of new and reliable water to enhance water security in North Burnett and South Burnett being in the national interest. The likelihood of securing funding to proceed from the 'feasibility component' of the NWIDF to the 'capital component' could be enhanced through submitting the project to Infrastructure Australia for an independent evaluation and inclusion on the Infrastructure Priority List (IPL)—a prioritised list of nationally significant investments.

The involvement of Infrastructure Australia (IA) in this proposal will be considered for the following reasons:

1. The cost of the problem (to be estimated in a detailed business case) is likely to exceed the national significance threshold for potential inclusion on the IPL.

2. IA in its IPL 2020 Update and 2019 Infrastructure Audit has increased its focus on the national significance of water use, management and security:

   a) IA has included in its IPL 2020 update a 'National Water Strategy' as a high priority initiative. The initiative identifies the need to efficiently and sustainably capture, use and manage water. IA notes that 'the demand for water across many water systems is increasing as a result of population growth and relocation, increasing agricultural demand and requirements for environmental and cultural uses. The water cycle is also being altered by changing climate, changes to run-off and evaporation due to land and forest management'.

   b) IA has also included in its IPL 2020 update 'water supply and resilience for town and city populations' as a high priority initiative. IA notes that Australia's urban water infrastructure is critical for liveability, prosperity and the public realm and services industries, supporting growth in productivity and employment as a high priority initiative. IA also states that '[f]or regional towns, water utilities often rely on a single supply source, with no physical link to an alternative bulk water supply. The lack of supply diversification creates further water security risks for these communities'.

3. The service need for the project reflects a range of challenges and opportunities specifically identified in the Australian Infrastructure Audit.

By seeking to meet growing agricultural demand through delivering an efficient and reliable water source and addressing urban water security in South Burnett, the service need for this project strongly aligns with the emerging IA priorities. Indeed, IA in a media statement accompanying its IPL 2020 update states that '[i]n response to this call to action, we're expecting a range of solutions to be considered for capturing, managing and distributing water, along with improvements in reporting and use of data in the water sector'.[18]

3.6 Benefits targeted

3.6.1 Benefits targeted

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

Table 3-18: Benefits targeted and relative importance

Rank	North Burnett	South Burnett
1	Sustained increases in agricultural production and employment	Sustained increases in agricultural production and employment
2	Improved economic (agricultural) resilience	Improved community (urban) resilience
3	Emergence of efficient local supply chain industries	Improved economic (agricultural) resilience
4		Growth of efficient agricultural processing industries

Benefits targeted were identified and agreed by participants in Investment Logic Mapping workshops (see **Figure 3-1** and **Figure 3-2**) and are described in further detail in the tables below.

Table 3-19: Benefit targeted: Sustained increases in agricultural production and employment

Benefit: Sustained increases in agricultural production and employment	
Relevant sub-region	**North Burnett**

[18] Infrastructure Australia *Call to action for infrastructure resilience, as water, waste and coastal inundation headline latest Infrastructure Priority List*, media release, 26 February 2020, https://www.infrastructureaustralia.gov.au/listing/media-release/february-2020-infrastructure-priority-list.

Benefit: Sustained increases in agricultural production and employment	
	South Burnett
Benefit and KPI description	If water volume and reliability are improved, agricultural production will increase, given the amount and suitability of agricultural land in the region. KPIs for this benefit are: • regional gross value of agricultural production (GVP) in dollars (ABS, Value of Agricultural Commodities Produced, SA2, cat. 7503.0) • agricultural employment (ABS census data, Industry of Employment, SA2). Other employment measures may need to be identified to supplement ABS data to ensure seasonal and casual/part-time labour is captured.
Related problem statement	The benefit sought will be realised through removing or mitigating the following problems: • Existing agricultural supplemented water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment (North Burnett). • Existing Barker Barambah agricultural water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment (South Burnett). • Large areas of fertile land have no access to a reliable source of water hindering crop yields, values and diversity due to dependence on unreliable seasonal rains (North Burnett). • Large areas of fertile land have no or insufficient access irrigation water, hindering crop yields, value and diversity due to dependence on seasonal rains (South Burnett). • Security of urban water supply is poor and deteriorating, harming community welfare, limiting industrial expansion and contributing to unreliability of agricultural water supply (South Burnett).
Risks	Biosecurity threats, climate change, poor access to export markets, lack of demand (export or local), future government policy and investment decisions (particularly the future Paradise Dam solutions)—see the Risk Register (proposal risks) at Appendix C.
Anticipated beneficiaries	The beneficiaries include (i) existing and prospective local farm owners; (ii) existing and prospective local farm workers; (iii), agricultural suppliers, transport, logistics, processing and packaging businesses; and (iv) consumers.
Identified dependencies	The key dependency is irrigators responding to any intervention to address the service need, by either (i) changing water use practices; (ii) taking up new water allocations, at commercially-viable rates, to increase agricultural production; (iii) investing in on-farm infrastructure to service new agricultural production; and (iv) changing land use to higher value agriculture. Achieving this benefit may require investment in other (non-water) supporting public infrastructure. It also requires availability of labour.
Urgency of benefit	High/medium (some degree of urgency for existing irrigators due to drought and recent trend of financial distress, business failures and falling agricultural production and employment).
Timing	Medium to long term (benefit realisation will involve a long ramp up period due to dependencies identified above).

Table 3-20: Benefit targeted: Improved economic (agricultural) resilience

Benefit: Improved economic (agricultural) resilience	
Relevant sub-region	**North Burnett** **South Burnett**
Benefit and KPI description	If water supply and reliability is improved, investment certainty, crop diversity and average producer margins will improve as a result. In turn, this will **improve economic resilience,** as farms will have a less volatile access to water and be better placed to withstand shocks and the local economy will be less reliant on individual agricultural sub-sectors, farms and crops. KPIs for this benefit are: • increased average returns (net margin) per hectare cropped (Agricultural Gross Margin Calculator, www.agmargins.net.au)

Benefit: Improved economic (agricultural) resilience	
	• reduced volatility (variance) in gross regional product (SA2 region https://economy.id.com.au), SA2 region • reduced variance in total employment (Department of Employment, Skills, Small and Family Business, Small Areal Labour Markets publication, Australian Government).
Related problem statement	The benefit sought will be realised through removing or mitigating the following problems: • Existing agricultural supplemented water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment (North Burnett). • Existing Barker Barambah agricultural water allocations are highly unreliable, resulting in business failures, job losses and reduced investment (South Burnett). • Large areas of fertile land have no access to a reliable source of water, hindering crop yields, values and diversity due to dependence on unreliable seasonal rains (North Burnett). • Large areas of fertile land have no or insufficient access to irrigation water, hindering crop yields, value and diversity due to dependence on seasonal rains (South Burnett).
Risks	Biosecurity threats, climate change, poor access to export markers, lack of demand (export or local), future government policy and investment decisions (particularly the future Paradise Dam solutions)—see the Risk Register (proposal risks) at Appendix C.
Anticipated beneficiaries	Existing and prospective local businesses, local workers and local residents.
Identified dependencies	The key dependency is irrigators responding to any intervention to address the service need, by taking up new water allocations, diversifying and changing land use to higher value agriculture. Achieving this benefit may require investment in other (non-water) supporting public infrastructure. It also requires availability of labour and availability of finance.
Urgency of benefit	Medium
Timing	Medium to long term (benefit realisation will involve a long ramp up period due to dependencies identified above)

Table 3-21: Benefit targeted: Improved community (urban) resilience

Benefit: Improved community (urban) resilience	
Relevant sub-region	**South Burnett**
Benefit and KPI description	**Improved community (urban) resilience** is sought by addressing poor urban water supply security. KPIs for this benefit are a reduction in the frequency and severity of urban water restrictions and reduction in the frequency of supply failure resulting in carting—both under present and forecast future demand.
Related problem statement	The benefit sought will be realised through removing or mitigating the following problems: Security of urban water supply is poor and deteriorating, harming community welfare, limiting industrial expansion and contributing to unreliability of agricultural water supply.
Risks	Nil
Anticipated beneficiaries	Current and future local residents
Identified dependencies	Nil
Urgency of benefit	High (urban water security is unacceptably poor and deteriorating in Kingaroy and intervention to improve community resilience is critical)
Timing	Immediate

Table 3-22: Benefit targeted: Growth of efficient agricultural processing industries

Benefit: Growth of efficient agricultural processing industries	
Relevant sub-region	**South Burnett**
Benefit and KPI description	Water is a significant input to production for many local industries. **Growth of efficient agricultural processing industries** is currently being held back by a lack of urban water security. The primary KPI for this benefit is regional gross value of manufacturing production (GVP) in dollars.

Benefit: Growth of efficient agricultural processing industries	
Problem statement	The benefit sought will be realised through removing or mitigating the following problems. Security of urban water supply is poor and deteriorating, harming community welfare, limiting industrial expansion and contributing to unreliability of agricultural water supply
Risks	Nil
Anticipated beneficiaries	Existing local industry (including Swickers and Bega) and emerging future industrial processors; local workforce.
Identified dependencies	Capital availability for expansion Increased agricultural production
Urgency of benefit	Medium
Timing	Short to medium term (Swickers and Bega have communicated a desire to expand subject to water availability)

Table 3-23: Benefit sought: Emergence of efficient local supply chain industries

Benefit: Emergence of efficient local supply chain industries	
Relevant sub-region	**North Burnett**
Benefit and KPI description	If sustained increases in agricultural output occurs, economies of scale could facilitate the **emergence of efficient local supply chain industries** (i.e. industries that may package, process, cool, dry, or extract the raw agriculture produce increase the value of the production before it leaves the local area). The primary KPI is an increase in the number of new agribusinesses (Counts of Australian Businesses by SA2 area, ABS cat. 8165.0).
Problem statement	Large areas of fertile land have no access to a reliable source of water hindering crop yields, values and diversity due to dependence on unreliable seasonal rains (North Burnett). Existing agricultural supplemented water allocations are highly unreliable resulting in reduced agricultural output, jobs and investment (North Burnett).
Risks	Nil
Anticipated beneficiaries	New local businesses and their workers
Identified dependencies	Availability of capital Increased agricultural production
Urgency of benefit	Low
Timing	Long term (dependent on sustained increases in agricultural production)

3.6.2 Related proposals

3.6.2.1 Paradise Dam

Paradise Dam is a roller compacted concrete (RCC) dam, 52 m high, located approximately 80 km south-west of Bundaberg on the Burnett River. It was built in 2005 to store 300,000 ML and supply water to irrigators and urban communities around Bundaberg. Sunwater owns and operates the dam.

In 2013, a flood event resulted in scour downstream of the primary spillway, requiring Sunwater to undertake dam repair and strengthening works. Sunwater completed flood repair works in 2013, and undertook detailed dam safety reviews, risk assessment investigations, and associated studies.

Sunwater also carried out early stage dam improvement works from 2015 to 2017, to strengthen the base of primary spillway monoliths and reviewed and implemented improved emergency planning and response measures from 2015 to 2018 (and ongoing).

Through this process, Sunwater commissioned further geotechnical investigations, a revised dam stability assessment, and peer review by national and international experts. These investigations identified that, whilst the dam is considered safe under normal conditions, there is an increased risk of dam failure should an extreme flood like the 2013 event occur again.

In response, the Queensland Government announced Sunwater would reduce the water level of Paradise Dam ahead of the 2019–2020 wet season and commence works to reduce dam safety risk. In the same announcement, the government requested that Building Queensland complete a report to assesses long-term options for the dam to ensure water security for the region for future economic growth and to maintain community safety.

Building Queensland considered options including maintaining the spillway at the current height, lowering the spillway between 5 and 10 m and decommissioning the dam. Building Queensland recommended, amongst other things, that a detailed business case investigate the preliminary design and cost estimates to:

- maintain the primary spillway height at the level of the essential works (nominally 5 m below the existing spillway level prior to essential works)
- raise the primary spillway height to an optimal level (up to the existing spillway level prior to the essential works) and explore alternative water supply options
- lower the primary spillway height to an optimal level (down to a maximum of 10 m below the existing spillway level prior to essential works) and explore alternative water supply options.

Lowering the spillway by 5 m reduces the medium priority yield by 57,000 ML, and lowering it by 10 m reduces the medium priority yield by 105,000 ML.

Sunwater undertook a scan of alternative water supply options that might be able to return water supply to the Bundaberg Water Supply Scheme and to the broader Burnett area. The initial water supply options identified by Sunwater are listed in Table 3-24.

Table 3-24 Options identified by Sunwater

North Burnett	South Burnett	Bundaberg
Jones Weir—1.4 m raising	Barlil Weir	Bucca Weir—5 m raising
Claude Wharton Weir—2 m raising	Boonara Dam	Ned Churchward Weir—2 m raising
Auburn River Weir		Gregory River Dam
Mt Lawless offstream storage		Ned Churchward offstream storage
Reids Creek Dam		
Cooranga Weir		
Deglibo Creek Dam		

While some of these options are relevant to this study, the Queensland Government has indicated that its focus will be on returning water to the Bundaberg Water Supply Scheme or areas where Paradise Dam could have benefited, in accordance with demonstrated need and demand for water. This will need to consider the assessment of likely demand for water in the area with a view to consider alternative water supply options that would align with the demand and needs assessment undertaken by Building Queensland in as far as volume, timing and location. Further consideration of alternative water supply options will be undertaken by Queensland Government and Sunwater as further stages of the assessment of Paradise Dam long-term future occur.

Due to the uncertainty of how the Paradise Dam water supply will be allocated, this study will identify other relevant water supplies, including the substantial amount of unallocated water within the water plan. If the viability of an option is entirely reliant on water supply from Paradise Dam, that will impact on the assessment in this study.

4. Base case

4.1 Purpose

This chapter outlines the base case that forms the benchmark against which all the options are assessed in subsequent chapters. The base case represents the most likely, business-as-usual state of world in the absence of the project.

4.2 Base case

The base case is defined below separately for water supply, agriculture demand and production, population and employment, and urban demand.

4.2.1 Base case—water supply

Surface water and groundwater in the Burnett River Basin is allocated and managed under the Water Plan (Burnett Basin) 2014. This effectively caps the total volume of water that may be allocated in the basin. A summary of water storage capacity and allocations is tabled below.

Table 4-1 : Availability of water allocations

Water supply scheme	Total water storage capacity (ML)	Water allocations held by customers (ML)	Uncommitted water allocations (ML)
Barker Barambah	136,190	33,512	803
Boyne River and Tarong	204,200	41,785	0
Bundaberg[1]	937,420	209,978	128,831
Three Moon Creek	89,328	14,734	0
Upper Burnett	188,439	40,985	7,565

Note (1) This is subject to an ongoing investigation regarding Paradise Dam and is currently subject to 399B notice under Water Supply Safety and Reliability Act. Refer Section 2.1.10.2.
Source: QBWOS (2018).

The overwhelming majority of uncommitted water allocations relate to the Bundaberg Water Supply Scheme, which is outside of the study area and subject to several other investigations. The balance of uncommitted water allocations are expected to be put into productive use.

Given the absence of committed and funded projects in the study area, storage capacity is assumed to be fixed in the base case over the 30-year evaluation period. Further, with no water reliability improvements expected, no new water allocations are assumed under the base case.

4.2.2 Agricultural demand and production

The North Burnett agricultural production has remained relatively constant over the past 10 years (Chapter 3). Agricultural production in the South Burnett has fluctuated over the past 10 years; however, the trend is also flat.

As the agricultural sector needs a more reliable water source in order to grow, the base case for this study assumes the mix of crops and overall value of agricultural production observed in 2019 remains steady over the evaluation period until 2036. Some further observations to support this assumption are the following:

- Demands on urban water in the South Burnett will grow moderately over time resulting in deteriorating urban water security. This would, all else being equal, reduce water reliability for the irrigation sector in the region over time. Under the base case, this is, however, conservatively assumed to be able to be offset through improvements in the efficiency of on-farm practices and water trading.
- Climate change projections predict an increase in evaporation across the water plan area, as well as a small decrease in rainfall mainly during the spring months and a small increase in rainfall mainly during the

autumn months.[19] It is assumed, that the potential negative impacts of climate change on agricultural production can be offset through improvements in the efficiency of on-farm practices and water trading.

- There has been a significant shift over time in both the South Burnett and North Burnett towards higher-value fruit, vegetables and nut production. Under the base case, however, no further transition to high-value crops is assumed to occur, given the absence of a new reliable water source.

4.2.3 Population and employment

The population in the North Burnett region is highly influenced by the available economic opportunities—dominated by the agricultural sector. The unemployment rate has historically been low, relative to other areas. This low rate is driven by itinerant workers who come to the area for work and leave when work is not available. Also, unemployed residents tend to leave the area to find work elsewhere or be unemployed elsewhere. Given the assumed steady value of agricultural production under the base case, the population, employment and underemployment rate in North Burnett is also assumed to remain steady under the base case. This is consistent with the forecasts from the Queensland Government Statistician's Office, which forecasts a reduction of 1.6 per cent between 2021 and 2041[20].

The population in South Burnett is also highly influenced by available economic opportunities. Unlike North Burnett, the population of South Burnett grew strongly in the early 1990s, due partly to the second stage of the expansion of Tarong Power Station. Population growth has been flat since 2013, which could have been caused by the 2012 shutdown of two generating units, which have since been restarted. As South Burnett is not as reliant as North Burnett on agricultural production, some growth in population and employment is assumed under the base case, reflecting the general. This is consistent with the forecasts from the Queensland Government Statistician's Office, which forecasts an increase of 12.4 per cent between 2021 and 2041.[21]

4.2.4 Base case—urban water

Urban water security is not considered to be a problem in North Burnett.

In South Burnett, urban water security in Kingaroy is poor. Currently, Kingaroy's total demand is 1,400 ML per annum, and level 3 water restrictions apply. In 2019, DNRME undertook a Regional Water Supply Security Assessment (RWSSA) for Kingaroy. This assessment concluded that current annual demand is 1,400 ML for Kingaroy. The forecast demand in 2020–21 is 1,600 ML. For further details, see Chapter 10.

4.2.5 Base case—Tarong Power Station

The TPS is scheduled to close and be decommissioned in 2036–37[22], although this scheduled date may be subject to change. At the time that TPS is decommissioned, there is potential for the extensive water infrastructure at the TPS site to be re-purposed for use for alternative urban, agricultural and industrial water uses. Given the uncertainty with respect to timing and ultimate availability of the water infrastructure at the TPS site, the base case assumes TPS continues to operate over the 30-year evaluation period.

4.3 Summary

In summary, the base case—the benchmark against which all the options are assessed—assumes:

- existing water storage capacity and water allocations prevail over the 30-year evaluation period
- the mix of crops and overall value of agricultural production observed in 2019 remains steady over the evaluation period until 2036
- population and employment are assumed to remain steady under the base case
- current annual urban water demand is 1,400 ML for Kingaroy, rising to 1,600 ML in 2020–21.

[19] DNRME, *Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014*, Water Policy and Water Services (South Region), November 2019.
[20] Queensland Government Statistician's Office, Projected population, by local government area, Queensland, 2016 to 2041, Cat no. 3235.0
[21] Queensland Government Statistician's Office, Projected population, by local government area, Queensland, 2016 to 2041, Cat no. 3235.0
[22] National Energy Market Operator.

5. Options longlist

The strategic assessment identified a longlist of potential options. The identified options include all types of options for improving service performance, in accordance with the State Infrastructure Plan Hierarchy.

After the strategic assessment was finalised, consultation with stakeholders continued, which resulted in the identification of additional options. The new options (4A, 4B and 4I) relate to Coalstoun Lakes—they are further permutations to deliver water to Coalstoun Lakes irrigators. The options numbers were re-assigned accordingly.

Option 8 relates to the opportunity to recycle water at the Swickers pork processing facility in Kingaroy. This would allow Swickers to expand production without requiring additional water from the Kingaroy urban supply.

A further permutation relates to the conversion of Gordonbrook Dam to irrigation use. Early assessment indicated that this option could only be viable if additional urban water supplies were sourced to replace the foregone supply. The longlist contains four options that relate to urban water security in South Burnett and directly purchasing permanent water allocations from Tarong Power Station. While these options are largely similar, they have been split into separate options to facilitate comparison, assessment of variations between the options and more accurate modelling.

The initial screening of the options longlist identified six new options:

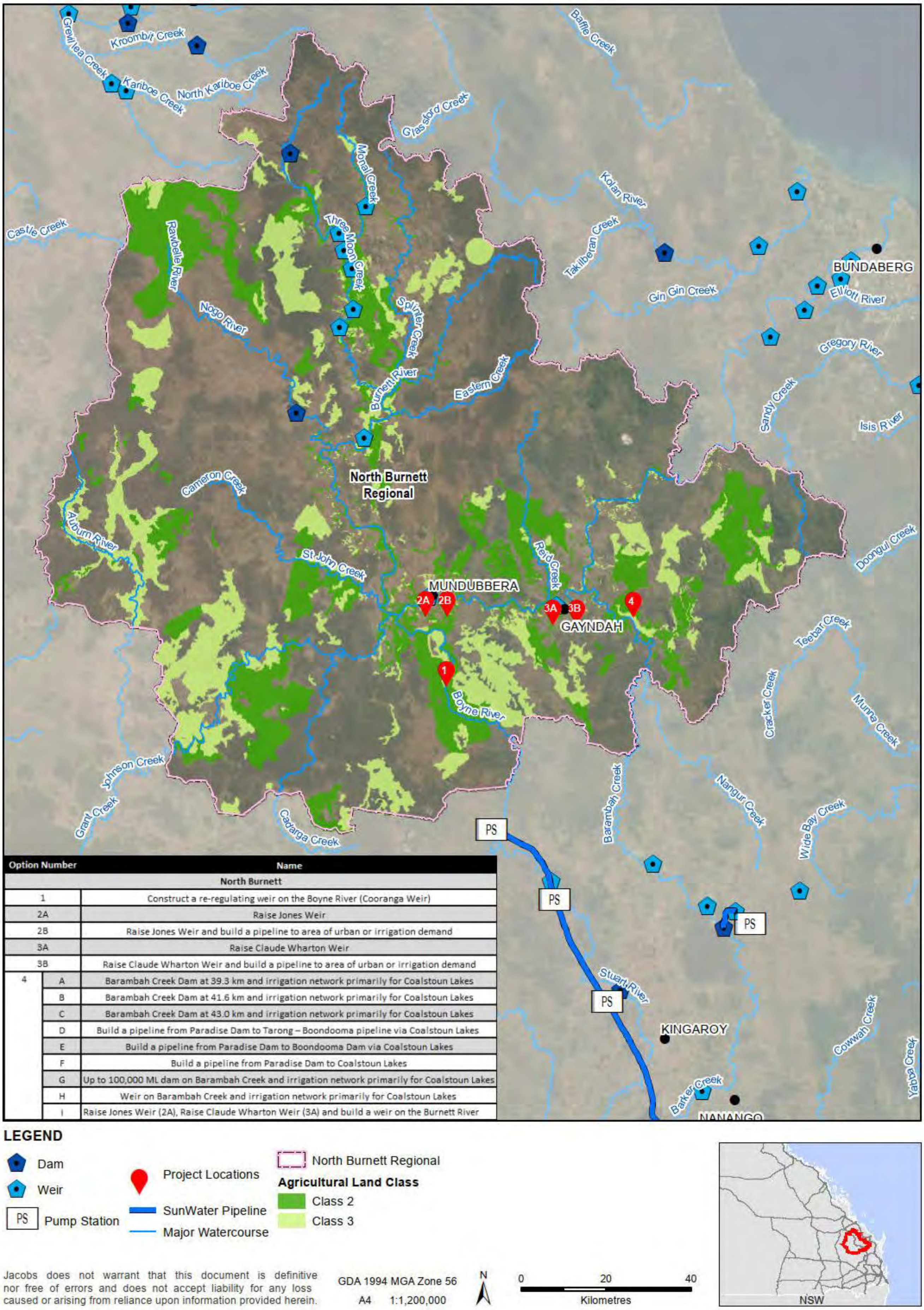
- Option 4A: Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes
- Option 4B: Build a pipeline from Paradise Dam to Coalstoun Lakes
- Option 4I: Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes
- Option 8: Construct a water recycling plant at Swickers facility in Kingaroy
- Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook Dam to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)
- Option 10B: Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook Dam to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station).

The initial screening also resulted in the exclusion of one option from the longlist of options identified in the strategic business case—that is, option 13: Interchangeable water allocations between schemes. This option was excluded on the basis that it is not suitable for assessment as a stand-alone option and instead should be included as a mechanism to facilitate the operation of other options.

5.1 North Burnett options longlist

There are 14 longlist options located in North Burnett. The location of longlisted option in the North Burnett as shown in Figure 5.1. Only options with a physical location are shown. Table 5.1 provides a summary of each of the options on the North Burnett options longlist. Appendix B sets out the high-level assessment on each of these options, including further detail and relevant source references.

Figure 5.1: North Burnett longlist option locations



Option Number		Name
North Burnett		
1		Construct a re-regulating weir on the Boyne River (Cooranga Weir)
2A		Raise Jones Weir
2B		Raise Jones Weir and build a pipeline to area of urban or irrigation demand
3A		Raise Claude Wharton Weir
3B		Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand
4	A	Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes
	B	Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes
	C	Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes
	D	Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes
	E	Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes
	F	Build a pipeline from Paradise Dam to Coalstoun Lakes
	G	Up to 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes
	H	Weir on Barambah Creek and irrigation network primarily for Coalstoun Lakes
	I	Raise Jones Weir (2A), Raise Claude Wharton Weir (3A) and build a weir on the Burnett River

Table 5.1: North Burnett options longlist

Option Number	Name	Description
1	Construct a re-regulating weir on the Boyne River	This option proposes building a re-regulating weir of approximately 5,266 ML capacity on the Boyne River downstream of Boondooma Dam. The purpose of this weir would be to increase the reliability of existing medium priority water allocations in the Boyne River Irrigation Area (BRIA). Multiple possible locations have been suggested for the weir on the Boyne River. These include at 33.8, 33.95 and 34.45 AMTD. Geotechnical investigations were conducted at river location 34.45 AMTD and found that the bedrock was quite permeable and the left bank unsuitable. Insufficient geotechnical investigations have been conducted at the other possible locations to assess their viability at this stage. The BRIA irrigators hold a range of medium priority allocations under the Boyne River and Tarong Water Scheme and rely on water stored in Boondooma Dam for those allocations. Water availability in the Boyne River and Tarong Water Scheme has been assessed at 73%. Due to recent years of low water levels, large high priority water allocations and the medium priority cut-off, the water reliability for the BRIA irrigators has been low. The construction of a re-regulating weir downstream on Boyne River is intended to generate an 11% increase in monthly performance for medium priority allocations in the BRIA. Analysis conducted by Sunwater indicated that the construction of this weir could decrease reliance and stress on Boondooma Dam for medium priority allocations, reduce the occurrence and duration of medium priority allocation cut-offs from Boondooma Dam and result in increased Boondooma Dam spills.
2A	Raise Jones Weir	This option proposes raising Jones Weir by 1.4 m in order to increase storage capacity and improve reliability for irrigators in the area and potentially for urban users. Jones Weir is located on the Burnett River at approximately 240 km AMTD, immediately adjacent to the township of Mundubbera. The weir is one of the oldest concrete weirs commissioned in Queensland and was constructed in 1951. Jones Weir is a mass concrete structure on a rock formation. This project was designated as an 'infrastructure facility of significance' in 2002. This project was originally proposed in the 1990s and received Commonwealth Government approval in November 2001, including environmental approval from both the Queensland and Commonwealth governments. This proposal was previously under the direction of Burnett Water Pty Ltd, who has undertaken preliminary work including some designs, land acquisition and consultations in relation to cultural heritage impacts.
2B	Raise Jones Weir and build a pipeline to an area of urban or irrigation demand	This option proposes raising Jones Weir by 1.4 m and then transporting the water through a pipeline to an area where soil suitability is high. A pipeline reduces transmission losses and allows water to be delivered to suitable areas that are not adjacent to a river. Jones Weir is located on the Burnett River at approximately 240 km ATMD, immediately adjacent to the township of Mundubbera. The weir is one of the oldest concrete weirs commissioned in Queensland and was constructed in 1951. The purpose of the project is to supply new water to an area with highly fertile soil. The raising of Jones Weir (although not the pipeline) was designated as an 'infrastructure facility of significance' in 2002. This project was originally proposed in the 1990s and received Commonwealth Government approval in November 2001, including environmental approval from both the Queensland and Commonwealth governments. This proposal was previously under the direction of Burnett Water Pty Ltd, who has undertaken preliminary work including some designs, land acquisition and consultations in relation to cultural heritage impacts.

3A	Raise Claude Wharton Weir	This option proposes a 1.5 m raising of the Claude Wharton Weir full supply level by installing crest gates. The purpose would be to replace the volume lost from failure, and decommissioning by Sunwater, of the previous fabri-dam at Claude Wharton Weir. Reinstating the lost volume at Claude Wharton Weir would allow the reinstatement of 10,469 ML of medium priority (that is currently not being supplied) which would then be suitable for irrigation. This water is currently being held by Burnett Water Pty Ltd but cannot be distributed, as it is excluded from the scheme's water sharing rules unless water storage is reinstated (such as by raising Claude Wharton Weir). The raising of Claude Wharton Weir has been considered as one element of larger projects (including the GRID Project), and it will require further investigation and assessment to determine the cost and benefit of raising Claude Wharton Weir as a stand-alone project.
3B	Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	This option proposes a 1.5 m raising of the Claude Wharton Weir full supply level by installing crest gates. The purpose of the option would be to replace the volume lost from failure, and decommissioning by Sunwater, of the previous fabri-dam at Claude Wharton Weir. Reinstating the lost volume at Claude Wharton Weir would allow the conversion of 10,469 ML of low priority water allocations to medium priority, which would then be suitable for irrigation. This water is currently being held by Burnett Water Pty Ltd but cannot be distributed as it is excluded from the scheme's water sharing rules unless water storage is reinstated (such as by raising Claude Wharton Weir). The raising of Claude Wharton Weir has been considered as one element of larger projects (including the GRID Project), and it will require further investigation and assessment to determine the cost and benefit of raising Claude Wharton Weir as a stand-alone project. This new medium priority water could then be transported through a pipeline to areas where demand and soil suitability is high, such as Coalstoun Lakes or the south side of the Burnett River. A pipeline reduces transmission losses and allows water to be delivered to suitable areas that are not adjacent to a river. If this water was delivered to Coalstoun Lakes, it would partially meet an existing demand for reliable new water for irrigation and would service agricultural production in an area with highly fertile soil. The feasibility of this option has been assessed on the basis that the water would be piped to Coalstoun Lakes, although the considerations in this option would be largely similar if the water was delivered to the highly fertile irrigation area on the south side of the Burnett River. An alternative option would be to utilise all or some of this new water for urban users in the North Burnett.
4A	Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	This option proposes the construction of a storage (small dam or large weir) on Barambah Creek upstream of its confluence with the Burnett River and an irrigation network to transport and distribute water to irrigators in the Coalstoun Lakes area. This option would utilise an irrigation network system, with a pipeline and channel scheme to take the water from the dam to the irrigation area, including balancing storages and relift, due to the gain in elevation. The storage size and type (dam or weir) will depend on what will provide the most effective yield to satisfy the water demand in and around Coalstoun Lakes. Two of the options that have been considered are: ▪ a dam or weir with a full supply volume of 65,000 ML and 18,500 ML dead storage; or ▪ a dam or weir with a full supply volume of 47, 000 ML and 0 ML dead storage. The purpose of this proposal is to provide additional new water for the irrigators in and around Coalstoun Lakes. Previous studies have identified a willingness among irrigators in the Coalstoun Lakes area to pay commercial rates for a reliable new water source. The site for the proposed storage on Barambah Creek would be downstream of Silverleaf Weir, with the final location determined on the basis of hydrological and

		geotechnical evidence. Four primary locations on Barambah Creek have been investigated previously as sites for a potential dam, including at ATMD 32 km, ATMD 39.3 km (see option 4D), ATMD 41.6 km (see option 4E) and ATMD 43.0 km (see option 4F). The location of the storage will impact on the size, route and cost of the proposed irrigation network.
4B	Build a pipeline from Paradise Dam to Coalstoun Lakes	This option proposes the construction of a 37–43 km (approximately) pipeline from Paradise Dam and Coalstoun Lakes to directly deliver reliable water to an area of high demand and highly fertile soils. This option would be more efficient and costs less than alternative pipeline proposals (such as options 4G and 4H) involving Coalstoun Lakes, on the basis that it would deliver water directly. Design and engineering assessment are required to determine the best formulation for the pipeline, including the requirement for buffer storage and the most efficient and cost-effective pipeline materials. This option would provide new, reliable water to irrigators in Coalstoun Lakes. It could facilitate the creation of 4,000 to 6,000 ha of new irrigation areas in Coalstoun Lakes utilising 20,000 ML to 30,000 ML of water annually. This option is an amalgamation of proposals considered in previous studies that seek to maximize the efficiency and utilisation of available additional water from Paradise Dam. Accordingly, some features in this proposal have not been subject to detailed assessment at this stage.
4C	Up to 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	This option proposes the construction of a 100,000 ML dam at Barambah Creek and a new irrigation network to distribute water to irrigators in Coalstoun Lakes, and surrounding areas. The construction involves the implementation of a pipeline and channel scheme to take the water from the dam to the irrigation area, including balancing storages and relift, due to the gain in elevation. This option would facilitate the creation of new irrigation areas in Coalstoun Lakes and downstream users. It will require the creation of new water allocations for Coalstoun Lakes irrigators and irrigator downstream of the new dam on Barambah Creek. The site for the proposed weir on Barambah Creek will be downstream of Silverleaf Weir, with the final location determined on the basis of hydrological and geotechnical evidence. Four primary locations on Barambah Creek have been investigated previously as sites for a potential dam, including at ATMD 32 km, ATMD 39.3 km (see option 4D), ATMD 41.6 km (see option 4E) and ATMD 43.0 km (see option 4F).
4D	Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	This option proposes the construction of a 200,000+ ML dam on Barambah Creek at 39.3 km and a pipeline reticulation system to transport water from the new dam to Coalstoun Lakes and other surrounding irrigation areas. The purpose of this option is to provide increased water supply for downstream irrigators in the North Burnett. Earlier studies recommended a 48 m high dam with storage of 250,000 ML at this site, although more recent analysis has focused on a smaller 210,000 ML dam. This option has been reviewed and assessed as part of multiple formal and informal studies. As a result of these studies, there are four variations of the pipeline reticulation system with differing beneficiaries, costs and performance that must be considered: a) Coalstoun Lakes, Ban Ban Springs and Biggenden This involves the irrigation of the Coalstoun Lakes and Ban Ban Springs areas through a pipeline reticulation system pumped from a new storage. There will be a pump station with a main pipeline located parallel to Isis Highway, and a 3 km tunnel to Biggenden. Total capacity is 52,100 ML per year to irrigate 9,370 hectares for a cost of between $136 million and $279 million (2015 dollars). b) Coalstoun Lakes, Ban Ban Springs

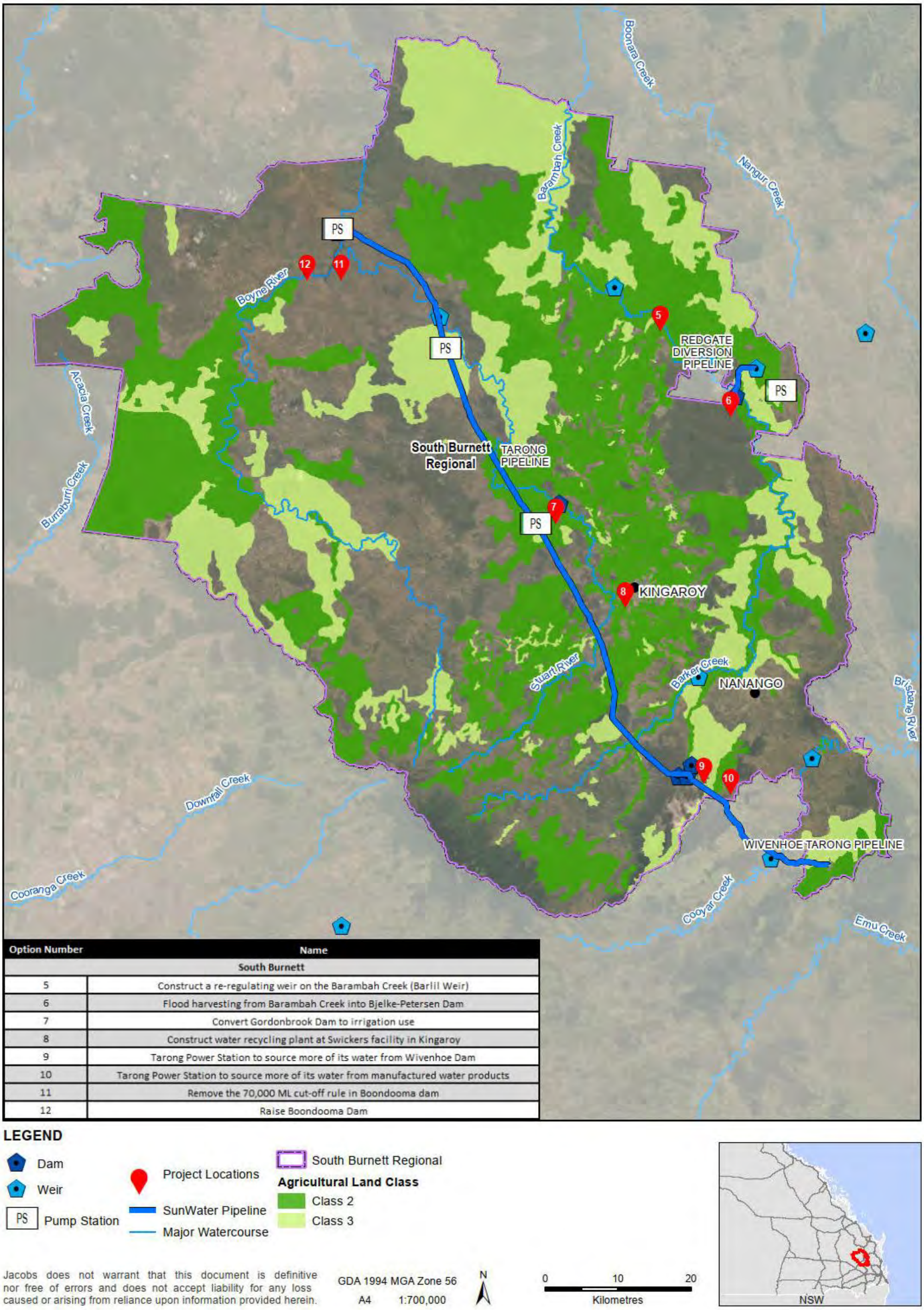
		This involves the irrigation of the Coalstoun Lakes, Ban Ban Springs and Biggenden areas through a pipeline reticulation system pumped from a new storage. There will be a pump station with a main pipeline located parallel to Isis Highway. Total capacity is 42,690 ML per year to irrigate 8,200 h for a cost of between $136 million to $279 million (2015 dollars). c) Coalstoun Lakes/Biggenden Water Development Group Irrigation Area including Biggenden This involves the irrigation of Coalstoun Lakes, Ban Ban Springs and Biggenden through a pipeline reticulation system pumped from a new storage. There will be a pump station with a main pipeline located parallel to Isis Highway, and a 3 km tunnel to Biggenden. Total capacity is 52,100 ML per year to irrigate 8,686 ha for a cost of between $136 million to $279 million (2015 dollars). d) Coalstoun Lakes/Biggenden Water Development Group Irrigation Area excluding Biggenden This involves the irrigation of Coalstoun Lakes and Ban Ban Springs (not Biggenden) through a pipeline reticulation system pumped from a new storage. There will be a pump station with a main pipeline located parallel to Isis Highway. Total capacity is 49,200 ML per year to irrigate 8,200 ha for a cost of between $115 million to $215 million (2015 dollars).
4E	Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	This option proposes the construction of a dam at 41.6 km and a pipeline reticulation system to transport water from the new dam to Coalstoun Lakes and other surrounding irrigation areas. The purpose of this option is to provide increased water supply for downstream irrigators in the North Burnett. The dam has been assessed and costed on the basis of 210,000 ML storage volume. This option has been reviewed and assessed as part of multiple formal and informal studies. As a result of these studies, there are four variations of the pipeline reticulation system with differing beneficiaries, costs and performance that must be considered (as summarised in option 4D above).
4F	Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	This option proposes the construction of a 200,000+ ML dam on Barambah Creek at 43.0 km and a pipeline reticulation system to transport water from the new dam to Coalstoun Lakes and other surrounding irrigation areas. The purpose of this option is to provide increased water supply for downstream irrigators in the North Burnett. Earlier studies recommended a 62 m high dam with storage of 280,000 ML at this site, although more recent studies have focused on a smaller 210,000 ML dam. This option has been reviewed and assessed as part of multiple formal and informal studies. As a result of these studies, there are four variations of the pipeline reticulation system with differing beneficiaries, costs and performance that must be considered (as summarised in option 4D above).
4G	Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	This option proposes the construction of a 100 km pipeline between Paradise Dam and Boondooma Dam to transfer surplus water allocations in Paradise Dam to areas of higher demand. Multiple pump stations and 2.2 MW of power will be required to the manage elevation on the route. This option would connect the dams at Wivenhoe, Boondooma and Paradise and facilitate greater efficiency between these storages by locating surplus water to areas of high demand within the Burnett Water Plan area. This option would provide new water to irrigators in: ▪ Coalstoun Lakes, via the existing Boyne River Irrigation Scheme ▪ the South Burnett region via the existing Tarong–Boondooma pipeline. This option would facilitate the generation of 20,000 ha of new irrigation areas in these two regions. This option involves resetting the water allocations in the Boyne River and Tarong Scheme so that Tarong Power Station sources all of its water from Wivenhoe Dam through the Tarong–Wivenhoe pipeline.
4H	Build a pipeline from Paradise Dam to Tarong–Boondooma pipeline via Coalstoun Lakes	This option proposes to source 55,000 ML of water from Paradise Dam and pump it through a 170 km pipeline to the Tarong-Boondooma pipeline via the highly fertile agricultural Coalstoun Lakes area. This option would use electricity

		generated through a pumped-hydro energy storage system to pump water along the pipeline, with excess electricity fed into the electricity grid. This option would involve the development and construction of major water infrastructure (170 km pipeline, pump stations, balance reservoirs, distribution networks); and energy infrastructure (head and tail ponds, penstock, transmission). This option relocates water within the Burnett Water Plan from Paradise Dam to other areas. The viability of this option is subject to the outcome of the current studies on the future of Paradise Dam. The areas that will receive new water under this option have identified urban demand for additional water and/or potential for agricultural expansion with identified demand. This option is complex and will require a staged construction and delivery to overcome multiple challenges, including rising elevation of 375 m over the length of the 170 km pipeline that requires significant pumping infrastructure. This option has a diverse water distribution network covering a large area of North Burnett and parts of South Burnett, including multiple urban locations (including Murgon, Biggenden and Kingaroy) and agricultural areas (including Coalstoun Lakes, the Boyne Irrigation Scheme and Biggenden irrigation).
4I	Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	This option proposes undertaking a combination of construction projects in order to supply 20,000–25,000 ML of water to the highly fertile agricultural area in and around Coalstoun Lakes. This option includes: ▪ 1.5m raising of the Claude Wharton Weir full supply level by installing crest gates or some other construction (outlined in detail in option 3A) ▪ raising Jones Weir by 1.4 m (outlined in detail in option 2A) ▪ building a new weir on the Burnett River, downstream of the confluence with Barambah Creek ▪ building a pipeline, or similar, to transport the water to Coalstoun Lakes ▪ extending the downstream extent of the Upper Burnett Water Supply Scheme to include the location of the new weir on the Burnett River. The purpose of this option is to deliver reliable new water to the highly fertile agricultural area around Coalstoun Lakes. This option would be facilitated by the creation of 20,000–25,000 ML of new medium priority water allocations at an annual price that would allow the capital and operational costs of the project to be partially recovered from the water users. This option has been designed in order to capitalise on the presence of potential water allocations in upper Burnett and facilitate the movement of water to an area of high economic potential and growth. The size and location of the new weir on the Burnett River will be subject to further hydrological and engineering review in order to maximize the effectiveness of that water storage. The location of that weir will impact on the route, length and construction of the pipeline to Coalstoun Lakes.

5.2 South Burnett options longlist

There are 8 longlist options located in South Burnett. The location of long-listed option in the South Burnett as shown in **Table 5.2**. Only options with a physical location are shown. Table 5.2 provides a summary of each of the options on the North Burnett options longlist. Appendix B sets out the high-level assessment on each of these options, including further detail and relevant source references.

Figure 5.2: South Burnett longlist options locations



Option Number	Name
	South Burnett
5	Construct a re-regulating weir on the Barambah Creek (Barlil Weir)
6	Flood harvesting from Barambah Creek into Bjelke-Petersen Dam
7	Convert Gordonbrook Dam to irrigation use
8	Construct water recycling plant at Swickers facility in Kingaroy
9	Tarong Power Station to source more of its water from Wivenhoe Dam
10	Tarong Power Station to source more of its water from manufactured water products
11	Remove the 70,000 ML cut-off rule in Boondooma dam
12	Raise Boondooma Dam

Table 5.2: South Burnett longlist options locations

Option Number	Name	Description
5	Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	This option proposes the construction of a 1,000 ML capacity re-regulating weir on Barambah Creek downstream of Bjelke-Petersen Dam. This proposed project is known as Barlil Weir. The proposed site for the Barlil Weir is on Barambah Creek at 135.2 km AMTD, downstream of Bjelke-Petersen Dam and about 8 km north-west of the township of Murgon. The purpose of this new weir would be to increase medium priority water allocations at the re-regulating weir plus indirectly benefit all water users in the Barker Barambah Water Supply Scheme through increases in its system operation efficiency. This option will also improve alignment of agricultural water allocations to demand in areas containing fertile soils.
6	Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	This option proposes to develop and implement system and process for pumping flood waters, at times of significant inflows, from Barambah Creek, into Barker Creek to be stored in Bjelke-Petersen Dam. As Bjelke-Petersen Dam is rarely full, there is capacity to improve the capture of water to be used by current and new irrigators. The purpose of this option is to improve the reliability for irrigators that hold medium priority allocations in the Barker Barambah Water Supply Scheme. The Bjelke-Petersen Dam is not a high-performing water storage, and this option would improve the performance of water products that rely on the dam for supply. This option would require review and refinement of existing flood management regulations and practices to ensure that during times of flood that there is a ready system and process that would allow flood waters to be harvested efficiently, safely and effectively. This option involves the building of a substantial channel for the transmission of high volumes of water over a short period (4–5 days) in the event of a flood event. The channel is estimated to be 2.0 km in length, and at least 2 m deep and 14 m wide.
7	Convert Gordonbrook Dam to irrigation use	This option proposes converting Gordonbrook Dam to exclusive irrigation use and removing the existing high priority allocation for urban usage in Kingaroy township. The purpose of this option is to provide improved reliability for irrigators with existing medium priority allocation holders in Boyne River and Tarong Water Supply Scheme. South Burnett Regional Council holds an 1,809 ML high priority water allocation from Gordonbrook Dam that supplements the water supply for Kingaroy. The primary water supply for Kingaroy is Boondooma Dam. Gordonbrook Dam is a 6,600 ML storage located 14 km north-west of Kingaroy on the Stuart River. It is owned and operated by the South Burnett Regional Council. Gordonbrook Dam has significant water quality issues that mean that South Burnett Regional Council will only utilise the storage for urban water supply when it is storing more than 3,250 ML (50% of full supply volume). South Burnett Regional Council currently draws approximately 30% of Kingaroy's water supply from Gordonbrook Dam and 70% from Boondooma Dam. Under this option, South Burnett Regional Council would need to increase its draw from Boondooma Dam for Kingaroy, potentially through purchasing water allocations from the Tarong Power Station. Purchasing allocations from Stanwell (owner of the Tarong Power Station) cannot be confirmed with certainty and would be subject to detailed analysis by

		Stanwell on the potential impacts on water security at the Tarong Power Station. The Boyne River and Tarong Scheme presently has an allocation of 30,333 ML per year for industrial (high priority) water, although since 2007–08 the actual industrial water deliveries have averaged 55% of the available allocation.
8	Construct water recycling plant at Swickers facility in Kingaroy	This option proposes to upgrade and expand water treatment system at the Swickers processing and packaging facility in Kingaroy for the onsite recycling and reuse of water for use in the Swickers operations. The proposed water treatment system will allow Swickers to treat and reuse between 5.00 ML and 8.8 ML per week. The purpose of this option is to make Swickers self-sufficient for a part of its daily water usage for industrial purposes. Swickers currently use around 14 ML per week on site from a combination of sources: ▪ 7–8 ML per week is sourced from the Kingaroy water treatment plant and is purchased from South Burnett Regional Council at commercial rates. ▪ 6 ML per week is sourced from bores owned and operated by Swickers. ▪ 0–4 ML is sourced from existing onsite recycling, although this water is only suitable for cleaning vehicles. The volume of water that can be sourced from Kingaroy water treatment plant is limited by the council owned water infrastructure, which is designed to pump water at 18 L per second but only is capable of pumping at 12 L per second. If Swickers were to exceed this pumping rate, it would result decreased performance in the water infrastructure (including the pipelines), which could result in substantive water quality problems for Swickers and potentially for urban water users in Kingaroy. This option would allow Swickers to either reduce the amount of water it takes from Kingaroy or expand its operation on the basis of the additional water supply it secures from the new water treatment system.
9A	Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	This option proposes that the Tarong Power Station source more of its water from Wivenhoe Dam through the Wivenhoe pipeline, which would reduce its usage of Boondooma Dam. Under this option, the Tarong Power Station would then sell (by way of permanent transfer) approximately 500 ML per year to 1,300 ML per year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy, while retaining Gordonbrook Dam for urban water usage, will be subject to further review. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). Under this option, the South Burnett Regional Council would retain Gordonbrook Dam for urban usage and continue the treatment and mixing of water from Gordonbrook Dam with the water from Boondooma Dam. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14 million (2013). The Tarong Power Station presently uses approximately 32,000 ML of water per year. The power station currently sources high priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma–Tarong pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme, which produces purified recycled water. This water is supplied through the Wivenhoe pipeline. Both sources of water are important to the water security and power generation requirements of the stations. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Stations, and any alteration to Stanwell's water allocation from the dam must

		not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the Queensland Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019–20, the Tarong Power Stations will take around 50% of its water from Wivenhoe Dam. This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer of a small proportion of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Station.
9B	Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	This option proposes that the Tarong Power Station source more of its water from Wivenhoe Dam through the Wivenhoe pipeline, which would reduce its usage of Boondooma Dam. Under this option, the Tarong Power Station would then sell (by way of permanent transfer) approximately 500 ML per year to 1,300 ML per year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy and allow South Burnett Regional Council to cease using Gordonbrook Dam for urban water usage will be subject to further review. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). The purposes of this option are to provide urban water security for Kingaroy (and potentially Nanango), reduce urban reliance on the low-quality water in Gordonbrook Dam and increase the reliability for irrigators with existing medium priority allocation holders in Boyne River and Tarong Water Supply Scheme. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14 million (2013). The Tarong Power Stations presently use approximately 32,000 ML of water per year. The power station currently sources high priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma–Tarong pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme, which produces purified recycled water. This water is supplied through the Wivenhoe pipeline. Both sources of water are important to the water security and power generation requirements of the power station. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Station, and any alteration to Stanwell's water allocation from the dam must not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the Queensland Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019–20, the Tarong Power Stations will take around 50% of its water from Wivenhoe Dam.

		This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Station.
10A	Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	This option proposes that the Tarong Power Station source more of its water from purified recycled water sourced from the Luggage Point treatment plant (instead of Wivenhoe Dam) through the Wivenhoe pipeline. This same option could be used where other manufactured water plants need to be kept running for operational reasons, but not for water security reasons, and the water could be used by the Tarong Power Station. This would reduce the usage of Boondooma Dam. Under this option, the Tarong Power Station would then sell (by way of permanent transfer) approximately 500 ML per year to 1,300 ML per year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy, while retaining Gordonbrook Dam for urban water usage, will be subject to further review. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). Under this option, the South Burnett Regional Council would retain Gordonbrook Dam for urban usage and continue the treatment and mixing of water from Gordonbrook Dam with the water from Boondooma Dam. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14 million (2013). The Tarong Power Stations presently use approximately 32,000 ML of water per year. The power stations currently source high priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma–Tarong pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme, which produces purified recycled water. This water is supplied through the Wivenhoe pipeline. Both sources of water are important to the water security and power generation requirements of the stations. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Station, and any alteration to Stanwell's water allocation from the dam must not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the Queensland Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019–20, the Tarong Power Station will take around 50% of its water from Wivenhoe Dam. This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer a small proportion of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Station.
10B	Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use	This option proposes that the Tarong Power Station source more of its water from purified recycled water sourced from the Luggage Point treatment plant (instead of Wivenhoe Dam) through the Wivenhoe pipeline. This same option

	and supplement urban supply with additional water allocation from Tarong Power Station)	could be used where other manufactured water plants need to be kept running for operational reasons, but not for water security reasons, and the water could be used by the Tarong Power Station. This would reduce the usage of Boondooma Dam. Under this option, the Tarong Power Station would then sell (by way of permanent transfer) approximately 500 ML per year to 1,300 ML per year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy and allow South Burnett Regional Council to cease using Gordonbrook Dam for urban water usage will be subject to further review. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). The purposes of this option are to provide urban water security for Kingaroy and Nanango, reduce urban reliance on the low-quality water in Gordonbrook Dam and increase the reliability for irrigators with existing medium priority allocation holders in Boyne River and Tarong Water Supply Scheme. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14 million (2013). The Tarong Power Stations presently use approximately 32,000 ML of water per year. The power stations currently source High Priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma–Tarong pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme, which produces purified recycled water. This water is supplied through the Wivenhoe pipeline. Both sources of water are important to the water security and power generation requirements of the stations. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Station, and any alteration to Stanwell's water allocation from the dam must not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the Queensland Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019–20, the Tarong Power Station will take around 50% of its water from Wivenhoe Dam. This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer a small proportion of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Station.

5.3 Both North and South Burnett longlist options

Some options are not geographically bound to either the North Burnett or South Burnett but could be relevant to both areas. There are six longlist options that are relevant to both North and South Burnett. These are summarised below.

Table 5.3: North and South Burnett longlist options

Option number	Name	Description
11	Remove the 70,000 ML cut-off rule in Boondooma Dam	This option proposes amending the critical water supply arrangements for Boondooma Dam to remove the rule that stops all supply to medium priority water allocation holders when dam levels fall below the set threshold. The purpose of this option is to increase the reliability of water for medium priority water allocations in the Boyne River and Tarong Water Supply Scheme. Boondooma Dam is managed by Sunwater and has special critical water supply arrangements that Sunwater implements in circumstances of a critical water situation. Under those arrangements, if the stored water in Boondooma Dam falls below a threshold level (approximately 70,000 ML), then stage one of the arrangements is implemented. Under the stage one arrangements, there can be no distribution of water to medium priority allocation holders in Boyne River and Tarong Water Supply Scheme (the cut-off rule). The original purpose of the cut-off rule was to protect the security of the high priority water allocations in the Boyne River and Tarong Water Supply Scheme, and particularly the allocation held by the Tarong Power Station. At the time the cut-off rule was introduced, Boondooma Dam was the only source of water for the Tarong Power Station, and the cut-off rule was considered essential to protect water security for the critical power generation function of Tarong Power Station. Since that time, the Wivenhoe pipeline was constructed in the late 1990s to provide a secondary water source for the Tarong Power stations. The Tarong North unit was constructed in 2003, based on the availability of water from the Wivenhoe pipeline. The argument for this option is that the cut-off rule is no longer required to protect the water security for the Tarong Power Station, and that the necessary risk management for the stations can be achieved through the existing allocation announcement system that prioritises high priority allocations above medium priority allocations. Under this option, it is suggested that the cut-off rule imposes an artificial and arbitrary restriction on medium priority allocation holders. All the medium priority allocation holders in Boyne River and Tarong Water Supply Scheme are irrigators, and the imposition of the cut-off rule means that those irrigators cannot access their water allocations under the scheme. Since 1983 there have been four significant periods when the cut-off rule was imposed.
12	Raise Boondooma Dam	This option proposes raising the height of Boondooma Dam by 12 m (or similar) in order to increase the storage capacity. This proposal would use a fixed crest structure without gates, and would increase the storage capacity from 204,000 ML to 600,000 ML, which is an estimated increase of 396,000 ML. The purpose of this option would be to provide additional new water to irrigators in the Boyne River and Tarong Water Scheme or improve the reliability of existing allocations. The medium priority allocations within the scheme are currently highly unreliable due to a combination of low water levels in the dam, the impact of the 70,000 ML cut-off (see option 11) and the high demand from Boondooma Dam from urban, industrial and irrigation users. This option could potentially, wholly or partially, address the urban water security concerns in some or all of the towns in South Burnett.
14	Optimise in-scheme unsupplemented access rules	This option proposes operational improvements to the administration of water harvesting entitlements. This would involve optimising in-scheme unsupplemented access rules, in schemes across North Burnett and South Burnett, to enable the use of projected downstream water levels when making water harvesting announcements (in relation to both the commencement and cessation of water harvesting events). This proposal will allow greater utilisation of water harvesting opportunities by existing unsupplemented water allocations and support expansion of irrigated agriculture. This option would involve reforms and refinement to the access rules and the practices of Sunwater in the management and delivery of harvesting announcements. This option is based on anecdotal evidence that water harvesting opportunities are either cut short or do not commence because the triggers are specified too far downstream from

		the location of the water allocations. Building in the ability to predict whether downstream levels will be triggered (rather than waiting them to be met) will allow water allocations to actually access their entitlements and offer them greater water security to support expansion of irrigated agriculture.
15	Greater utilisation of the Wivenhoe pipeline (for Blackbutt irrigation)	This option proposes increasing the usage of the Wivenhoe pipeline to access more water from Wivenhoe Dam for use by irrigators in Blackbutt in South Burnett. Consultations with irrigators in and around Blackbutt have identified demand for approximately 2,350 ML per year. The Blackbutt irrigators are currently reliant on water allocations from Boondooma Dam that are unreliable and impacted by the 70,000 ML cut-off for medium priority allocation holders. This option would provide a reliable source of additional water to a highly fertile area that is significantly impacted by water shortages, which has a negative impact on local economic conditions, employment and social issues. There currently is a pipeline from Wivenhoe Dam to the Tarong Power Station. It is primarily used to supply water to the Tarong Power Station (used in conjunction with Boondooma Dam) and was constructed to provide water security for the station. It would be important that the additional usage of the Wivenhoe pipeline did not impact the water reliability for the Tarong Power Station. The Tarong Power Station is owned by Stanwell and is a major stakeholder in water in South Burnett.
16	Private water harvesting	The option proposes harvesting wet-season floodwaters for off-stream storage and later use to irrigate riparian and near riparian lands. It could be expected that this type of development would be replicated in multiple locations across lands that have previously been identified noting static lift and distance from watercourse. This option generally has fewer environmental regulations to satisfy as in-stream infrastructure is limited and there is very little additional inundation. Suitable sites need to be available adjacent to areas of water demand.
17	Agricultural supply chain improvements	The option proposes developing a supply value chain for the region and addressing supply chain gaps and constraints. The purpose of this review would be to understand the opportunities for local value-add, local jobs and opportunities for processing to occur within the region (e.g. for peanuts and blueberries). This review would seek to understand the impediments, particularly regarding economies of scales and reliability, that could be addressed through additional /more reliable water sources.

6. Options longlist to shortlist

6.1 Introduction

The strategic business case identified 23 options for the options longlist. The longlist was reduced to a shortlist through a systematic process, to identify the best available projects to address the water needs and problems in the study area.

6.2 Options longlist to shortlist

The shortlist was developed through three phases:

- initial screening
- high-level assessment
- shortlisting through multi-criteria analysis.

The purpose of each of the three phases:

- **Initial screening** of the longlist of options identified in the strategic business case is conducted to identify any developments in the investment environment that have revealed additional options or made any of the existing options unacceptable.

- **High-level assessment** of the options on the longlist against four key considerations that provide context to the investment decision:
  - strategic and policy alignment
  - legal and regulatory concerns
  - public interest considerations
  - strategic risk.

  The high-level assessment identifies and discards options that are not feasible in the context of wider political, social and legal environments. Each option is measured as having low, medium or high feasibility against each of the four key considerations. The high-level assessment of the options longlist is set out in this Annexure 2, and the methodology used for that assessment is discussed further below.

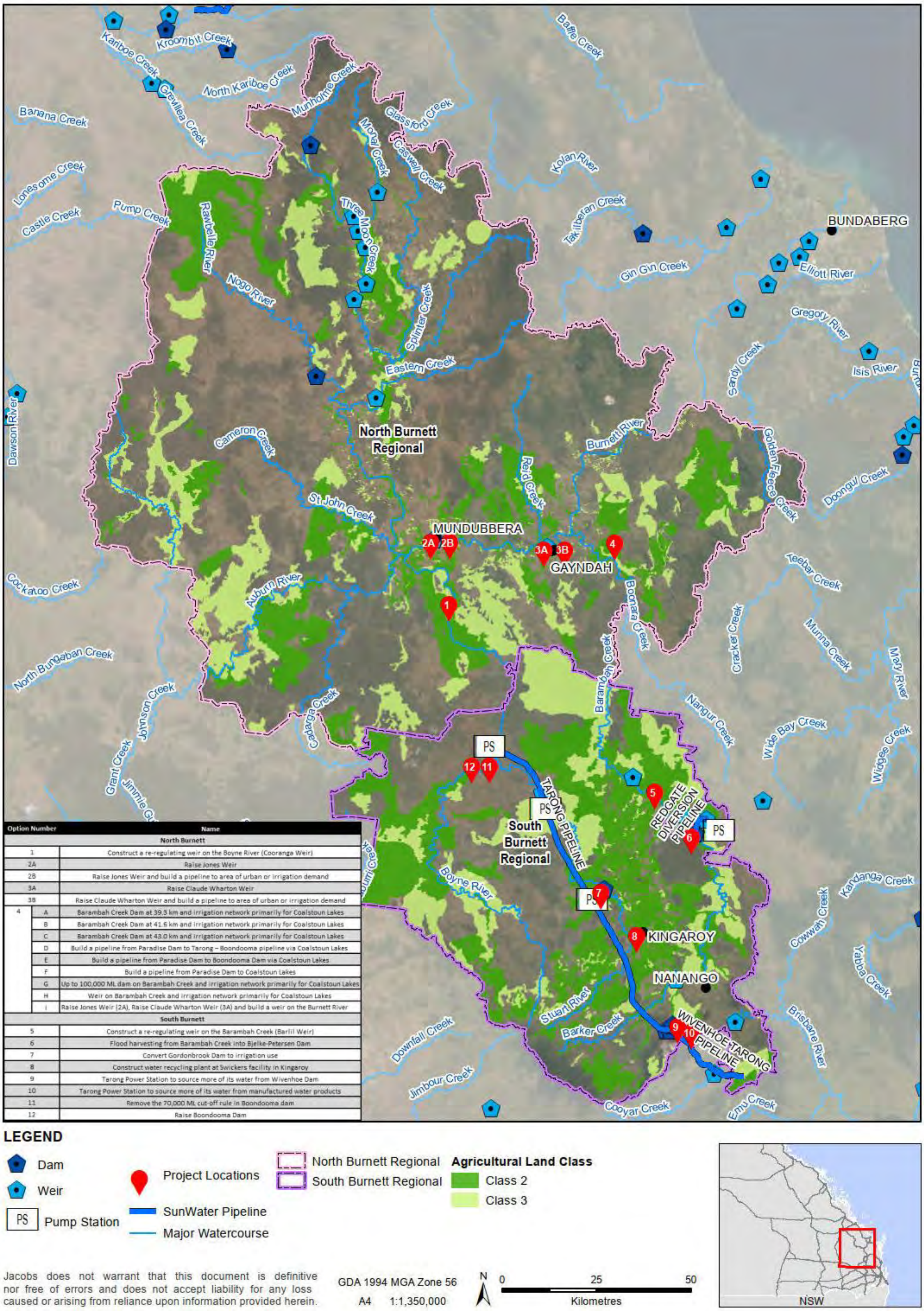
- **Shortlisting** the remaining, feasible options through a multi-criteria analysis scores and filters the options. The criteria for the multi-criteria analysis is determined by the Project Steering Committee. The criteria include the areas reviewed in the high-level assessment and additional criteria that enlightens the assessment of the options.

6.3 Initial screening

Prior to finalising the longlist, an initial screening was conducted, which resulted in the addition of six options and the removal of one option.

The location of the 28 options on final longlist is set out in **Figure 6.1**.

Figure 6.1: Location of options



Option Number		Name
North Burnett		
1		Construct a re-regulating weir on the Boyne River (Cooranga Weir)
2A		Raise Jones Weir
2B		Raise Jones Weir and build a pipeline to area of urban or irrigation demand
3A		Raise Claude Wharton Weir
3B		Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand
4	A	Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes
	B	Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes
	C	Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes
	D	Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes
	E	Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes
	F	Build a pipeline from Paradise Dam to Coalstoun Lakes
	G	Up to 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes
	H	Weir on Barambah Creek and irrigation network primarily for Coalstoun Lakes
	I	Raise Jones Weir (2A), Raise Claude Wharton Weir (3A) and build a weir on the Burnett River
South Burnett		
5		Construct a re-regulating weir on the Barambah Creek (Barlil Weir)
6		Flood harvesting from Barambah Creek into Bjelke-Petersen Dam
7		Convert Gordonbrook Dam to irrigation use
8		Construct water recycling plant at Swickers facility in Kingaroy
9		Tarong Power Station to source more of its water from Wivenhoe Dam
10		Tarong Power Station to source more of its water from manufactured water products
11		Remove the 70,000 ML cut-off rule in Boondooma dam
12		Raise Boondooma Dam

6.4 High-level assessment

The high-level assessment is a broad-scale review that covers a range of issues that inform the investment environment and ultimate investment decision.

In this study, the high-level assessment provides an overview of each option through a review of previous studies, reviews and assessments that have examined the key elements of the options. Some of the options have been under consideration for over 20 years and have been subject to multiple previous reviews—from costs estimates and economic impacts through to environmental impacts and geotechnical viability. Other options have been developed recently and have a smaller amount of relevant information that can be considered.

6.4.1 Purpose

The high-level assessment considers the feasibility of all of the options on the longlist and identifies any critical flaws that justify removal of an option from consideration prior to the multi-criteria analysis. The high-level assessment does not constitute a detailed analysis, and it should not be taken as a comprehensive review of each critical aspect of an option. Where an option progresses to the shortlist (following completion of the multi-criteria analysis) it will be subject to more detailed review and analysis.

6.4.2 Structure

The information from the high-level assessment is used to determine if a particular option is feasible, and to exclude any option that is unfeasible prior to conducting the shortlisting through the multi-criteria analysis. For this study, a template has been developed for the high-level assessment, which has five sections:

- **Background to the option**—this section describes the option, the potential costs (if known), the hydrological benefits, the customers it will benefit and how it will address the identified problems. The information is descriptive and does not include an assessment of the feasibility of the option.
- **Strategic considerations**—this section identifies the applicable State Infrastructure Plan classification and considers the alignment of the option with government policies and objectives. The feasibility of the option is measured against these considerations.
- **Legal and regulatory considerations**—this section considers the legal and regulatory requirements for the option and any subsequent impact on the viability of the option. The feasibility of the option is measured against these considerations.
- **Public interest considerations**—this section considers the option's impact on stakeholders, environmental impacts, timeframes, social and economic context, access to water and the proximity to demand. The feasibility of the option is measured against these considerations.
- **Risk considerations**—this section considers the key risks that would impact the viability of the option and potential mitigation actions (if known). The feasibility of the option is measured against these considerations.

An assessment of 'high', 'medium' or 'low' in the high-level assessment indicates the degree of feasibility for that option against the particular feasibility measure. For example, an assessment of 'high' under the feasibility measure of risk means that the option is highly feasible against the relevant risk considerations.

The analysis and information in the high-level assessment is intentionally high-level. The aim is not to provide a comprehensive review of every aspect of the option. The items that are shortlisted following the multi-criteria analysis will be subject to detailed analysis of social impact, environmental, sustainability, economic, financial, and affordability aspects.

6.4.3 Outcome

The high-level assessment measured the feasibility of 28 options, and provided a detailed analysis of the context, strengths and weaknesses of each option.

The detailed high-level assessment of each option is set out at Annexure 2.

Table 6.1 shows the outcome of the assessment for each option, including the measure of the feasibility of the option against the four feasibility criteria.

Table 6.1: Outcome of the high-level assessment

Option number	Name	Location	Feasibility measure			
			Strategic	Regulatory	Public interest	Risk
North Burnett						
1	Construct a re-regulating weir on the Boyne River	Boyne River (34.45; 33.8; 33.65 AMTD)	High	High	High	Medium
2A	Raise Jones Weir	Jones Weir, Burnett River (240 AMTD), near Mundubbera	Medium	High	Medium	Medium
2B	Raise Jones Weir and build a pipeline to area of urban or irrigation demand	Jones Weir, Burnett River (240 AMTD), near Mundubbera	Medium	High	Medium	Medium
3A	Raise Claude Wharton Weir	Clause Wharton Weir, Burnett River, near Gayndah	Medium	High	Medium	Medium
3B	Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	Clause Wharton Weir, Burnett River, near Gayndah	Medium	High	High	High
4A	Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	Barambah Creek (32.0, 39.3, 41.6, 43.0 AMTD)	High	Medium	High	High
4B	Build a pipeline from Paradise Dam to Coalstoun Lakes	Paradise Dam to Coalstoun Lakes	High	Medium	High	Medium
4C	Up to 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	Barambah Creek (32.0, 39.3, 41.6, 43.0 AMTD)	Medium	Medium	Medium	Medium
4D	Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	Barambah Creek (39.3 AMTD)	Low	Medium	Medium	Medium
4E	Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	Barambah Creek (41.6 AMTD)	Low	Medium	Medium	Medium
4F	Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	Barambah Creek (43.0 AMTD)	Low	Medium	Medium	Medium
4G	Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	Paradise Dam to Boondooma Dam	Low	Medium	Medium	Low
4H	Build a pipeline from Paradise Dam to Tarong–Boondooma pipeline via Coalstoun Lakes	Paradise Dam to Tarong-Boondooma Pipeline	Low	Low	Medium	Low
4I	Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	Multiple locations on the Burnett River	High	High	High	High

South Burnett						
5	Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	Barambah Creek (135.2 AMTD), near Murgon	High	High	High	Medium
6	Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	Bjelke-Petersen Dam on Barambah Creek	Low	Medium	Medium	Medium
7	Convert Gordonbrook Dam to irrigation use	Gordonbrook Dam	Low	Medium	Low	Low
8	Construct water recycling plant at Swickers facility in Kingaroy	Kingaroy	High	High	High	High
9A	Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	Tarong Power Station	Medium	Medium	Medium	Low
9B	Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	Tarong Power Station	High	Medium	Medium	Low
10A	Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	Tarong Power Station	Medium	Medium	Medium	Low
10B	Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	Tarong Power Station	High	Medium	Medium	Low
Both North Burnett and South Burnett						
11	Remove the 70,000 ML cut-off rule in Boondooma dam	Boondooma Dam	Low	Low	Low	Low
12	Raise Boondooma Dam	Boondooma Dam	Low	Medium	Low	Low
14	Optimise in-scheme unsupplemented access rules	–	High	High	Medium	High
15	Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	Boyne River & Tarong Water Supply Scheme	Medium	Medium	Medium	Medium
16	Water harvesting	Multiple locations	High	High	Medium	High
17	Agricultural supply chain improvements	–	High	High	Medium	High

Some options are more feasible than other options, and there are substantive weaknesses in some of the options (**Table 6.1**). However, all of the 28 options were assessed as feasible.

The outcome of the high-level assessment was presented to the PSC and it was determined that all of the options would proceed to the shortlisting processes through the multi-criteria analysis.

6.5 Shortlisting: multi-criteria analysis

The shortlisting process involved reviewing and measuring the 28 options against a set of weighted criteria determined by the PSC.

6.5.1 Developing the criteria and weightings

The criteria and the weighting (Table 6.2) for each criterion for the multi-criteria analysis were developed in consultation with the PSC.

Table 6.2: Criteria and weightings

Criteria	Weighting (%)
Service need	20
Benefits	20
Support from stakeholders	15
Public interest considerations	10
Risks	15
Legal issues	10
Strategic and policy alignment	10
Total	**100**

The options were assessed by assigning a score under each criterion. The score and score description for each criterion is outlined in Annexure F.

6.5.2 Service need

This criterion assesses how the potential option will address the service needs (problem/opportunity) that were identified in the strategic business case.

Table 6.3: Service needs

Problem	North Burnett	South Burnett
1		Security of urban water supply is poor and deteriorating, harming community welfare and limiting industrial expansion
2	Existing agricultural supplemented water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment	
3	Large areas of fertile land have no access to a reliable source of water, hindering crop yields, value and diversity due to dependence on unreliable seasonal rains	

6.5.3 Benefits

This criterion assesses how the potential options deliver the targeted benefits that were identified in the strategic business case.

Table 6.4: Targeted benefits

Benefit	North Burnett	South Burnett
1	Sustained increases in agricultural production and employment (50%)	Sustained increases in agricultural production and employment (35%)
2	Improved economic (agricultural) resilience (35%)	Improved community (urban) resilience (30%)
3	Emergence of efficient local supply chain industries (15%)	Improved economic (agricultural) resilience (20%)
4		Growth of efficient agricultural processing industries (15%)

6.5.4 Support from stakeholders

This criterion assesses the level of support from the stakeholders for the option. The key stakeholders considered in this assessment include:

- irrigators (focus on identified demand nodes)
- processors
- councils
- urban water users
- Tarong Power Station
- rest of Queensland.

6.5.5 Public interest considerations

This criterion assesses whether the option is in the public interest. The public interest considerations used in this assessment include:

- public access and equity
- access to water
- impact on stakeholders
- environmental impact
- social and economic
- proximity to demand.

6.5.6 Risks

This criterion assesses the risks of the options and how those risks impact on the viability of the option. The risks used in this assessment include:

- costs
- inefficient demand/willingness to pay
- cultural heritage/native title
- hydrological performance/access to water
- energy and water security
- legal risks
- environmental risks
- project-specific risks.

6.5.7 Legal issues

This criterion assesses any specific legislative and/or regulatory requirements or issues (both current and foreshadowed) or other legal matters relevant to the option (or their ongoing operation) that may prevent, impede or have a significant impact on the realisation of the benefits of the option. The key legal and regulatory issues used in this assessment include:

- Water Act (Qld) and Burnett Water Plan
- Commonwealth legislation and instruments
- Queensland legislation and instruments
- operations manuals, water management protocol and supply schemes.

6.5.8 Strategic and policy alignment

This criterion assesses how the option contributes to or is aligned with the strategic objectives of the agency and government. Key government initiatives used in this assessment include:

- National Water Initiative
- State Infrastructure Plan (SIP)
- Queensland Bulk Water Opportunities Statement
- Growing for Queensland (a strategy for the agriculture, fisheries and forestry sector)
- regional council economic, development and water strategies

6.6 Outcome of the multi-criteria analysis

After the 28 options were assessed under the multi-criteria analysis, each option was provided a score against each of the criteria.

Table 6.5 shows the scores and the ranking of each option.

Table 6.5: Outcome of the multi-criteria analysis

Rank	Option	Total score	Service need	Benefits	Support from stakeholders	Public interest	Risks	Legal issues	Strategic and policy alignment
1	Option 4I: Raise Jones Weir, raise Claude Wharton Weir, build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	**3.80**	5	4	3	4	3	2	5
1	Option 4B: Build a pipeline from Paradise Dam to Coalstoun Lakes	**3.80**	5	4	3	4	3	2	5
3	Option 1: Construct re-regulating weir on the Boyne River	**3.70**	3	4	3	5	3	4	5
3	Option 5: Construct a re-regulating weir on Barambah Creek	**3.70**	3	4	3	5	3	4	5
5	Option 8: Construct water recycling plant at Swickers facility in Kingaroy	**3.65**	3	1	4	5	5	5	5
6	Option 15: Greater utilisation of the Wivenhoe to Tarong pipeline	**3.60**	4	4	3	4	3	4	3
7	Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	**3.30**	5	5	2	3	2	3	1
7	Option 10B: Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	**3.30**	5	5	2	3	2	3	1

Rank	Option	Total score	Service need	Benefits	Support from stakeholders	Public interest	Risks	Legal issues	Strategic and policy alignment
7	Option 14: Optimise in-scheme unsupplemented access rules	**3.30**	2	2	3	4	5	4	5
10	Option 9A: Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	**3.15**	3	3	3	4	2	4	4
11	Option 4A: Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	**3.10**	5	3	2	4	2	2	3
12	Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	**2.90**	5	3	2	4	2	2	1
12	Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	**2.90**	5	3	2	4	2	2	1
12	Option 4F: Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	**2.90**	5	3	2	4	2	2	1
12	Option 4C: 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	**2.90**	5	3	2	4	2	2	1
16	Option 3A: Raise Claude Wharton Weir	**2.85**	2	2	3	3	4	3	4
16	Option 17: Agricultural supply chain improvements	**2.85**	1	3	2	2	5	5	3
18	Option 4G: Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	**2.80**	4	4	2	3	2	2	1
19	Option 2A: Raise Jones Weir	**2.75**	1	2	3	4	4	3	4

Rank	Option	Total score	Service need	Benefits	Support from stakeholders	Public interest	Risks	Legal issues	Strategic and policy alignment
19	Option 4H: Build a pipeline from Paradise Dam to Tarong–Boondooma pipeline via Coalstoun Lakes	**2.75**	5	5	2	1	1	1	1
21	Option 10A Tarong Power Station to source more of its water from manufactured water products	**2.70**	3	3	2	4	2	4	1
21	Option 16: Private water harvesting	**2.70**	2	2	3	4	3	2	4
23	Option 3B: Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	**2.55**	2	3	2	3	3	2	3
24	Option 6: Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	**2.35**	1	1	3	4	4	2	3
25	Option 2B: Raise Jones Weir and build a pipeline to area of urban or irrigation demand	**2.15**	1	2	2	3	3	2	3
26	Option 12: Raise Boondooma Dam	**1.65**	3	1	2	1	1	2	1
27	Option 11: Remove the 70,000 ML cut-off rule in Boondooma Dam	**1.00**	0	0	2	1	2	3	0
28	Option 7: Convert Gordonbrook Dam to irrigation use	**0.95**	1	0	2	1	1	2	0

Table 6.6: Summary of shortlisting

Rank	Option	Total score	Outcome	Reason
1	Option 4I: Raise Jones Weir, raise Claude Wharton Weir, build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	**3.80**	Included in the shortlist	This option provides the full amount of water demanded by a highly fertile agricultural area and opens up water allocations that will facilitate the accessing of this new water. The option includes parts that have been reviewed and approved at multiple levels of government.
1	Option 4B: Build a pipeline from Paradise Dam to Coalstoun Lakes	**3.80**	Included in the shortlist	This option provides a substantive increase in reliability for existing allocations to an area of high agricultural potential but with risks relating to environmental impacts and affordability.
3	Option 1: Construct a re-regulating weir on the Boyne River	**3.70**	Included in the shortlist	This option provides a substantive increase in reliability for existing allocations to an area of high agricultural potential with low risk.
3	Option 5: Construct a re-regulating weir on Barambah Creek	**3.70**	Included in the shortlist	This option provides reliable, high-yield new water to an area of high agricultural potential with some uncertainty regarding existing approvals (new approvals may be required) and affordability.
5	Option 8: Construct water recycling plant at Swickers facility in Kingaroy	**3.65**	Included in the shortlist	This option provides new water to a highly productive industrial water user at a low cost, with minimal risk and positive environmental impact.
6	Option 15: Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigators)	**3.60**	Included in the shortlist	This option provides new water to a highly fertile agricultural area with high potential economic return for low risk and, potentially, full cost recovery.
7	Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	**3.30**	Included in the shortlist	This option provides increased urban water security, and improved quality, to Kingaroy at a relatively low cost, and new water for agricultural users.
7	Option 10B: Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	**3.30**	Included in the shortlist	This option provides increased urban water security, and improved quality, to Kingaroy at a relatively low cost, and new water for agricultural users.
7	Option 14: Optimise in-scheme unsupplemented access rules	**3.30**	Referred to the Queensland Government; not included in the shortlist	This option provides operational and efficiency benefits at a low cost, and it is most suitable for it to be progressed by the government.

Rank	Option	Total score	Outcome	Reason
10	Option 9A: Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	**3.15**	Included in the shortlist	This option provides increased urban water security, and improved quality, to Kingaroy at a relatively low cost.
11	Option 4A: Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	**3.10**	Included in the shortlist	This option provides the full amount of water demanded by a highly fertile agricultural area, although at a higher cost and risk than alternative options that deliver similar benefits.
12	Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	**2.90**	Not included in the shortlist	This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the plan.
12	Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	**2.90**	Not included in the shortlist	This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the plan.
12	Option 4F: Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	**2.90**	Not included in the shortlist	This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the plan.
12	Option 4C: 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	**2.90**	Not included in the shortlist	This option supplies significantly more water than is demanded and would be dependent on obtaining water from other areas within the plan.
16	Option 10A: Tarong Power Station to source more of its water from manufactured water products	**2.85**	Not included in the shortlist	This option is a permutation of options 9B, 9A, and 10B, which are all progressing to the short list. Due to the high cost of manufactured water, this option is considered the least promising of the bundle.
16	Option 3A: Raise Claude Wharton Weir	**2.85**	Not included in the shortlist	This option does not deliver water to areas of highest demand and alone does not solve the identified problems in the area. However, in combination with other options is considered in the shortlist as option 4I.
16	Option 17: Agricultural supply chain improvements	**2.85**	Referred to the Queensland Government; not included in the shortlist	This option potentially provides administrative and efficiency; The most suitable outcome is if the government progresses it.
19	Option 4G: Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	**2.80**	Not included in the shortlist	This option has a very high cost; the outcomes of this option can be achieved more simply and cheaper by option 4B, which is on the shortlist.

Rank	Option	Total score	Outcome	Reason
20	Option 2A: Raise Jones Weir	**2.75**	Not included in the shortlist	This option does not deliver water to areas of highest demand and alone does not solve the identified problems in the area. However, in combination with other options it is considered in the shortlist as option 4I.
21	Option 4H: Build a pipeline from Paradise Dam to Tarong–Boondooma pipeline via Coalstoun Lakes	**2.75**	Not included in the shortlist	This option is very high-cost and would likely be unable to secure the necessary public and private funding to proceed.
22	Option 16: Private water harvesting	**2.70**	Referred to the Queensland Government; not included in the shortlist	This option provides operational and efficiency benefits at a low cost, and the most suitable outcome is if the government progresses it.
23	Option 3B: Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	**2.55**	Not included in the shortlist	This option alone is insufficient to meet identified demand. However, in combination with other options is considered in the shortlist as option 4I.
24	Option 6: Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	**2.35**	Not included in the shortlist	This option is relatively high-cost for a low-reliability water product that is unlikely to provide substantive economic benefits. The water plan constrains the total available water. This option requires the same water as option 5, which is considered a superior project, unless further water is made available.
25	Option 2B: Raise Jones Weir and build a pipeline to area of urban or irrigation demand	**2.15**	Not included in the shortlist	This option alone is insufficient to meet identified demand. However, in combination with other options it is considered in the shortlist as option 4I.
26	Option 12: Raise Boondooma Dam	**1.65**	Not included in the shortlist	This option has a relatively high cost, will provide limited yield and will not be able to recover a substantive portion of capital or operational costs. This option fails to reduce timing and transmission loss issues for irrigators on the Boyne River. The dominant user, Tarong, is scheduled to shut in 2036.
27	Option 11: Remove the 70,000 ML cut-off rule in Boondooma Dam	**1.00**	Not included in the shortlist	This option removes a risk management mechanism for urban, industrial and energy generation security for limited tangible benefit.
28	Option 7: Convert Gordonbrook Dam to irrigation use	**0.95**	Not included in the shortlist	This option increases the water security problem in the South Burnett and imposes more stress on Boondooma Dam.

6.7 Summary of the high-scoring options

6.7.1 Shortlist options

The 10 options that scored the highest in the multi-criteria analysis formed the options shortlist (**Table 6.7**).

Table 6.7: Shortlisted options

Option 4I: Raise Jones Weir, raise Claude Wharton Weir, build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	Option 15: Greater utilisation of the Wivenhoe to Tarong pipeline
Option 4B: Build a pipeline from Paradise Dam to Coalstoun Lakes	Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)
Option 1: Construct re-regulating weir on the Boyne River	Option 10B: Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)
Option 5: Construct a re-regulating weir on the Barambah Creek	Option 4A: Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes
Option 8: Construct a water recycling plant at Swickers facility in Kingaroy	Option 9A: Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)

The shortlisted options are analysed in detail in the following chapters.

6.7.2 Options for referral for action

The multi-criteria analysis identified multiple options that are not suitable for the shortlist, although they have significant value and can be actioned by the government or private organisations without requiring further analysis. These projects are:

- Option 14: Optimise in-scheme unsupplemented access rules
- Option 17: Agricultural supply chain improvements
- Option 16: Private water harvesting.

The potential next steps, including recommended actions, for each of these actionable options are outlined in section 19.2.

7. Social impact evaluation

7.1 Key points

- This chapter presents the social impacts associated with the short-listed options.
- It follows the Building Queensland Social Impact Evaluation Guidelines (Release 3).
- To facilitate the analysis, the options are classified as 1) new irrigation and urban usage; 2) new water reuse; and 3) better use.
- The new irrigation and urban usage projects are those that involve the construction of new storages, weirs and pipelines.
- The new water re-use option involves the construction of a water recycling plant at the Swickers facility in Kingaroy.
- The better use options involve modifications to the current water supply scheme to the Tarong Power Station.
- To facilitate the analysis, a baseline study of the study region (North Burnett and South Burnett) in comparison to the rest of Queensland was undertaken.
- The baseline study showed that:
  - population growth in the area is stagnant or very low
  - there is a high proportion of people aged over 65
  - there is a high proportion of families with no parent employed
  - the majority of dwellings are private houses with a high proportion being fully owned
  - education levels are lower than the rest of Queensland
  - there is a high level of social disadvantage
  - wages are significantly lower than the rest of Queensland
  - agriculture and food processing are the major industries in the region.
- The greatest social impacts are associated with the new build options.
- Dependent on the individual project within the new-build category, the new-build projects can stimulate construction and agricultural activity in the region.
- Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food-processing industries.
- New build project can also provide the greatest potential for negative social outcomes, mainly through their impacts on existing property rights, cultural heritage, lifestyles and the environment.
- The new build water re-use option at Swickers will have minor social impacts. It may potentially increase regional employment and provide certainty for urban water supply.
- The better use projects associated with changing water supply options at Tarong can have potentially positive and negative social impacts.
- The options will result in more water available for irrigation and urban water supply in the Burnett study area and provide associated employment benefits.

7.2 Methodology

A social impact evaluation was undertaken in line with the guidelines developed by Building Queensland. The guidelines outline a three-step process (Table 7.1).

Table 7.1: Building Queensland three-step process for undertaking a social impact evaluation

1 IDENTIFY IMPACTS	2 EVALUATE IMPACTS	3 INTEGRATE OUTCOMES
Identify stakeholders	Assess likelihood and consequence of impacts occurring with the project	Include impacts to be included in the economic analysis
Understand the social context and document the baseline	Assess the likelihood and consequence of impacts occurring under the baseline	Include relevant elements in reference project and other analyses
Document the project elements	Assess the likelihood and consequence of negative impacts after mitigations	Include relevant elements in appraisal summary table
Identify and describe impacts		Update the evaluation and the risk and benefits registers
Consider and document mitigations		
Document opportunities to enhance positive impact		
Describe the impacts after mitigation/ enhancements		

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The social impact evaluation built on previous work done as part of the strategic assessment and options analysis. Inputs included previous analysis of the stakeholders, service need, strategic, legal and regulatory, market, public interest and sustainability considerations presented in previous chapters. The outputs of the social impact evaluation have informed the economic, financial and environmental analysis. Data to further inform this social impact evaluation was derived from Australian Bureau of Statistics data, other published reports and previous studies.

The 10 shortlisted options fall into the following categories:

- Options that require new infrastructure to be constructed to provide additional water for irrigation and urban supply (new irrigation and urban)
- Options that require new infrastructure for water reuse (new water reuse)
- Options that require changes to existing allocations and policies to provide for required supply (better use).

7.3 Shortlisted options, stakeholders and potential social impacts

A stakeholder engagement plan has been developed. Key stakeholders and the potential impacts that the options may have on them are identified in the following table.

Table 7.2: Shortlisted options by category, stakeholders and potential social impacts

Category	Option	Stakeholders	Potential impacts
New irrigation and urban usage	Construct a re-regulating weir on the Boyne River	Landholders Irrigators Local contractors Local businesses Local government Urban and industrial water users Sunwater Utilities	Additional water for production Greater level of economic activity and certainty of investment Additional construction and operation jobs Additional water security for urban centres Construction impacts (noise, dust, etc.)
	Construct a re-regulating weir on Barambah Creek		
	Build a pipeline from Paradise Dam to Coalstoun Lakes		
	Up to 65,000 ML storage on Barambah Creek and irrigation network		
	Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River,		

	downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	State government Departments Traditional owners Environmental groups	Temporary loss of access to areas of land Disruption of business activities Transport disruptions Land acquisition and easements Additional on-farm infrastructure Impacts on council infrastructure such as roads from construction of infrastructure Impacts on utility infrastructure such as electricity, communications and water assets from construction Disruptions to existing irrigation infrastructure operation Additional workloads and licencing requirements Impacts on areas of cultural significance Environmental impacts
New water reuse	Construct a recycling plant at Swickers facility in Kingaroy	Swickers Urban and industrial water users Local council Landholders Local contractors State government departments	Additional water for production Additional water security for urban centres. Greater level of economic activity and certainty of investment Additional construction and operation jobs Construction impacts
Better Use	Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation) Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water use from Tarong Power Station) Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water use from Tarong Power Station) Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	Stanwell Sunwater Seqwater State government Departments Local government Local businesses Urban and industrial water users Irrigators	Additional water for production Additional employment Additional water security for urban centres Greater reliance on water from Western Corridor Recycled Water Scheme Additional costs to electricity consumers Additional costs to water consumers

7.4 Baseline

7.4.1 Regional context

All the identified project options will occur in the Burnett region in Queensland.

The study region comprises the local government areas of the North Burnett Regional Council and South Burnett Regional Council.

7.4.2 Existing social environment

The study area is in regional Queensland and covers an area of 28,051 square kilometres, which is approximately 1.6 per cent of the total land area of Queensland (1,734,238 km²).

Broadacre cattle grazing is the major land use in the area, with pockets of high-value irrigation occurring. The region contains a number of major water storages and there are areas of urban and rural residential development.

The population of the study area is 43,120 people. The population is growing slower than the rest of Queensland. The median age of residents is higher than the rest of Queensland, with a far higher proportion of people over 65.

A small proportion of the population is born overseas. The majority of households are families with no children.

Table 7.3: Population and demographic characteristics of communities in the study area, compared to Queensland

Characteristic	North Burnett	South Burnett	Study area	Queensland
Population and growth				
Estimated resident population (ERP) (2019)	10,599	32,521	43,120	5,094,510
Average annual change in ERP (2009–2019) (%)	0.2	0.4	0.4	1.6
Population projection (2041)	10,562	37,107	47,669	7,161,661
Projected annual change in population (2016–2041) %	0.0	0.5	0.4	1.6
Age profile				
Median age (years) (2018)	46.6	45.4	45.7	37.3
0–14 years (%)	17.2	19.1	18.6	19.6
15–64 years (%)	58.9	57.5	57.9	65
65+ years (%)	23.9	23.4	23.5	15.4
Cultural diversity				
Overseas born (%)	22.0	17.7	18.7	21.6
Speaks other language at home and speaks English not well or not at all	1.0	0.3	0.5	1.8
Families and households				
Couple family with no children (%)	50.6	47.9	48.6	39.4
Families with children (%)	35.4	33.8	34.2	60.6
Total families	2,599	8511	11,110	1,221,148
Families with children and no parent employed (%)	17.6	23.2	21.9	13.8
Housing				
Total private dwellings	3,916	12,265	16,181	1,656,831
Separate houses (%)	91.1	91.9	91.7	76.6
Fully owned (%)	43.1	39.7	40.5	28.5
Rented (%)	27.6	28.6	28.3	34.2
Median weekly rental costs (3-bedroom house) ($)	245	260		370

Source: Information based on ABS data taken from Queensland Government Statistician's Office (2020), Queensland Regional Profiles: Resident profile for North and South Burnett LGAs.

Based on the 2016 Census of Population and Housing, 5.7 per cent of the regional population is identified as Indigenous, compared to 4.0 per cent for Queensland.

Education and qualification levels are lower than the rest of Queensland—50.5 per cent of residents have a qualification compared to 59.1 per cent for the rest of Queensland.

The Index of Relative Social Disadvantage showed that in the study region, 59.8 per cent of residents were classified as in the most disadvantaged quintile, compared to Queensland, where the number is 20 per cent.

A comparison between income and employment data for the study area and for Queensland (Table 7.4) shows that at the time of the 2016 Census, the study area had:

- lower median weekly incomes than in Queensland as a whole
- higher rates of unemployment than Queensland overall, though the unemployment rate in the North Burnett area was lower than Queensland overall.

Agriculture is the major employer in the study region.

Table 7.4: Employment and income

Characteristic	North Burnett	South Burnett	Study area	Queensland
Income				
Median weekly personal income ($)	501	478	483	660
Median weekly household income ($)	1159	1143	1147	1,402
Employment				
Total labour force	5211	13,297	18,508	2,693,713
Unemployment (%)	4.7	8.7	7.6	6.1
Main industries of employment (top 5)			Agriculture (15.7%) Pre-school and school Education (8.4%) Food product manufacturing (5.0%) Public administration (4.2% Other store -based retailing (4.0%)	Hospitals (except psychiatric hospital) (4.3%) Primary education (2.5%) Supermarket and grocery stores (2.4%) Cafes and restaurants (2.3%) Takeaway food services (2.0%)

Source: Information based on ABS data taken from Queensland Government Statistician's Office, Queensland Treasury (2020), Queensland Regional Profiles: Resident profile for North and South Burnett LGA's. ABS 2016 Census of Population and Housing, Census QuickStats Social infrastructure, transport and access

Within the study area, 50.3 per cent of registered businesses were classified within the agriculture, forestry and fishing category.

The study area is classified by the Australian Bureau of Statistics as inner regional Australia. Within the study area, there are 13 police stations, 10 ambulance stations, 13 fire stations, 44 schools and 11 hospitals. The majority of services are located in larger regional centres.

7.5 Impact identification

7.5.1 Property impacts

New irrigation and urban options

Construction of the storages, weirs and pipelines and other associated permanent infrastructure will require the acquisition of land and easements. Access routes will also necessitate land acquisition or access easements over freehold land. Any additional on-farm infrastructure required to store and use the water will be the responsibility of the individual landholder. Current landholders within the construction footprint will potentially be disadvantaged. This will be resolved through commercial negotiation between the affected landholders and the proponent. Farming enterprises with access to the additional water will be the greatest beneficiaries of the project. There may be impact on property values, due to amenity impacts from construction activities (e.g. noise, dust, traffic disruptions).

New water re-use option

The property impacts of the new water re-use option will be minor and mainly contained within the proponent's property.

Better use options

None of the better use options are expected to impact on existing property rights.

7.5.2 Housing and accommodation

New irrigation and urban options

During construction, demand for accommodation from the construction workforce is generally expected to be for both temporary accommodation, such as hotel and guest accommodation, and permanent accommodation, such as rental housing. The majority of construction sites are in commuting distance to existing townships. Significant accommodation for construction workers is available.

During operation of the project, increases in demand for housing and accommodation are expected as the demand for additional labour increases.

New water re-use option

The housing impacts of the new water re-use option will be minor and are mainly related to the construction phase of the project.

Better use options

None of the better use options are expected to have an impact on housing and accommodation.

7.5.3 Population and demography

New irrigation and urban options

The acquisition of property for the project under the suite of new irrigation and urban options is not expected to impact significantly on the study area's population or demography.

The influx of construction workers may result in a small increase in the population of the study area for the duration of the construction phase dependent on the option implemented. This will impact on community services and facilities in the study area, through increased demand for existing services (e.g. health care). Other local community facilities, such as sporting clubs, shops and community organisations, will benefit from an increased population during construction.

During operation, the project will provide opportunities to expand existing agricultural and horticultural businesses and develop new ones. This may provide new employment opportunities in the study area and help create diversity in employment opportunities.

New water re-use option

The potential population and demographic impacts of the new water re-use option are minimal.

Better use options

Better use options could provide a small population increase and improve water security for existing urban areas.

7.5.4 Employment and training

New irrigation and urban options

Construction workers could be sourced locally to maximise the employment benefits for local residents and communities in the study area. However, the availability of appropriately skilled and qualified workers may impact on the ability of workers to be sourced locally, and the level of benefit would be dependent on access to appropriate skilling and employment programs prior to construction. In order to maximise employment, an employment and training strategy will be considered to identify the skills required for construction as well as training needs to enable locals to gain the necessary skills.

Indirect employment opportunities are also likely to be created during construction through increased demand for goods and services. This would have positive benefits for local residents and workers.

The construction phase of the project is expected to provide a range of opportunities for local contractors and suppliers, which could have direct and indirect employment benefits for local residents.

Following construction, it is expected the infrastructure options would only require a small workforce for operation.

New water re-use option

The new water re-use option provides some opportunities for additional training and a potentially minor increase in employment.

Better use options

The better use options are expected to have an impact on employment and as agricultural output increases additional direct and indirect jobs are expected to be created.

7.5.5 Community services and facilities

New irrigation and urban options

An increase in population during the construction phase will increase demand for medical and health services, potentially impacting on service levels. Consultation will be undertaken with Queensland Health to ensure that potential increases in population and demand for medical and health services can be appropriately managed. It is expected that emergency services and hospitals will have capacity and capability to respond to most construction-related incidents and emergencies; however, consultation will be undertaken with the hospital and emergency services in the preparation of emergency response procedures.

An increase in the number of children relocating to the study area with construction workers will impact on childcare services and local schools, particularly smaller schools. Early consultation will be undertaken with Education Queensland, local schools and childcare providers to manage potential impacts.

Operation of the project is not expected to have an impact on community services and facilities.

New water re-use option

The new water reuse option is not expected to have an impact community services and facilities.

Better use options

The better use options are not expected to have an impact on community services and facilities in the study area.

7.5.6 Transport and access

New irrigation and urban options

The area is well serviced by road links that have been developed to support the extensive agricultural operations in the area.

Construction activities for the new build options may negatively impact on regional transport infrastructure with the scale of the impact dependent on the option under consideration.

New water re-use options

The new water re-use option is not expected to have an impact on transport and access in the study area.

Better use options

The better use option is not expected to have an impact on transport and access in the study area.

7.6 Impact assessment and mitigation

Table 7.5: Social impact risk assessment of new irrigation and urban options

Summary of social benefits and impacts	Project element	Nature of impact	Stakeholders	Significance rating	Can the impact be quantified or monetised?	Mitigation measures and strategies	Significance rating after mitigation
Community impacts							
Long-term increase in regional employment from expanded increases in agriculture and agricultural processing	Operation	Positive	Farmers, local community, labour market participants	Major	Yes	No mitigation required	Major
Additional demands on existing transport networks and electricity infrastructure in the irrigation area	Operation	Negative	Infrastructure providers	Medium	Yes	Inform relevant organisations of the proposed works program and schedule and engage as part of the planning process	Minor
Potential loss of areas of cultural significance during construction of infrastructure	Construction and operation	Negative	Traditional owners	Major	No	Consult with native title groups; undertake a cultural heritage survey and incorporate it in planning program; develop a cultural heritage management plan	Medium
Competition for skilled labour	Construction	Negative	Labour market	Medium	Yes	Undertake workforce skills gap analysis	Low
Urban water security supply (a number of options will add to the flexibility and resilience of urban water supply)	Operation	Positive	Urban consumers	Major	Yes	No mitigation required	Major
Additional demands on existing services during construction and operational phases	Construction and operation	Negative	Service providers	Medium	Yes	Inform relevant organisations of the proposed works program and schedule and engage as part of the planning process	Minor
Demand for worker housing during construction may impact on regional housing affordability and supply	Construction	Negative	Regional housing market	Medium	Yes	Undertake housing supply analysis and develop alternative housing arrangements if required	Minor
Cultural impacts							
Potential significant impacts on areas of cultural significance	Operation	Negative	Traditional owners	Major	No	Determine the significance of impacts as part of the approvals process and develop mitigation strategies	Major

Summary of social benefits and impacts	Project element	Nature of impact	Stakeholders	Significance rating	Can the impact be quantified or monetised?	Mitigation measures and strategies	Significance rating after mitigation
Opposition by regional, national and international groups to projects that further impact on regional waterways, which could undermine social cohesion	Construction and operation	Negative	Regional community	Major	No	Develop a detailed consultation and communication strategy	Major
Change in land use to higher value per hectare crops in suitable areas	Operation	Positive	Landowners	Medium	Yes	No mitigation required	Medium
Competition for new water sources and cost of water may drive social conflict	Operation	Negative	Regional community	Medium	No	Develop a detailed consultation and communication strategy	Minor
Temporary influx of construction workers impacting on community cohesion	Construction	Negative	Regional community	Medium	No	Develop a detailed consultation and communication strategy	Minor
Displacement of existing landholders and industry	Operation	Negative	Landholders	Minor	Yes	Develop a detailed consultation and communication strategy	Minor
Health impacts							
Additional noise and dust during construction	Construction	Negative	Landholders, residents	Medium	No	Minimise noise and dust as part of the construction plan	Minor
Lifestyle impacts							
Disruption of lifestyles during construction of infrastructure from additional traffic	Construction and operation	Negative	Landholders, residents	Medium	No	Develop a construction traffic management plan	Minor
Institutional and legal, political systems and equity impacts							
Higher demands on government departments and authorities for approvals and licences	Construction and operation	Negative	Government	Medium	Yes	Ensure adequate resources for the approvals process	Minor
Personal and property rights							
Potential impacts on areas from changes in flow regimes and impacts on groundwater tables	Construction and operation	Negative	Regional community	Major	No	Mitigate as part of environmental approvals	Medium
Acquisition of land through purchase or easement	Construction	Negative	Landholder	Major	Yes	Adequately compensate the landholder	Medium

Summary of social benefits and impacts	Project element	Nature of impact	Stakeholders	Significance rating	Can the impact be quantified or monetised?	Mitigation measures and strategies	Significance rating after mitigation
Impacts on current water licence holders	Construction and operation	Negative	Water license holders	Medium	Yes	Adequately compensate the water licence holders	Minor
Lifestyle impacts from construction, development of additional irrigation area and supporting infrastructure.	Construction and operation	Negative	Regional community	Medium	No	Develop a detailed consultation and communication strategy	Minor
Temporary impacts during construction on liveability (noise, dust)	Construction	Negative	Regional community	Medium	No	Mitigate as part of the approvals process	Minor
Restriction on land use within infrastructure area	Construction and operation	Negative	Landholder	Minor	Yes	Adequately compensate the landholder	Minor
Economic							
Increase in long-term regional agricultural production and employment	Construction and operation	Positive	Landholders, irrigators, local businesses	Major	Yes	No mitigation required	Major
Environmental							
Impacts on riparian zones and other vegetation areas impacting terrestrial and aquatic flora and fauna	Construction	Negative	Environmental groups, residents, recreationists	Major	No	Develop an environmental management plan	Major
Changes to surface and groundwater flows	Operation	Negative	Environmental groups, residents, recreationists	Major	No	Develop an environmental management plan	Major

Table 7.6: Social impact risk assessment of the new water re-use option

Summary of social benefits and impacts	Project element	Nature of impact	Stakeholders	Significance rating	Can the impact be quantified or monetised?	Mitigation measures and strategies	Significance rating after mitigation
Community impacts							
Minor increase in regional employment from new infrastructure and ongoing viability of Swickers	Operation	Positive	Labour market participants	Minor	Yes	No mitigation required	Minor
Additional demands on existing electricity infrastructure	Operation	Negative	Infrastructure providers	Minor	Yes	Inform relevant organisations of the proposed works program and schedule and engage as part of the planning process	Minor
Urban water security supply	Operation	Positive	Urban consumers	Medium	Yes	No mitigation required	Medium
Additional demands on existing services during construction and operational phases	Construction and operation	Negative	Service providers	Minor	Yes	Inform relevant organisations of the proposed works program and schedule and engage as part of the planning process	Minor
Cultural impacts							
Potential significant impacts on areas of cultural significance	Operation	Negative	Traditional owners	Major	No	Determine significance of impacts as part of the approvals process and develop mitigation strategies	Major
Opposition to project and use of recycled water	Construction and operation	Negative	Community	Minor	No	Develop detailed consultation and communication strategy	Minor
Health impacts							
Additional noise and dust during construction	Construction	Negative	Landholders, residents	Minor	No	Minimise noise and dust as part of the construction plan	Minor
Lifestyle impacts							
Disruption of lifestyles during construction of infrastructure from additional traffic	Construction and operation	Negative	Landholders, residents	Minor	No	Develop a construction traffic management plan	Minor
Institutional and legal, political systems and equity impacts							

Summary of social benefits and impacts	Project element	Nature of impact	Stakeholders	Significance rating	Can the impact be quantified or monetised?	Mitigation measures and strategies	Significance rating after mitigation
Higher demands on government departments and authorities for approvals and licences including those associated with recycled water use	Construction and operation	Negative	Government	Medium	Yes	Ensure adequate resources for the approvals process	Minor
Personal and property rights							
Temporary impacts during construction on liveability (noise, dust)	Construction	Negative	Regional community	Medium	No	Mitigate as part of the approvals process	Minor
Economic							
Increase in long-term regional employment	Construction and operation	Positive	Landholders, irrigators, local businesses	Minor	Yes	No mitigation required	Minor

Table 7.7: Social impact risk assessment of better use options

Summary of social benefits and impacts	Project element	Nature of impact	Stakeholders	Significance rating	Can the impact be quantified or monetised?	Mitigation measures and strategies	Significance rating after mitigation
Community impacts							
Long-term increase in regional employment from expanded increases in agricultural and agricultural processing.	Operation	Positive	Farmers, local community, labour market participants	Major	Yes	No mitigation required	Major
Urban water security supply	Operation	Positive	Urban consumers	Major	Yes	No mitigation required	Major
Impacts on electricity prices from shifting to higher-cost water supply for Tarong Power Station	Operation	Negative	Tarong, electricity consumers	Major	Yes	Undertake economic analysis	Major
Additional costs to urban water consumers in the Burnett region and other regions	Operation	Negative	Seqwater, Sunwater, regional councils, water consumers	Major	Yes	Undertake economic analysis	Major
Cultural impacts							
Opposition to project and use of recycled water by regional, national and international groups undermining social cohesion	Construction and operation	Negative	South East Queensland community	Major	No	Develop a detailed consultation and communication strategy	Major
Change in land use to higher value per hectare crops in suitable areas	Operation	Positive	Landowners	Medium	Yes	No mitigation required	Medium
Competition for new water sources and cost of water may drive social conflict	Operation	Negative	Regional community	Medium	No	Develop a detailed consultation and communication strategy	Minor
Institutional and legal, political systems and equity impacts							
Higher demands on government departments and authorities for approvals and licences	Construction and operation	Negative	Government	Medium	Yes	Ensure adequate resources for the approvals process	Minor
Economic							
Increase in long-term regional agricultural production and employment	Construction and operation	Positive	Landholders, irrigators, local businesses	Major	Yes	No mitigation required	Major

7.7 Conclusion

An assessment of potential social impacts associated with the options was undertaken. Possible mitigation measures were also identified to minimise potential social impacts.

The baseline assessment showed that the region is disadvantaged and has low population growth and wages. The agricultural sector is by far the largest employer. Wages and education levels are lower than the rest of Queensland.

The greatest social impacts are associated with the new build options. Dependent on the individual project within the category they can stimulate construction and agricultural activity in the region. Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries. New build project can also provide the greatest potential for negative social outcomes, mainly through their impacts on existing property rights, cultural heritage, lifestyle and the environment.

The new build water re-use option at Swickers will have minor social impacts. It may potentially increase regional employment and provide certainty for urban water supply.

The better use projects associated with changing water supply options at Tarong Power Station can have potentially positive and negative social impacts. The options will result in more water available for irrigation and urban water supply in the Burnett study area and associated employment benefits. This will have to be balanced against the negative social impacts of potentially higher electricity and water prices for consumers.

8. Environmental assessment

This environmental assessment examines the potential environmental impact, including specific actions needed to meet all relevant policy, regulatory and legislative requirements, and any likely community concerns. This ensures that the potential environmental impacts of all options are clearly accounted for in the options analysis and decision-making process.

Most of the material below was sourced directly from previous studies and is directly quoted. No additional onsite studies have been undertaken, and some of the quoted material may be superseded by the studies undertaken in a detailed business case.

The key documents that informed this assessment include:

- *Soils of the Riparian Lands of the Burnett River between Mundubbera and Gayndah*, Queensland, 1996
- *Review for Lower Barambah / Coalstoun Lakes Irrigation Scheme*, 2015
- *Agricultural Land Resource Assessment of Coalstoun Lakes*, 2000
- Sunwater letter of 5 June 2017 to Boyne River Irrigation Advisory Committee
- *Gayndah Regional Irrigation Development (GRID) Project*, Detailed Business Case, 2018
- *Barlil Weir Draft Environmental Management Plan*, 2001
- *Burnett Basin Resource Operations Plan: Amendment to include groundwater*, 2014
- *Current Environmental Conditions and Impacts of Existing Water Resource Development*, 2000
- *Burnett Basin water resource plan amendment coastal Burnett groundwater project groundwater dependent ecosystem assessment*, 2005
- *Burnett Basin WAMP Proposed Environmental Flow Performance Measures*, 2000
- *Initial Advice Statement Jones Weir Stage 2*, 1998
- *Review of Water Resource (Burnett Basin) Plan 2000 and Resource Operations Plan*
- A *study of the impact of the development of the proposed Jones, Barlil, Cooranga and Bucca Weirs*, 1999.

The primary purpose of this assessment is to identify whether there are any environmental issues that could affect the selection of preferred options. It provides an overview of relevant legislation and regulation that relate to all of the infrastructure solutions. It also provides an overview of each of the short-listed infrastructure options.

8.1 Legislative overview

A number of legislative instruments need to be taken into account in the environmental assessment phase. A summary of the instruments is shown below.

Legislation	Description
Environment Protection and Biodiversity Conservation Act 1999	The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage place —defined in the EPBC Act as matters of national environmental significance.
Native Title Act 1993	This Act is designed to provide a national system for the recognition and protection of native title and for its co-existence with the national land management system.
Aboriginal Cultural Heritage Act 2003	The main purpose of this Act is to provide effective recognition, protection and conservation of Aboriginal cultural heritage. The following fundamental principles underlie the Act's main purpose: ▪ The recognition, protection and conservation of Aboriginal cultural heritage should be based on respect for Aboriginal knowledge, culture and traditional practices.

Legislation	Description
	▪ Aboriginal people should be recognised as the primary guardians, keepers and knowledge holders of Aboriginal cultural heritage. ▪ It is important to respect, preserve and maintain knowledge, innovations and practices of Aboriginal communities and to promote understanding of Aboriginal cultural heritage. ▪ Activities involved in recognition, protection and conservation of Aboriginal cultural heritage are important because they allow Aboriginal people to reaffirm their obligations to 'law and country'. ▪ There is a need to establish timely and efficient processes for the management of activities that may harm Aboriginal cultural heritage.
Environmental Offsets Act 2014	The main purpose of this Act is to counterbalance the significant residual impacts of particular activities on prescribed environmental matters through the use of environmental offsets. (2) The main purpose is achieved primarily by (a) establishing a framework for environmental offsets; (b) recognising the level of protection given to prescribed environmental matters under other legislation; (c) providing for national, State and local matters of environmental significance to be prescribed environmental matters for the purpose of this Act; and (d) coordinating the implementation of the framework in conjunction with other legislation.
Environmental Protection Act 1994	The object of this Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends
Fisheries Act 1994	The main purpose of this Act is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to: ▪ apply and balance the principles of ecologically sustainable development ▪ promote ecologically sustainable development. In balancing the principles, each principle is to be given the relative emphasis appropriate in the circumstances, having regard to ensuring access to the fisheries resources is allocated in a way that maximises the potential economic, social and cultural benefits to the community.
Nature Conservation Act 1992	The object of this Act is the conservation of nature while allowing for the involvement of indigenous people in the management of protected areas in which they have an interest under Aboriginal tradition or Island custom.
Regional Planning Interests Act 2014	The purposes of this Act are to (a) identify areas of Queensland that are of regional interest because they contribute, or are likely to contribute, to Queensland's economic, social and environmental prosperity; and (b) give effect to the policies about matters of State interest stated in regional plans; and (c) manage, including in ways identified in regional plans— (i) the impact of resource activities and other regulated activities on areas of regional interest; and (ii) the coexistence, in areas of regional interest, of resource activities and other regulated activities with other activities, including, for example, highly productive agricultural activities. To achieve its purposes, this Act provides for a transparent and accountable process for the impact of proposed resource activities and regulated activities on areas of regional interest to be assessed and managed.
Queensland Heritage Act 1992	The object of this Act is to provide for the conservation of Queensland's cultural heritage for the benefit of the community and future generations. The object is to be primarily achieved by: ▪ establishing the Queensland Heritage Council ▪ keeping a register of places and areas of State cultural heritage significance called the Queensland heritage register ▪ requiring the reporting of the discovery of archaeological artefacts and underwater cultural heritage artefacts ▪ providing for the identification and management of places of local cultural heritage significance by local governments ▪ regulating, in conjunction with other legislation, development affecting the cultural heritage significance of Queensland heritage places ▪ providing for heritage agreements to encourage appropriate management of Queensland heritage places ▪ providing for appropriate enforcement powers to help protect Queensland's cultural heritage
State Development and Public Works Organisation Act 1971	The SDPWO Act facilitates timely, coordinated and environmentally responsible infrastructure planning and development to support Queensland's economic and social progress.
Planning Act 2016	The purpose of this Act is to establish an efficient, effective, transparent, integrated, coordinated, and accountable system of land use planning (planning), development assessment and related matters that facilitates the achievement of ecological sustainability.

Legislation	Description
Vegetation Management Act 1999	The purpose of this Act is to regulate the clearing of vegetation in a way that: ▪ conserves remnant vegetation that is 1) an endangered regional ecosystem 2) an of concern regional ecosystem 3) at least concern regional ecosystem ▪ conserves vegetation in declared areas ▪ ensures the clearing does not cause land degradation ▪ prevents the loss of biodiversity ▪ maintains ecological processes ▪ manages the environmental effects of the clearing ▪ reduces greenhouse gas emissions ▪ allows for sustainable land use.
Water Act 2000	The main purposes of this Act are to provide a framework for the following: ▪ the sustainable management of Queensland's water resources and quarry material by establishing a system for (i) the planning, allocation and use of water (ii) the allocation of quarry material and riverine protection ▪ the sustainable and secure water supply and demand management for the south-east Queensland region and other designated regions ▪ the management of impacts on underground water caused by the exercise of underground water rights by the resource sector ▪ the effective operation of water authorities.

8.2 Climate change overview

The forecast impact of climate change has been considered for both council areas. Relevant to agriculture, more extremes of climate and changes in rainfall variability could decrease crop production, forage production, surface cover, livestock carrying capacity and animal production, and cause major changes in plant and animal species composition. Livestock may be exposed to a greater risk of heat stress in some regions. Lower rainfall and increasing evaporation will cause more frequent depletion of soil moisture, reduced ground cover and lower livestock carrying capacity. Conditions may increase plant diseases, weeds and pests. Warmer conditions would allow some pest species to move southwards into areas where they are currently excluded.

Figure 8.1 shows the climate risks, impacts and responses relevant to Queensland.

Figure 8.2 to Figure 8.4 outline the forecast temperature, rainfall and evaporation. The impact is very similar for both areas, as follows:

- The mean temperature is forecast to increase by approximately 0.5 degree per decade.
- The average precipitation is forecast to fall slightly.
- Evaporation is forecast to increase by 1.5 mm per day by 2090.

Climate change projections predict an increase in evaporation across the water plan area, as well as a small decrease in rainfall mainly during the spring months and a small increase in rainfall mainly during the autumn months.[23] It is assumed, however, that the potential negative impacts of climate change on agricultural production can be offset through improvements in the efficiency of on-farm practices and water trading.

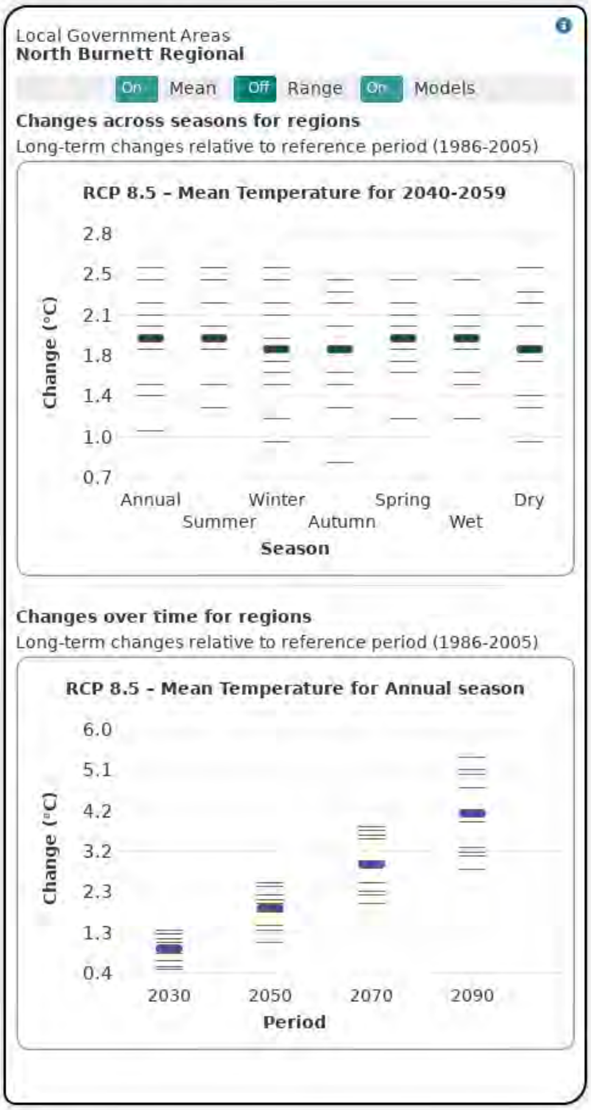
[23] DNRME, *Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014*, Water Policy and Water Services (South Region), November 2019.

Figure 8.1: Climate risks, impacts and responses

Sector	Climate risks* ↑ = increase, ↓ = decrease	Impacts*	Potential responses*
	↑ heatwaves ↑ fire weather ↑ inundation and flooding ↑ tropical cyclone intensity ↑ sea level	• Erosion and infrastructure damage along the coastline • Increased maintenance costs • Increased disruption to services • Increased energy and water usage	• Consider future climate and sea-level rise when locating and constructing new developments and infrastructure • Increase road heights • Insure public assets • Design buildings to accommodate changing climate
	↑ temperature ↑ heatwaves ↑ fire weather ↑ tropical cyclone intensity ↑ sea level	• Increased threats to tourism infrastructure • Damage to popular environmental sites • Risks to tourists unfamiliar with conditions	• Consider climate risks in emergency planning for tourist sites • Adopt appropriate cancellation policies for extreme weather • Prepare for changing seasonal demand
	↑ heatwaves ↑ fire weather ↑ rainfall intensity ↑ inundation and flooding ↑ tropical cyclone intensity ↑ sea level ↑ sea temperature	• Disruption to supply chains • Disruption to workplaces and infrastructure • Loss of customers during emergency recovery • Increased flood damage • Increased maintenance costs • Increased disruption to water supplies	• Business continuity planning • Shift critical infrastructure out of hazard zones • Enable flexible working arrangements • Diversify customer base and products • Consider future climate and sea-level rise when locating and constructing new infrastructure • Insure critical assets • Implement water management planning
	↑ heatwaves ↑ fire weather ↑ flooding ↑ sea level	• Damage to cultural sites • Loss of significant ecosystems	• Identify cultural sites at risk and mitigate impacts • Review and document cultural practices • Increase cultural activities and ceremonies to transfer knowledge
	↑ temperature ↑ hot days ↑ heatwaves ↑ fire weather ↑ drought risk ↓ rainfall ↑ tropical cyclone intensity ↑ sea temperature	• Changed distribution of pests and diseases • Heat stress on livestock and crops • Farms affected by bushfire • Reduced water security • Crops destroyed by cyclones • Increased heat stress	• Consider diversifying outputs or business • Employ strategies to minimise heat stress on livestock • Consider different crop varieties and sowing times • Improve water efficiency
	↑ temperature ↑ hot days ↑ fire weather ↑ drought risk ↓ rainfall ↑ tropical cyclone intensity ↑ sea level ↑ sea temperature ↑ ocean acidification	• Changes to habitat • Altered disturbance regimes • Changing dynamics of invasive species • Cyclone and storm tide inundation damage to landscapes and natural systems • Coral bleaching • Existing threats to flora and fauna are exacerbated	• Develop strategies to respond to new and emerging diseases and pests • Increase green urban infrastructure and urban biodiversity • Link habitats to allow species to move • Consider moving selected populations to new areas
	↑ heatwaves ↑ fire weather ↑ flooding ↑ tropical cyclone intensity	• More stress on health and emergency services • More heat-related deaths, particularly among the elderly and disadvantaged • Mental health effects • Changes in disease occurrence	• Use existing social networks to support vulnerable community members • Implement rural mental health care programs • Consider climate risks when developing emergency planning for schools, hospitals, services • Increase green spaces and cool zones for heat stress
	↑ heatwaves ↑ fire weather ↑ rainfall intensity ↑ inundation and flooding ↑ tropical cyclone intensity	• Increased fire season duration and fire intensity will affect urban fringe communities • Increased sea level and storm intensity will affect coastal communities and increase inland flooding risk	• Improve bushfire safety standards for urban development • Increase focus on community preparedness and prevention • Update risk management standards to account for increased risk from climate change

Source: Department of Environment and Science, Climate change in Queensland, Version 1, Queensland Government, 2019.

Figure 8.2: Mean temperature forecasts



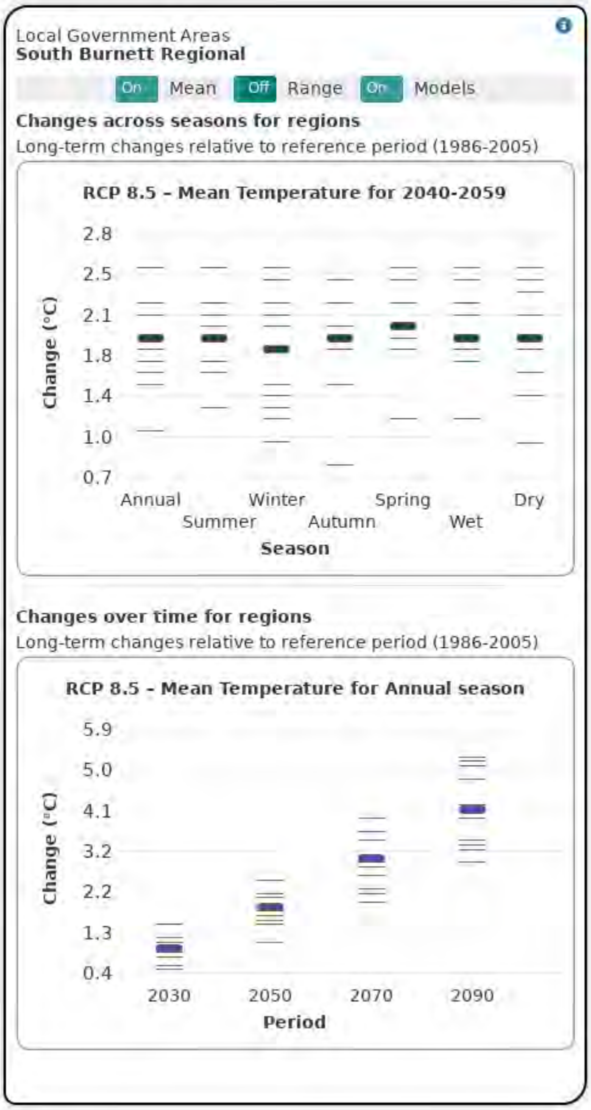


Figure 8.3: Precipitation forecasts

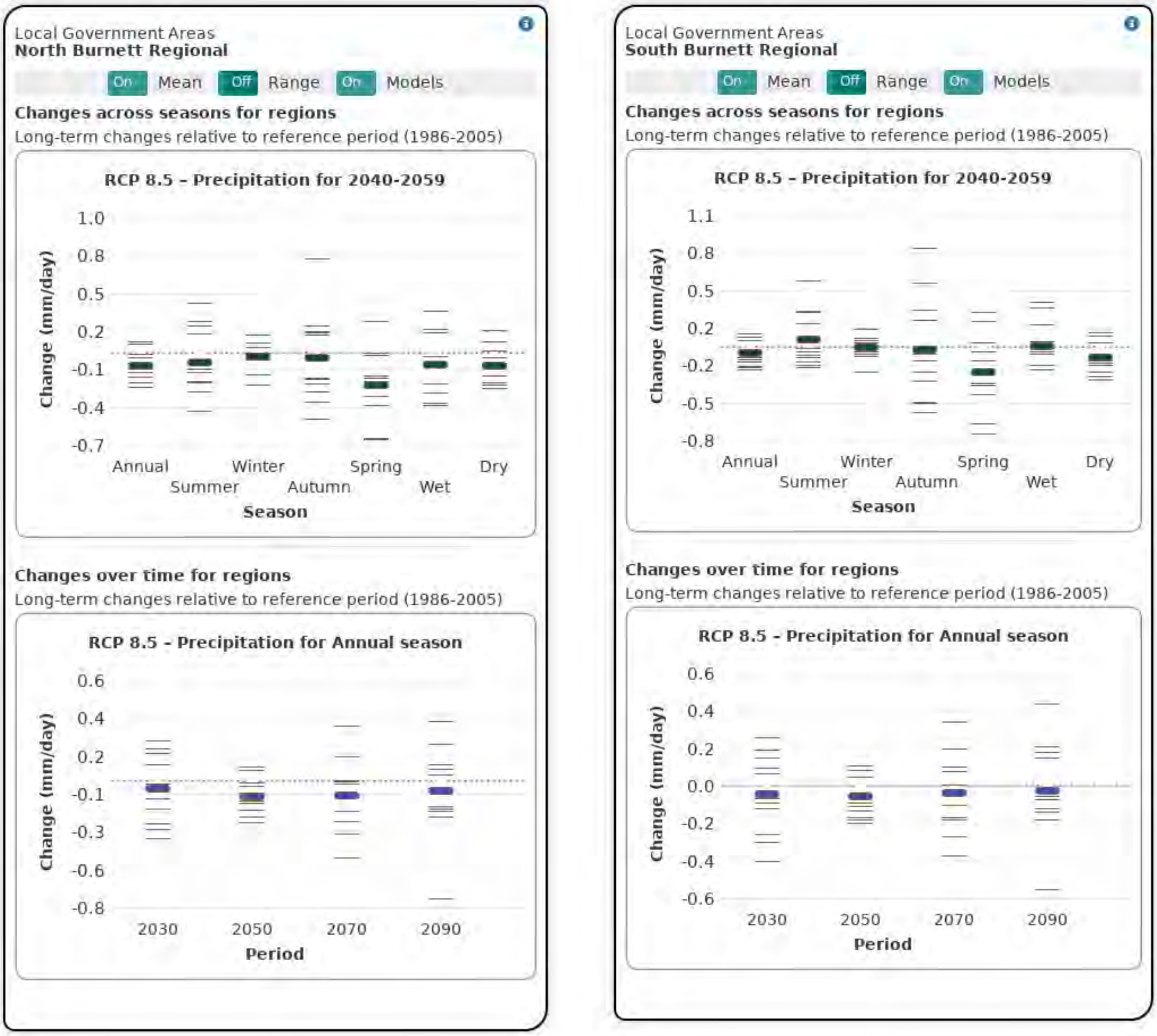
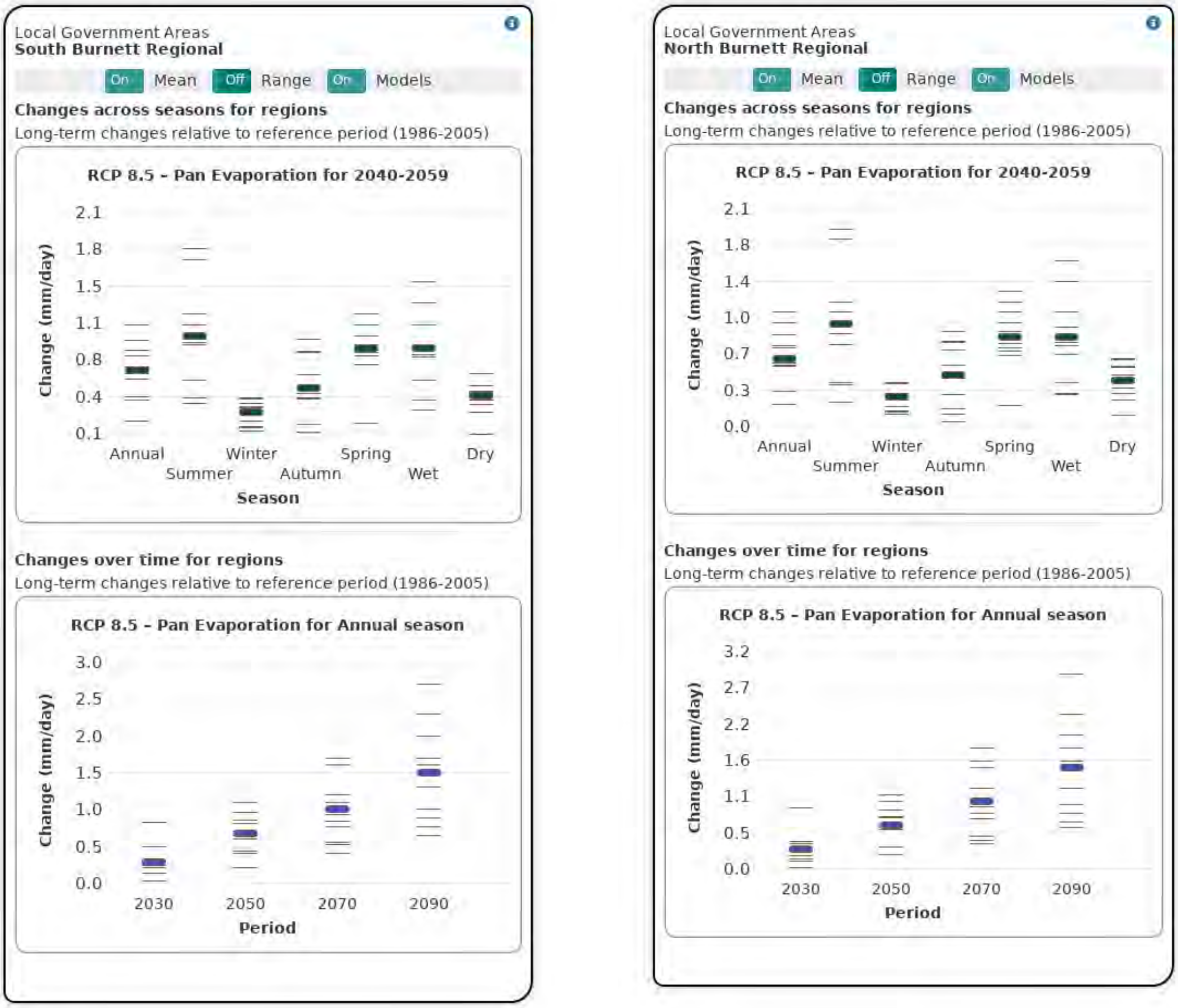


Figure 8.4: Evaporation forecasts



8.3 Option 1: Construct a re-regulating weir on the Boyne River

The Boyne River ecological environment will inevitably be impacted by the construction of the re-regulating weir. At this stage there has not been a comprehensive assessment of the environmental impacts of a weir on the area and various species in and around the Boyne River. Despite this, Sunwater has identified that the Queensland lungfish is present in the Boyne River and is found at the base of Boondooma Dam. Sunwater suggested that the proposed site at river location 34.45 AMTD would be the upper limit of the lungfish distribution. Suitable habitat for the lungfish may exist at other prospective sites on this river system.

This aquatic species is a nationally threatened species under the *Environment Protection and Biodiversity Conservation* Act 1999 (Cth) (EPBC Act). If the project is likely to have a significant impact on the species, the project muse be referred to the Commonwealth Environment Minister for a decision as to whether further assessment and approval of the project is required. Based on the potential impact on the lungfish as well as other environmental impacts, the project would likely require a comprehensive environmental impact assessment. Depending on the approvals pathway decided for the project, the environmental impact assessment could be assessed under the *Environmental Protection Act 1994* (Qld) or the *State Development Public Works Organisation Act 1971* (Qld). The bilateral agreement between the Commonwealth and Queensland governments would allow for the Commonwealth's assessment to be coordinated with the environmental impact assessment under Queensland legislation. The estimated timeframe for the completion of an environmental impact assessment, if one is required, is up to two years, subject to the level of assessment required.

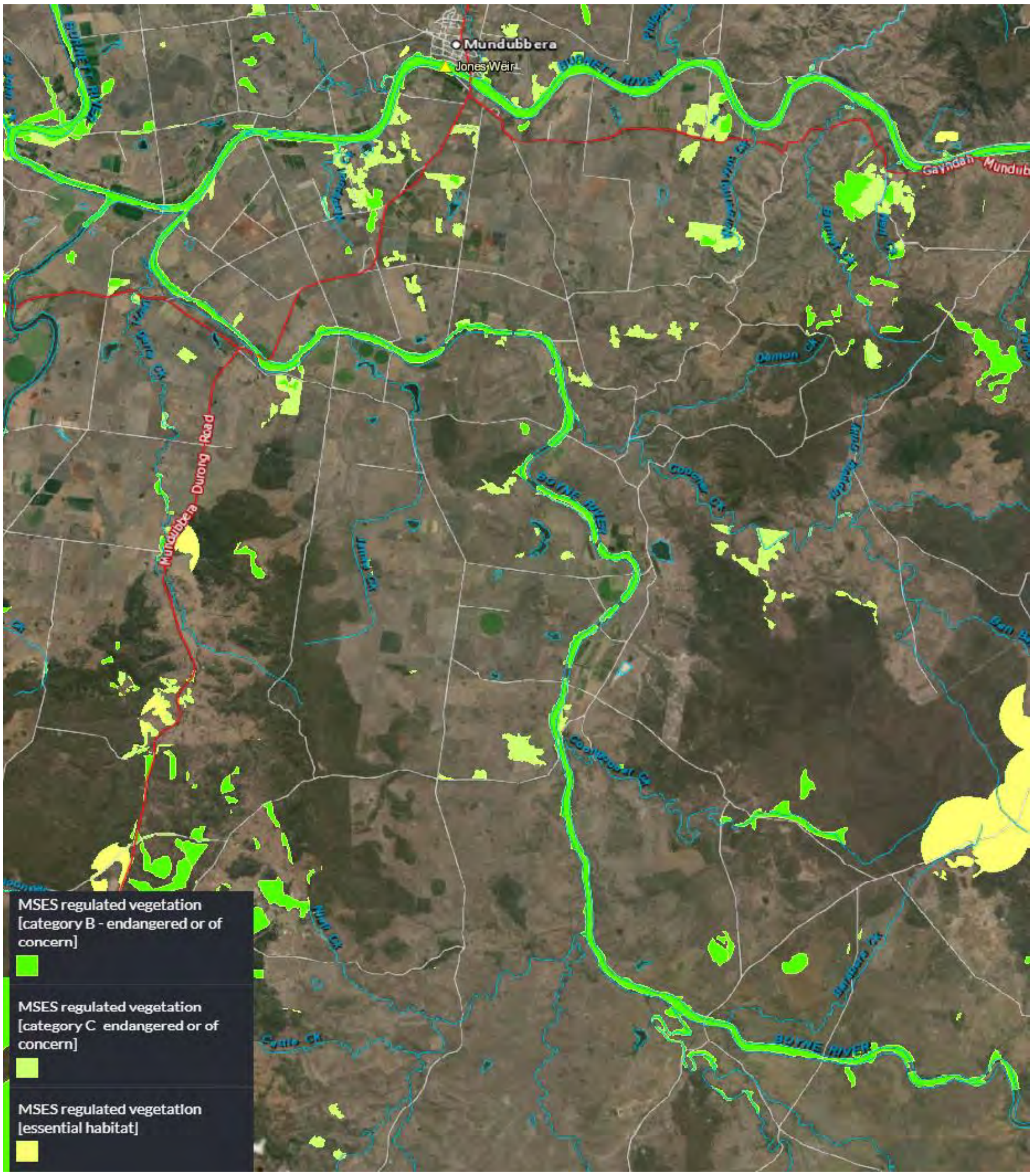


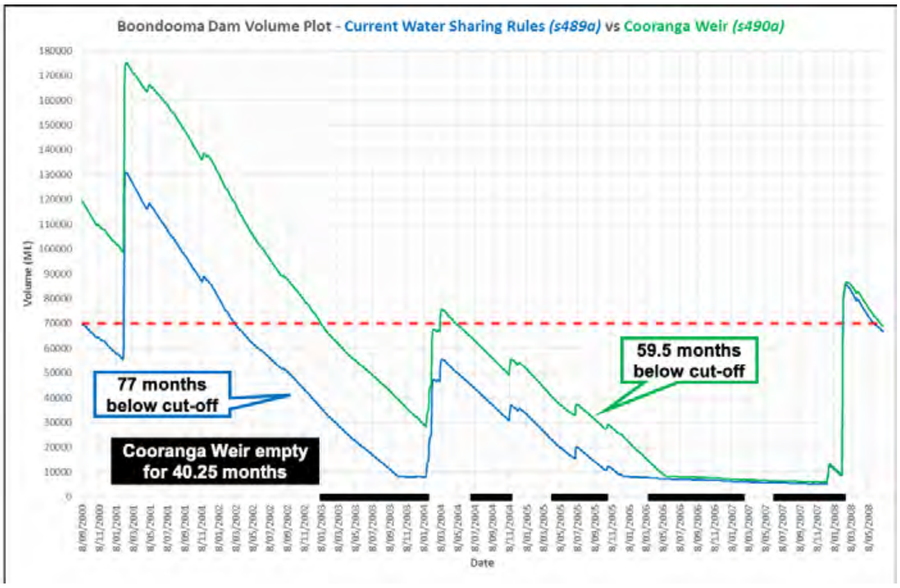
Table 8.1: Construct a re-regulating weir on the Boyne River

<table>
<tr><th>Aspect</th><th>Considerations</th></tr>
<tr><td>Property impacts</td><td>A small number of property holders will be directly impacted. Two landholders would be impacted by construction (one on each side of the river). The limit of storage would be at about AMTD 42.5, some 8.5 km upstream of the structure. The inundation area would impact a further six properties.</td></tr>
<tr><td>Topography , geology and soils</td><td>There are significant variations in the susceptibility of the Boyne River to geomorphological adjustments in response to flow regime change. The bedrock gorge reach below the dam is relatively resistant to change, while the sand and gravel-bed sections above and below the gorge are more capable of rapid adjustment. In these latter areas, the high flow channel of the river featured a defined low flow channel bordered by sand and gravel bars prior to regulation. The bars have become colonised by terrestrial vegetation, including grasses, shrubs and trees, due to the reduced frequency of large floods capable of scouring out such vegetation as well as increased moisture availability in the bed sands due to the elevated and more sustained baseflows.</td></tr>
<tr><td>Water quality</td><td>Lake Boondooma has been classified as strongly stratified and is subject to frequent blue-green algal blooms. The dam has a multi-level offtake, enabling releases of relatively good quality water from above the hypolimnion. The releases have relatively high conductivity compared to streamflows in other parts of the Burnett catchment (700–2,000 ms/cm, depending on flow), as well as relatively high concentrations of iron, copper, aluminium and zinc. These water quality characteristics may be due to natural geological factors, although elevated concentrations of metals can occur as a result of hypolimnetic releases. Hypolimnetic releases could still occur here, despite the multi-level offtake, depending on how it is operated.</td></tr>
<tr><td>Hydrology</td><td>It takes 5 to 10 days for water released from Boondooma Dam to reach the BRIA irrigators; the geographic conditions, including the porous sandy riverbed, result in a distribution loss of 18% of irrigation allocation.

The construction of a re-regulating weir downstream of Boondooma Dam would reduce distribution loss by locating water storage closer to the BRIA irrigators and capturing additional inflows downstream of Boondooma Dam. The effect would be to reduce the volume and frequency of releases to downstream irrigators from Boondooma Dam, reduce the time for releases to reach Boyne River irrigators to 2–3 days and increase the efficiency of the Boyne River and Tarong Water Scheme.

Non-BRIA medium priority allocation holders in the Boyne River and Tarong Water Scheme would benefit from the reduced demand from BRIA irrigators for medium priority allocations from Boondooma Dam. DNRME modelling found that the monthly performance of high priority would increase by 3% and medium priority by 11%. This suggests that further optimisation of this option may enable a configuration that achieves a higher than 11% increase in medium priority reliability if the current high priority reliability were to be maintained (rather than improved by 3%). This would require further modelling.

Sunwater modelling found that the construction of the weir would significantly reduce the frequency and the length of periods where Boondooma Dam is below the medium priority allocation cut-off. For example, the graph below shows that in the period of 2000 to 2008, a weir on the Boyne River would lead to 17.5 fewer weeks below the cut-off.

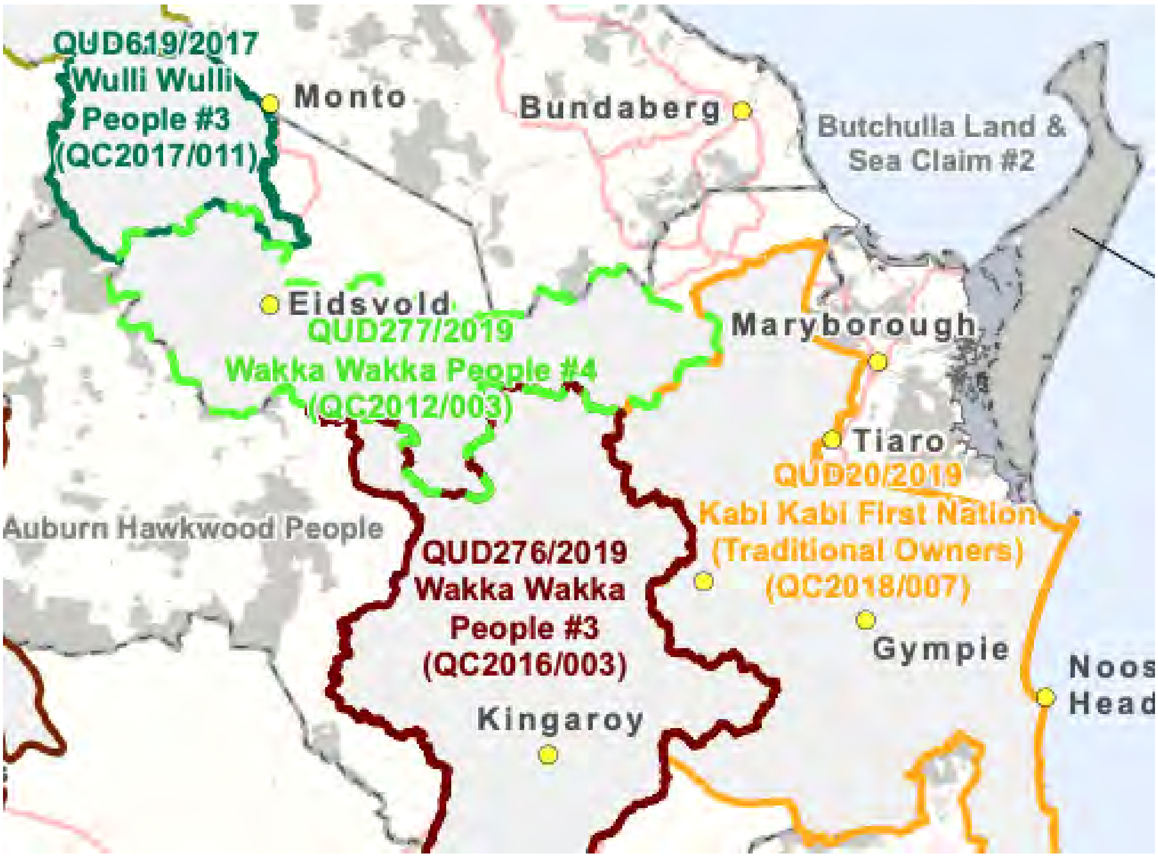


Sources: Irrigation from the Boyne River: The Value of Improved Water Security, 2019; State Water Projects Planning Report, 1998; Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017; Planning Report for Cooranga Weir,</td></tr>
</table>

Aspect	Considerations
	1998; Irrigation from the Boyne River: The Value of Improved Water Security, 2019; *DNRME presentation on Boyne River, August 2018.*
Flora and fauna	The Boyne River corridor contains extensive areas of regulated vegetation under the Vegetation Management Act 1999. Dense macrophyte beds have become established on many riffles. Factors which have enabled the establishment of the macrophyte beds include the elevated and more sustained baseflows, which provide suitable depth and velocity conditions, and reduction in the frequency of floods capable of scouring the macrophyte beds. The macrophyte beds have geomorphological implications including reduction in substrate mobility and likely accumulation of fine sediments within stands of submerged plants. Fine sediment accumulation has been observed in similar macrophyte beds in the regulated reach of the Brisbane River downstream of Wivenhoe Dam (Brizga 1998). Macroinvertebrate monitoring data indicate that regulated sites on the Boyne River downstream of Boondooma Dam differ from sites further upstream in the Boyne catchment in terms of trophic structure of macroinvertebrate communities, with filter feeders and grazers favoured in the regulated areas. The more sustained baseflows have made conditions more conducive for filter feeders, which require relatively high flow velocities. The grazers are likely to be favoured by algal growth, which may be a response to increased nutrients resulting from agricultural runoff. There has been a loss of seasonal variation in the macroinvertebrate communities which can be related to the more constant flow regime. The fish fauna of the Boyne River have been affected by flow regulation and associated changes in aquatic habitat—for example, the dense macrophyte beds (which include Vallisneria) provide good spawning habitat for lungfish, which is protected under the Queensland Fish and Oyster Act of 1914. Barriers to movement and altered flow regimens downstream of dams for irrigation purposes could lead to the disruption of existing population structure and cause even more loss of genetic variation. Changes in aquatic macroinvertebrates are also relevant, as fish that are able to successfully forage on the altered food source may be favoured. The elevated baseflows may have detrimental effects on fish larvae, if relatively high-flow velocities occur in nursery areas during the spawning season. Fish survey data indicate that the Boyne River does not have the full complement of species that would be expected, and this is at least partly due to the barrier effects of Boondooma Dam and weirs on the Burnett River further downstream. The reduction in high flows resulting from Boondooma Dam may be affecting recruitment from the Burnett River into the Boyne by leading to a loss of cues. Fish strandings have very occasionally occurred downstream of Boondooma Dam due to rapid reductions in releases. Potentially, poor water quality from hypolimnetic releases may affect fish. Changes in populations of turtles, frogs, waterbirds and platypus can be expected to have occurred in response to the flow regime changes, and associated changes in habitats and instream biota. The reach regulated by Boondooma Dam supports only one species of turtle, the generalist *E. krefftii.* The ecological adaptations to the more constant baseflows that prevail in most years mean that the prolonged dry spells that occur when no flows are released are likely to have greater impacts than would have been the case naturally. Extended periods of zero flow can lead to poor water quality in remaining refuge habitats, and/or habitat desiccation, possibly leading to loss of fish species, or at least temporary declines in fish abundances. Dry spells would have occurred in the natural regime, but the ecosystems would then have been more conditioned to intermittent flows. The clearing of regulated vegetation will require approval. Additionally, the vegetation clearing may also be valued as habitat for protected fauna species and may trigger the need for approval to tamper with an animal breeding place.
Noise and vibration	It is possible that noise may impact a very small number of neighbouring dwellings during construction. No ongoing operational impacts from noise are expected. Noise impacts during construction could be mitigated by operating within the hours of 7 am to 6 pm.
Landscape and visual amenity	The construction of a weir is not expected to create adverse visual and landscape impacts. It will only be visible from private property.
Cultural heritage[24]	**Vegetation** The vegetation along the river margins is thick; Callistemon sp and blue gum are growing within a dense cover of high grass. The largest blue gums generally are found on the slopes away from the rivers. The slopes along all the margins are steep and high. **Visibility** Surface visibility is less than 5%. The watercourse is densely vegetated with large Callistemon sp and other shrubs covering the point bars and the banks. Many trees have a dense vine growth, which covers the trunks. **Method**

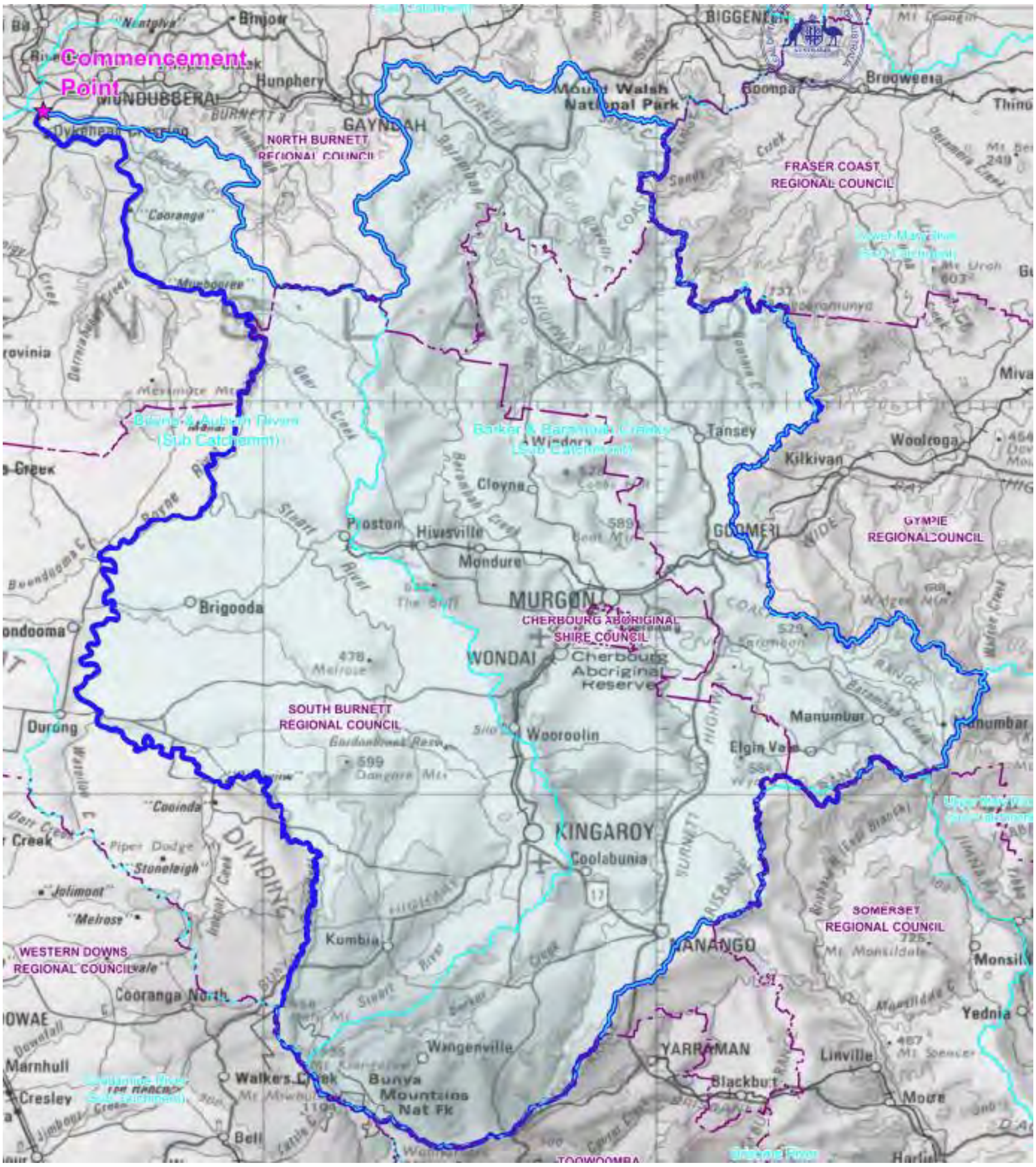
[24] Extract from The Burnett Weirs Study, 1999

Aspect	Considerations
	Survey was by foot, as the Boyne River levels were not sufficient for boat access. The weir location on Cooranga was inspected and the eastern (right—when looking downstream) bank was surveyed on foot to the road bridge for approximately 5 km. All rock exposures at the weir location and in the creek bed where it could be accessed were inspected. All large trees within the inundation area were inspected. Beth Zillman of 'Ben Venue' gave permission to access the left bank upstream of the road. A distance of approximately 4 km was driven and spot checks were made on foot. **Results** No sites were located. The larger trees along the watercourse have been logged and it is likely that scarred trees have not survived. Artefact scatters were expected to occur on the higher banks and slopes. These areas lay outside the inundation area in private property and were not inspected. The higher banks of gullies entering the inundation area were inspected but no artefacts were located.
Native Title	The location of the proposed weir on the Boyne River is likely to be within the area of Native Title Application QC2016/003 Wakka Wakka People #3. Figure 2-01 shows the location of the Native Title Claim within the study area, and Figure 2-02 shows the native title application area, which includes the likely location for the weir on the Boyne River. This application was filed with the Federal Court on 3 May 2019 and is currently before the court for consideration. It is possible, although unlikely, that the location of the proposed weir could move north and ultimately be located within the area of native title application QC2012/003 Wakka Wakka People #4. **Map of native title applications and determinations in the study area**



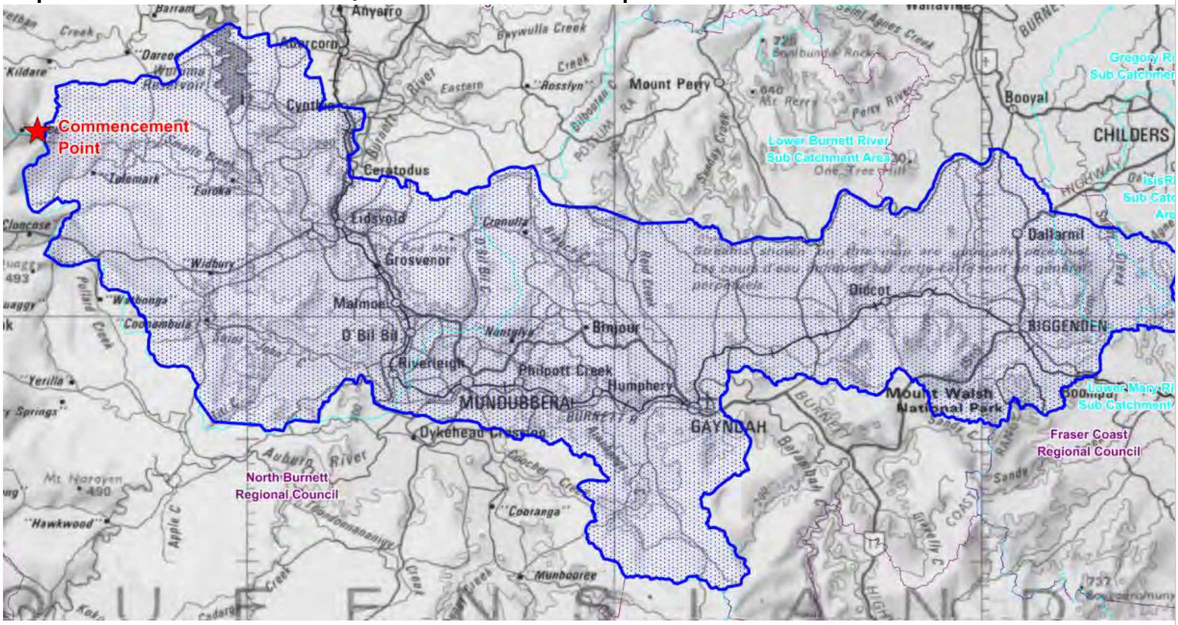
Source: Native Title Tribunal, March 2020.

Extract of map showing external boundaries of claim area



Source: Native Title Application QC2016/003.

Aspect	Considerations
	Map of claimant area for QUD91/2012 Wakka Wakka People #4



Source: Native Title Application QUD91/2012

8.4 Option 4I: Raise Jones Weir, raise Claude Wharton Weir, build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme

This option is a combination of raising Jones Weir, Claude Wharton Weir, and new Burnett River weir and irrigation network at Coalstoun Lakes.

8.4.1 Raising Jones Weir

This raising of Jones Weir has been subject to an earlier environmental review and has been approved by the Commonwealth Government, subject to the satisfaction of conditions designed to mitigate any likely determined impacts of the expanded infrastructure. The Department of Natural Resources commissioned a review of environmental factors in 1998. This review identified the environmental impacts of this option and proposed mitigation actions for the planning and construction. An Environmental Management Plan was prepared for this option, which covered predevelopment, construction and operational phases. The Queensland Government provided certification that the proposal had been assessed to the greatest extent possible. Commonwealth Government approval under the EPBC Act was granted in 2001.

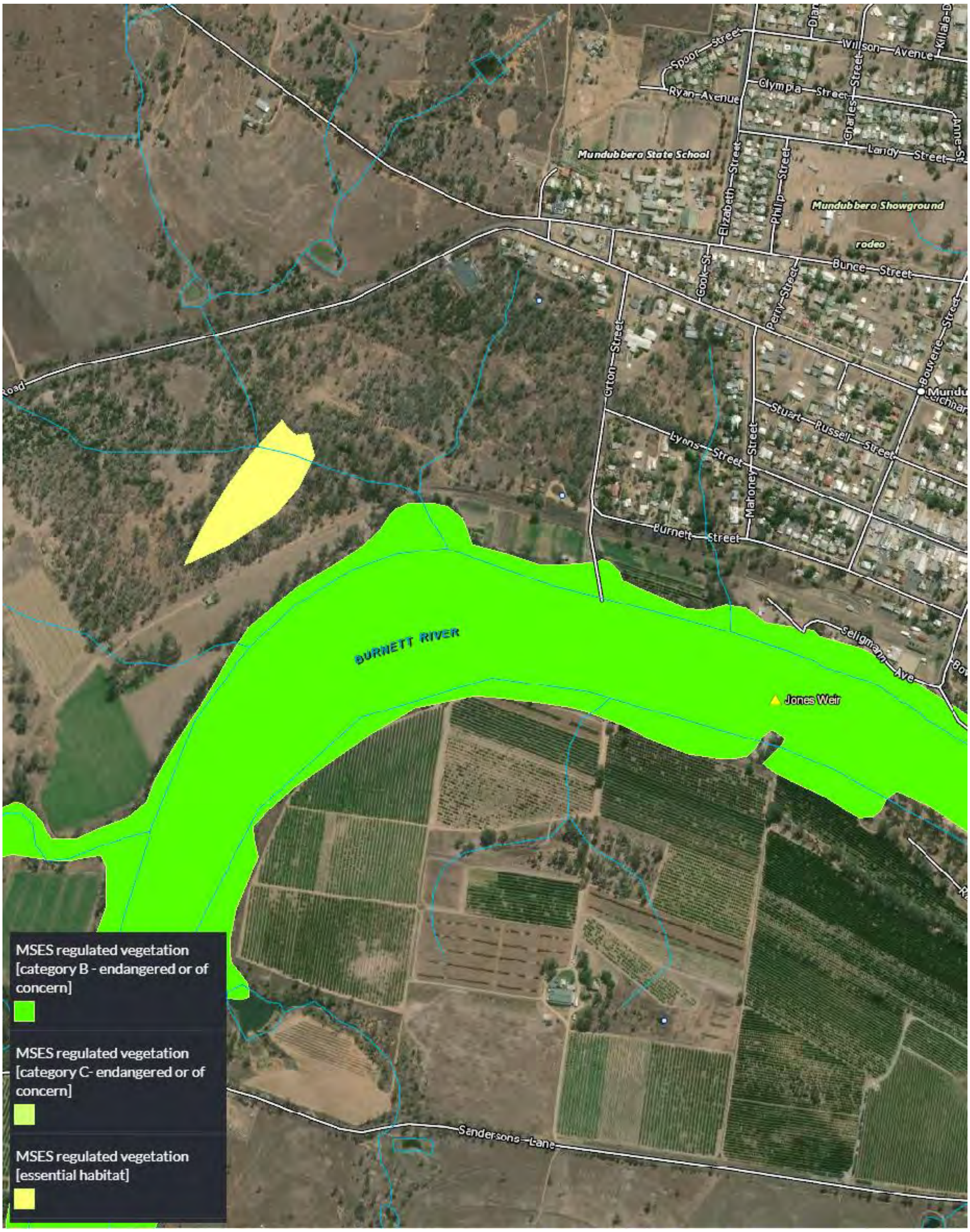


Table 8.2: Jones Weir

Aspect	Considerations
Property impacts	Inundated area will increase by about 55 ha. The new upstream limit of storage will be about AMTD 256 km on the Burnett River, about 2.4 km on the Boyne River and 4 km on the Auburn River.
Topography, geology and soils	The area immediately surrounding Jones Weir mostly consists of level, gently undulating alluvial plains. The alluvial material varies from sand to heavy clays with extensive areas of well drained soils adjacent to the rivers. Alluvial areas downstream of Jones Weir to Gayndah and are quite narrow in some areas. Away from the rivers, the alluvial plains give way to undulating rises to low hills. The main rock types on these rises and hills are sandstone, mudstones and other sediments.

<table>
<tr><th>Aspect</th><th>Considerations</th></tr>
<tr><td>Water quality</td><td>Monitoring River Health Initiative methods have been used to survey macroinvertebrates and water quality at four sites in the vicinity of Jones Weir and the data have been made available. The data provides a general indication of the ecological condition of the area.

The four sites were sampled only once in May 1997, so the assessed conditions are only a snapshot, taking no account of temporal variation. Assessment of such variations would require time series sampling and analysis. Two of the sites sampled (136013A and 136318A) are within or just upstream of the proposed new limit of storage.

All four sampling sites generally gentle slopes, grassy edges, moderate channel stability and an abundance of instream macrophytes.

Site 13601313 (Burnett River at Marriage's) is about 10 km upstream of Jones Weir and is just downstream of a small stream gauging weir. There was good riparian vegetation. The banks were grazed and land use adjacent to the river included rainfed and irrigated cropping. Overall, channel stability and instream habitat were assessed as moderate, with good macroinvertebrate populations.

Overall, water quality was assessed as moderate.

The primary implications for water quality related to raising the full supply level include:
▪ A further deepening of the impoundment will occur, thereby increasing the depth of water with low oxygen content when the storage is full. The depth of the Jones Weir impoundment is such that it has the potential to stratify when full, causing a significant decrease in the oxygen content of the bottom layer. However, the present operation suggests there is significant water movement through the storage, thereby reducing the potential for stratification and development of high blue-green algae populations.
▪ Further conversion from run and riffle zones into water impounded areas will occur, thereby reducing the capacity of the water to become oxygenated.

Generally, the impact of the 1.4 m water level raising on water quality is expected to be minimal. Given that a variable offtake was incorporated in the original structure, the quality of downstream releases is not expected to alter significantly. Also, there is no reason to suppose that the increase in irrigation will change the acceptable and stable conductivity levels in the river around the weir.</td></tr>
<tr><td>Hydrology</td><td>This option would result in approximately 10,000 ML of additional medium priority water allocations, with a monthly reliability of 90 per cent.</td></tr>
<tr><td>Flora and fauna</td><td>Flora

The primary impact on flora related to the raising of the weir would be the further inundation of regulated riparian vegetation. The remnants of all communities except the upper bank and crest species of open forest terrestrial communities would be further inundated in zones moving upstream to the new limits of storage. Another issue warranting concern is the presence of the Cat's Claw Creeper weed. Raising the storage by 1.4 m will drown some weed infestations but reinfestation above the new full supply level may occur.

Secondary impacts related to the weir raising include additional clearing that may occur due to the availability of extra water. However, the area likely to benefit is already extensively cleared, so extensive additional clearing is unlikely.

Vegetation in the streambed downstream of Jones Weir is dominated by Callistemon Viminalis, with Queensland blue gum along the banks.

Aquatic fauna

Aquatic fauna likely to be affected by the proposal to raise Jones Weir include freshwater turtles, lungfish, other fish species and platypus.

A previously undescribed species of freshwater turtle was found in the Burnett River in the vicinity of the Walla Weir site during the impact assessment study for that proposal (Boardman 1996). This species is found in the Mary and Fitzroy River systems as well. However, little is known about its preferred habitat and abundance.

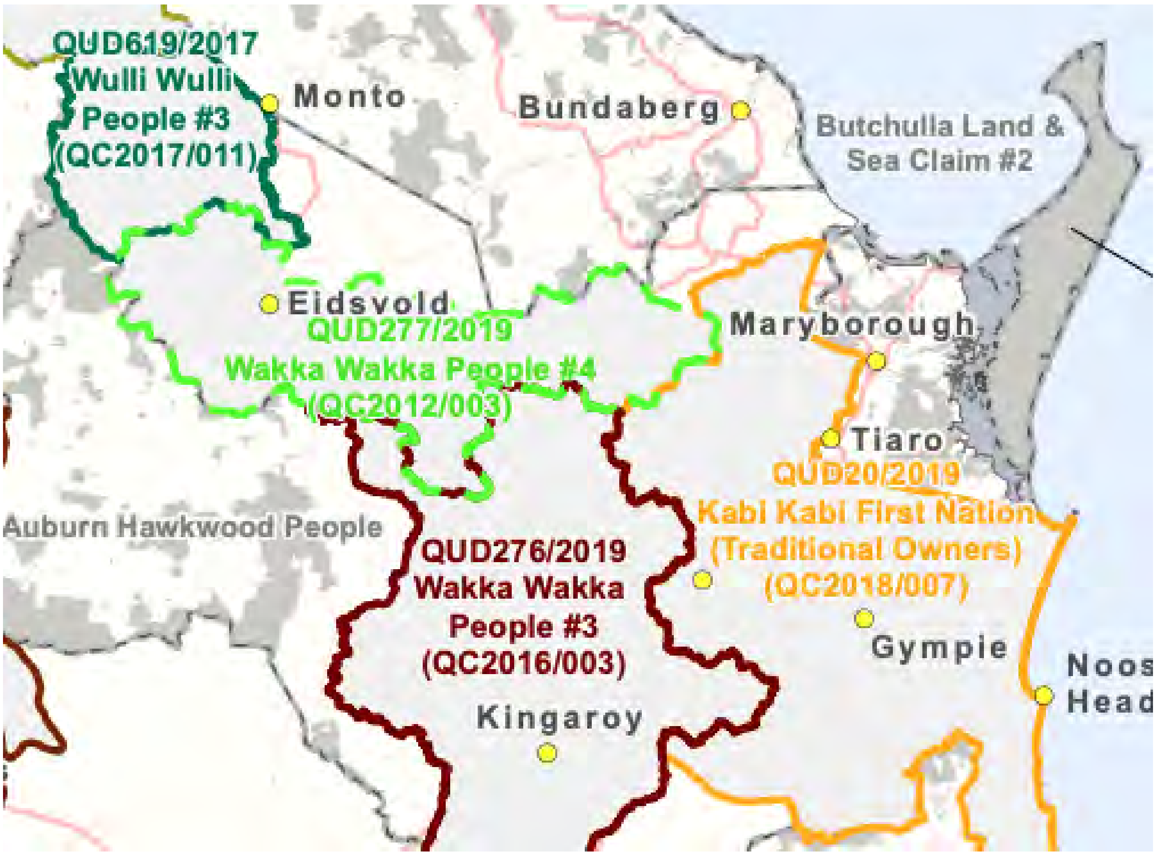
Since lungfish lay their eggs on macrophytes in shallow waters, they are sensitive to fluctuations in water level. Consequently, the eggs are at risk of either being washed away if water levels rise significantly or being exposed following a rapid reduction in water level. The weir raising has the potential to impact on breeding of lungfish if the storage provides significant breeding habitat and if there are large variations in release patterns through the breeding season. Through the implementation of measures to modify release patterns to accommodate the needs of lungfish and their spawning sites, including measures to maintain macrophytes and semi-aquatic plants during fluctuating water levels and flow rates, the impact on the lungfish can be minimised.</td></tr>
</table>

Aspect	Considerations
Noise and vibration	It is possible that noise may impact a very small number of neighbouring dwellings during construction. No ongoing operational impacts from noise are expected. Noise impacts during construction could be mitigated by operating within the hours of 7 am to 6 pm.
Landscape and visual amenity	The raising of a weir is not expected to create adverse visual and landscape impacts. There may be some visual improvement of additional ponded areas.
Cultural heritage[25]	**Vegetation** The vegetation along the river margins is thick, consisting of paper barks and blue gum growing within a dense cover of high grass. The older of the largest blue gums are generally found on the slopes away from the rivers although a few were found within 10 m of the current water level, especially along the Auburn River. The slopes along all the margins are steep and high. Three basic configurations of these slopes were noted. The most common slope type consisted of a narrow (<10 m) terrace above (<2 m) the river with a high steep slope immediately behind the terrace. A broader terrace characterises the second most common slope type. The terrace varies in width (roughly 15–50 m). The third slope type exhibits no terrace; rather the slope drops directly into the river. Surface visibility is virtually nil—even the cattle trails are largely overgrown and exhibit less than 5% visibility. **Method** Surveying involved inspection of proposed inundation areas by boat and on foot. Because of the size of the field crew, three boats were used in the survey. The existing weir is 7 m high; thus, the current water levels are between 3 m and 7 m above the original river levels and their associated margins. The existing weir is to be raised by 1.5 m, thus raising the water level by the same height. At the time of the Jones Weir survey, the water in the three rivers was at maximum level, which allowed a more accurate estimate of proposed inundation levels. Approximately 10 km or 90% of the proposed inundation area was surveyed by boat. The Auburn was surveyed to 318340E 7162490N, the Burnett was surveyed to 3183390E 71640250N. No GPS reading was taken on the Boyne. Foot survey was undertaken along the Auburn and began at a point where power lines cross the river about 1.5 km downstream from the bridge. This point was approximately where the boat survey had ended. Both sides of the river were walked to the bridge. **Results** Five sites were recorded during the survey; all of these were scarred trees. No visible evidence of shell middens was observed along any of the river margins. However, no more than about approximately 5% of the margins were sufficiently open to directly observe the ground surface. Nevertheless, individual examples of large river mussels were found when the field team walked along the margins. All but one of the five sites contained only a single tree; site 5 consisted of two trees, separated by only 3 m. All the scarred trees were large blue gum.
Native Title	Jones Weir, Claude Wharton Weir, and the locations of the proposed storage on the Burnett River and irrigation network to Coalstoun Lakes is within the area of Native Title Application QC2012/003 Wakka Wakka People #4.

[25] Extract from The Burnett Weirs Study, 1999.

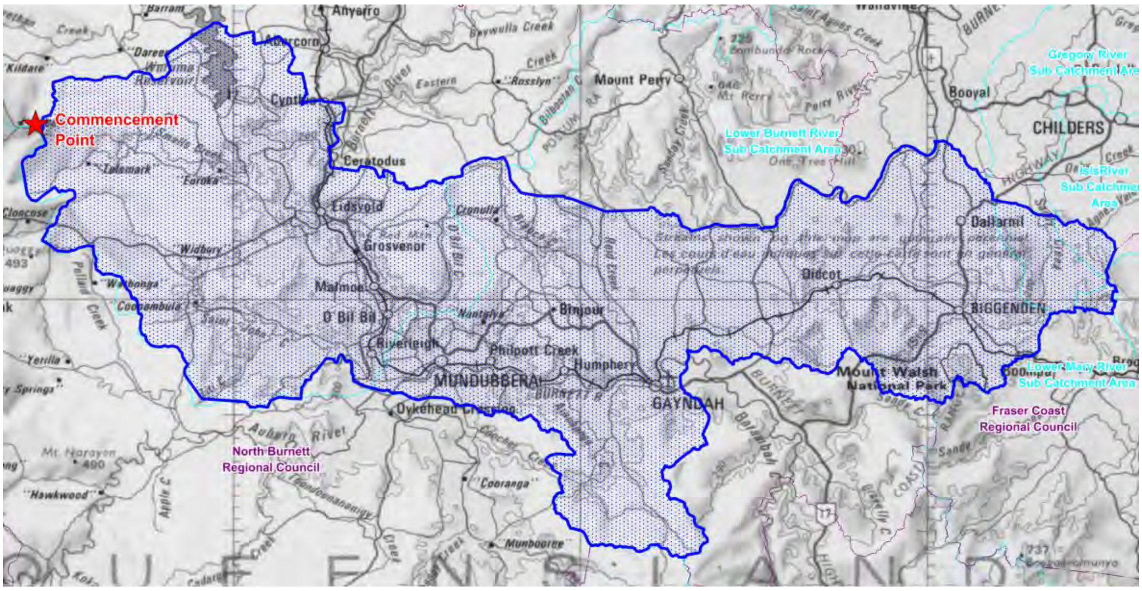
Aspect	Considerations

Map of Native title applications and determinations in the study area



Source: Native Title Tribunal, March 2020.

Map of claimant area for QUD91/2012 Wakka Wakka People #4



Source: Native Title Application QUD91/2012

8.4.2 Raising Claude Wharton Weir

There has been some assessment of the environmental impact of larger projects that incorporate the raising of Claude Wharton Weir, although it would not be suitable to apply those assessments here, as they could potentially overstate the environmental impact.

While the environmental impact of raising of Claude Wharton Weir may be limited, it would still be necessary to conduct a detailed review of the environmental impacts if this option progresses to a detail business case. Any review should consider whether it will be necessary to refer this project to the Commonwealth under the EPBC Act.

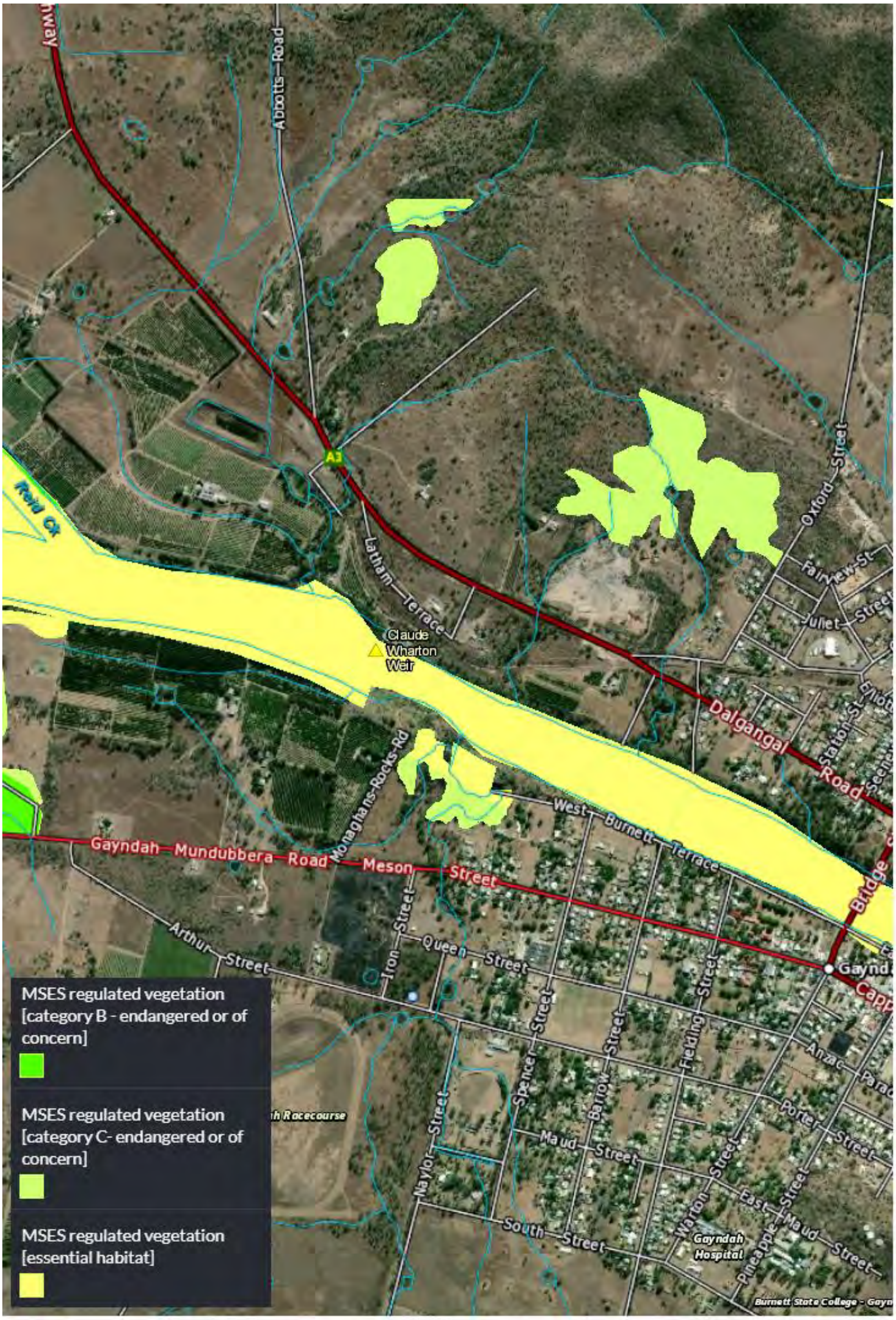


Table 8.3: Claude Wharton Weir

Aspect	Considerations
Planning and land use	Land use is predominantly agricultural, which is a mixture of grazing, cropping and irrigated horticulture occurring in the buffer zones of the proposed sites. Land tenure comprises freehold land, with some land lease tenures. Unallocated state land is present at the Claude Wharton Weir and the pump station, as parts of these sites are located within the river boundary. Land within and around the project areas are mapped as important agricultural areas (IAAs). Land within the areas associated with off-stream water storage are mapped as strategic cropping areas. Development of the project and supply of water to these areas are consistent with the intended land uses for the areas and align with state planning policies. The installation of floodgates on the Claude Wharton Weir to re-establish the full supply level is not expected to create any impact to adjoining property or land uses during construction. Re-establishing the full supply level of the Claude Wharton Weir would raise the water level behind the weir. This may result in some minor inundation of property adjacent to the Burnett River. For the most part this increase in water level would be contained within the surveyed boundaries of the Burnett River; however, small areas of land adjacent to the river would be inundated. This is not expected to adversely affect the activities of the impacted landowners; however, in some circumstances it may require the alteration or relocation of pump and irrigation equipment. It is recommended that consultation be held with potentially effected landholders to consult them on the potential impacts to their land. The proposed works aim to improve security of irrigation water supply to the region, and as such, it is likely that the operation of the weir in conjunction with the other proposed works would create a net benefit to property ad land uses in the region.
Property impacts	A small number of property holders will be directly impacted. Two landholders would be impacted by construction (one on each side of the river).
Topography, geology and soils	Acid sulfate soils are not considered likely to be encountered at the proposed development sites. The area is mapped as an extremely low probability of occurrence and low probability of occurrence for acid sulfate soils (ASRIS 2017).
Flora and fauna	The project areas largely comprise areas of non-remnant vegetation consistent with cleared areas for agricultural land uses (primarily grazing, but also some cropping). Remnant vegetation is confined to riparian and riverine areas along the Burnett River and Reids Creek. Commonwealth-listed threatened ecological communities are not considered likely to be present. No MSES flora species are assessed as likely or having the potential to occur within project areas. Subject to confirmation from field survey, no MNES or MSES flora species are considered likely to occur within project areas. The following MNES flora under the EPBC Act are considered to have the potential to occur: ▪ Dichanthium setosum (Bluegrass): listed as vulnerable, and potentially occurs in the project areas ▪ Acacia grandifolia: listed as vulnerable, and potentially occurs in the project areas. · From the desktop assessment, fauna species assessed as likely to occur within investigation areas include: ▪ Pteropus poliocephalus (grey-headed flying fox): listed as vulnerable under the EPBC Act; likely to occur in habitat associated with the project areas ▪ Furina dunmalli (Dunmall's snake): listed as vulnerable under the EPBC Act; land likely to occur within habitat (Acacia woodland) mapped in the vicinity of the project areas, but has the potential to occur of a much wider area ▪ Neoceratodus forsteri (Australian lungfish): Listed as vulnerable under the EPBC Act known to occur in the Burnett River system; likely to occur at the project sites for the Claude Wharton Weir and the pump station ▪ Elseya albagula (white-throated southern snapping turtle): listed as critically endangered under the EPBC Act and endangered under state legislation: known to occur within the Burnett River. Further investigation and field survey are required to determine the actual presence of conservation significant fauna and/or fauna habitat within the investigation areas. Where the presence of conservation significant flora and fauna are confirmed and determined to be impacted as a result for the project, mitigation and management measures would be required to be developed to minimise impacts, and where residual impacts are to persist, offset would need to be proposed. This will be considered further in the detailed business case.
Climate and air quality	Construction and installation work at the weir is not expected to create offsite impacts to air quality. Ongoing operation of the floodgates is not expected to cause offsite impacts to air quality.

Aspect	Considerations
Noise and vibration	It is possible that noise may impact a very small number of neighbouring dwellings during construction. No ongoing operational impacts from noise are expected. Noise impacts during construction could be mitigated by operating within the hours of 7 am to 6 pm.
Landscape and visual amenity	Installation of the floodgates on top of the Claude Wharton weir is expected to create minimal visual and landscape impact. The weir is not visible from the Burnett Highway on the north side of the river. The weir can be seen from the Les Baker Bridge crossing the Burnett River downstream of the weir; however, the addition of floodgates to the top of the weir is not expected to create an adverse visual impact from this vantage point.
Cultural heritage[26]	A search of the native title applications and Determination Areas for the Southern and Western Queensland Region identifies claim QC2016/003 attributed to the Wakka People #4 for the project areas. Land areas (outside of watercourse areas) within the proposed development sites have generally been developed for agricultural purposes and have been subject to ground disturbance. Searches in relation to Indigenous cultural heritage for the Claude Wharton Weir returned results indicating the potential for the presence of cultural heritage (for example, isolated finds). Several site points for indigenous cultural heritage were identified within the search extent for the Claude Wharton Weir. A Cultural Heritage Management Plan is proposed to be developed. No places listed under the Australian Heritage Database or Queensland Heritage Register were identified at the proposed development sites. Where sites are recorded in the vicinity of the Claude Wharton Weir, these reflect the heritage places located in the town of Gayndah that would not be impacted by the project but would need to be considered when locating pipelines.
Waste management	Surface runoff: preventing the release of contaminants and sediments from construction sites Mitigation: spill management; erosion and sediment control

8.4.3 Barambah Creek dam or weir

Table 8.4: Coalstoun Lakes

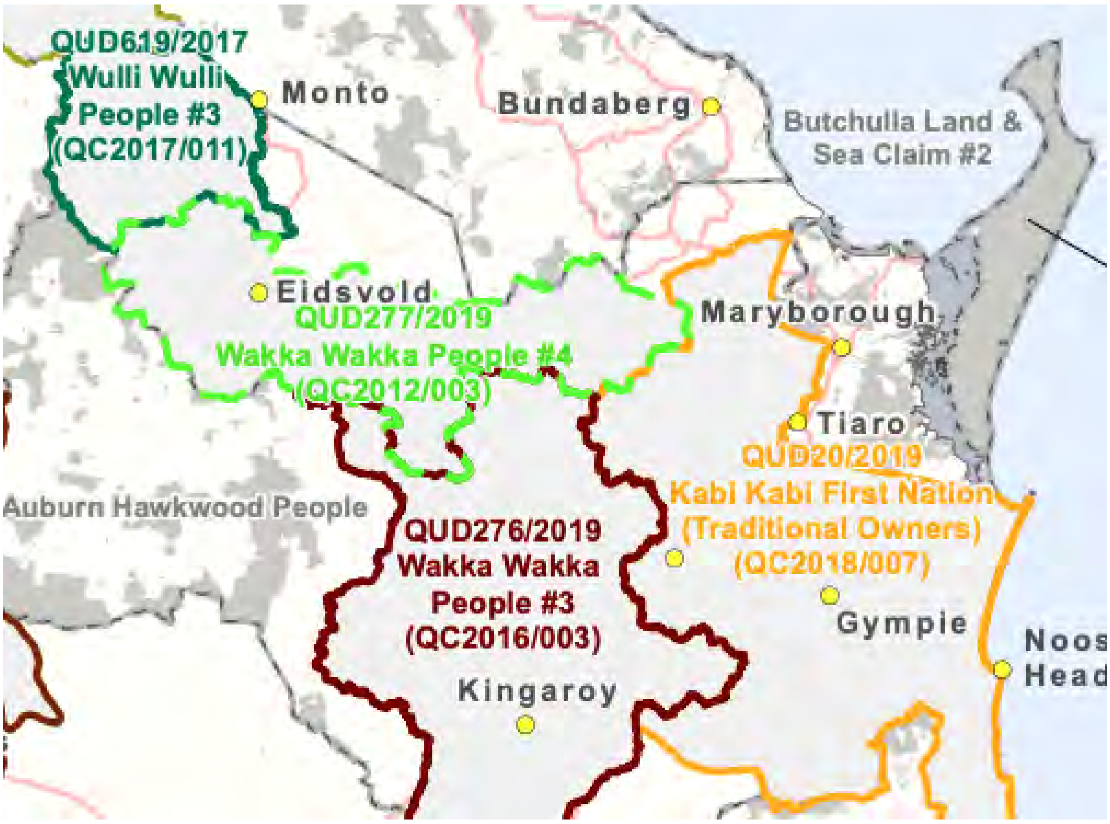
Aspect	Considerations
Property impacts	A small number of property holders would be directly impacted. Two landholders would be impacted by construction (one on each side of the river).
Topography, geology and soils	From a geomorphological viewpoint, the key impacts of water resource development on Barambah Creek to date relate to changes in sediment transport processes. Sediment inputs from Barker Creek can be expected to have changed due to trapping of sediment in Bjelke-Petersen Dam, as well as reductions in the sediment transport capacity of this tributary due to flow regime changes. The sediment transport capacity of Barambah Creek would also have been reduced by the reduction in high flows downstream of Barker Creek due to Bjelke-Petersen Dam. The weirs along Barambah Creek would also partially disrupt sediment transport continuity. Well-drained and friable red volcanic soils are dominant in the proposed irrigable areas of Coalstoun Lakes. The soils in this area, similar to the proposed irrigation area of Ban Ban Springs, are highly fertile. The Ben Ban Springs irrigation area, located alongside the Barambah Creek, is dominant with alluvial soils. The Biggenden region comprises of both alluvial soils from the Mungore and Degilbo creeks and volcanic rocks from the surrounding mountains.
Hydrology	Changes in flow regime resulting from water resource development vary along the length of Barambah Creek. Diversions from Bjelke-Petersen Dam have led to elevated baseflows below Joe Sippel Weir. Downstream of Barker Creek, total annual flow volumes and flood flows have been significantly reduced as a result of Bjelke-Petersen Dam.
Flora and fauna	**Threatened ecological communities** Within the study area, two threatened ecological communities (TECs) were predicted to occur by the Protected Matters Search Tool as follows: Brigalow (Acacia harpophylla dominant and cc-dominant)—endangered under the EPBC Act Lowland rainforest of subtropical Australia—critically endangered under the EPBC Act. In Queensland. TECs are generally identified though the presence of constituent vegetation mapped as regional ecosystems. In some instances, areas that are considered as high value regrowth can also satisfy the requirements for TECs. The occurrence of TECs was predicted based

[26] Extract from The Burnett Weirs Study, 1999.

Aspect	Considerations
	on the presence of constituent regional ecosystems for each TEC occurring within the study area using DNRME-certified regional ecosystem mapping (version 8). The likely presence of each TEC within the study area is discussed below. Brigalow TEC comprises open forest to open woodland vegetation communities dominated or co-dominated by brigalow. The lowland rainforest of subtropical Australia TEC comprises moderately tail to tall (220 to 230 m) closed forest (canopy cover 270%). Tree species with compound leaves are common and leaves are relatively large (notcphyll to mesophyll). Typically, there is a relatively low abundance of species from the genera Eucalyptus, Melaleuca and Casuarina. **Barambah Creek** From a fish viewpoint, changes in flow conditions over the rock bars may increase or reduce natural barrier effects. Four turtle species have been recorded, with E. krefftii dominant, as in regulated reaches elsewhere in the catchment. The new Elseya species has also been recorded. Aquatic habitat conditions between Litzows and Barker Creek have been significantly transformed by the weirs that dominate this reach. Three species of turtles have been recorded: E. krefftii, Elseya latisternum and the new species of Elseya. E. krefftii is dominant (80% of total catch). Downstream of Barker Creek, changes in the extent and nature of aquatic habitat can be inferred from the flow regime changes which have occurred. Elevated baseflows which extend from Barker Creek partway through the regulated section would have led to increased flow depths and/or velocities and/or wetted areas in susceptible areas such as riffles. The weirs in the regulated section have further altered aquatic habitat conditions in their backwater pondage areas. The reductions in low and medium flows which are apparent downstream of the regulated section would have led to reduced flow depths and/or velocities and/or wetted area in susceptible areas such as riffles. Macroinvertebrate sampling data indicate that macroinvertebrate communities in Barambah Creek have been significantly modified from reference conditions, as would be expected on the basis of changes in aquatic habitat conditions. The fish fauna of the Barker-Barambah Irrigation Project area has been studied in more detail than in any other part of the study area (Arthington et al. 1992, 1998, Arthington 1994). Gambusia are common throughout Barambah Creek. In the reach between Barker Creek and the upstream end of the gorge, the fish fauna was in a poor condition. Only half of the 18 species expected to be found here have actually been recorded. Few individuals reached reproductive maturity and there was poor recruitment of gudgeon species. 1998). No lungfish were found in this part of Barambah Creek, although they are known to occur further upstream and downstream. Possible contributing factors include changes in flow regime, as well as land use impacts including the use of pesticides in the production of cotton in the irrigated area, high nutrient levels resulting from agricultural practices and sewage effluent from Murgon, and infestations of floating macrophytes including water hyacinth and Azolla in weir pools. Good recruitment of fish was observed further downstream, below Boonara Creek. The barrier effects of Bjelke-Petersen Dam, as well as weirs on Barambah Creek and the lower Burnett River, are likely to have significantly affected the species composition of the fish fauna of Barambah Creek. Changes in populations of turtles, frogs, water birds and platypus can be expected to have occurred in response to the flow regime changes, and associated changes in habitats and instream biota. There are no turtle data for the section extending from Barker Creek to the Burnett River. Platypus have been recorded in this area, but there are no quantitative data on populations.
Noise and vibration	It is possible that noise may impact a very small number of neighbouring dwellings during construction. No ongoing operational impacts from noise are expected. Noise impacts during construction could be mitigated by operating within the hours of 7 am to 6 pm.
Cultural heritage[27]	Ban Ban Springs is of significance to Wakka Wakka people and is associated with stories of a great eel. According to tradition it was an area available to all people, subject to protocols and permission: a kind of 'common ground' where people could stay for short periods. Given the variability of rainfall and stream flow throughout the region wells, springs and soaks were an important element in the water management practices of Indigenous people. The maintenance of water sources was, and still is, considered of paramount importance to ensure the preservation of all living things.
Native Title	The location of the proposed storage on Barambah Creek is within the area of native title application QC2016/003 Wakka Wakka People #3. Figure 4-01 shows the location of the Native Title Claim within the study area, and Figure 4-02 shows the native title application area, which includes the likely location for the storage on Barambah Creek. This application was filed with the Federal Court on 3 May 2019 and is currently before the court for consideration. The irrigation network between the proposed storage and Coalstoun Lakes would be located within the area of native title application QC2012/003 Wakka Wakka People #4.

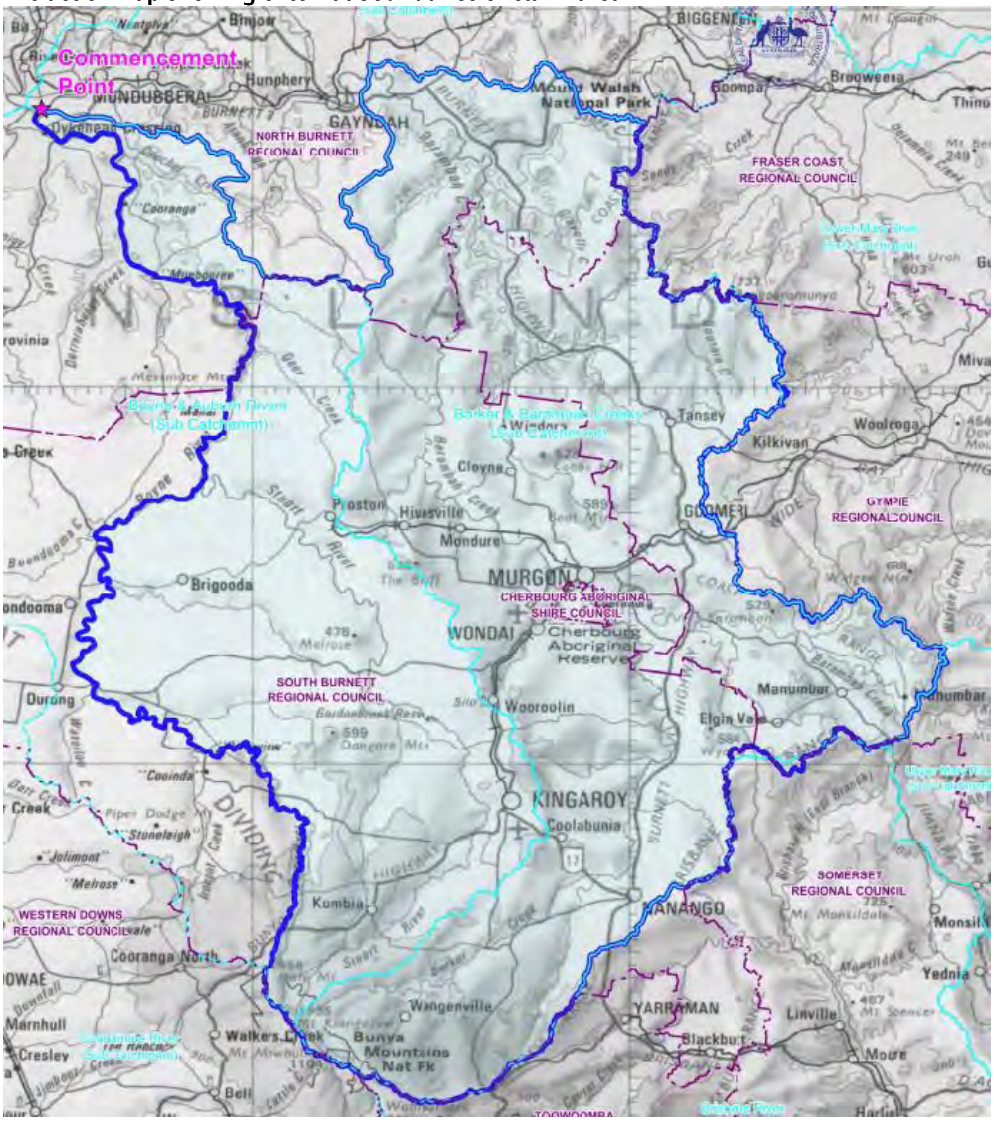
[27] Extract from The Burnett Weirs Study, 1999

Map of native title applications and determinations in the study area



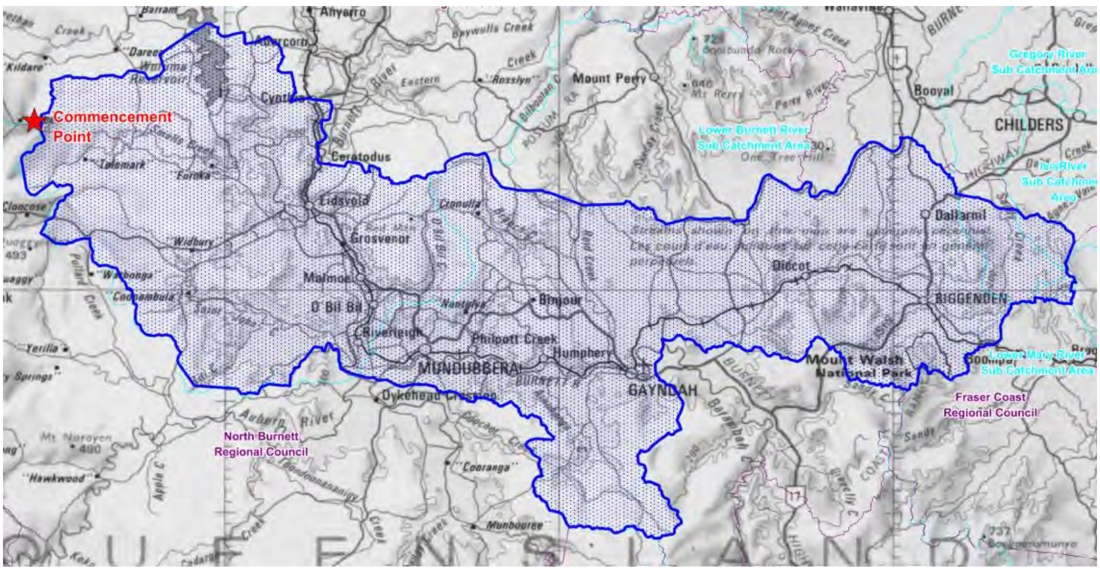
Source: Native Title Tribunal, March 2020.

Extract of map showing external boundaries of claim area



Source: Native Title Application QC2016/003.

Map of claimant area for QUD91/2012 Wakka Wakka People #4



Source: Native Title Application QUD91/2012

8.4.4 Build a pipeline from Paradise Dam to Coalstoun Lakes

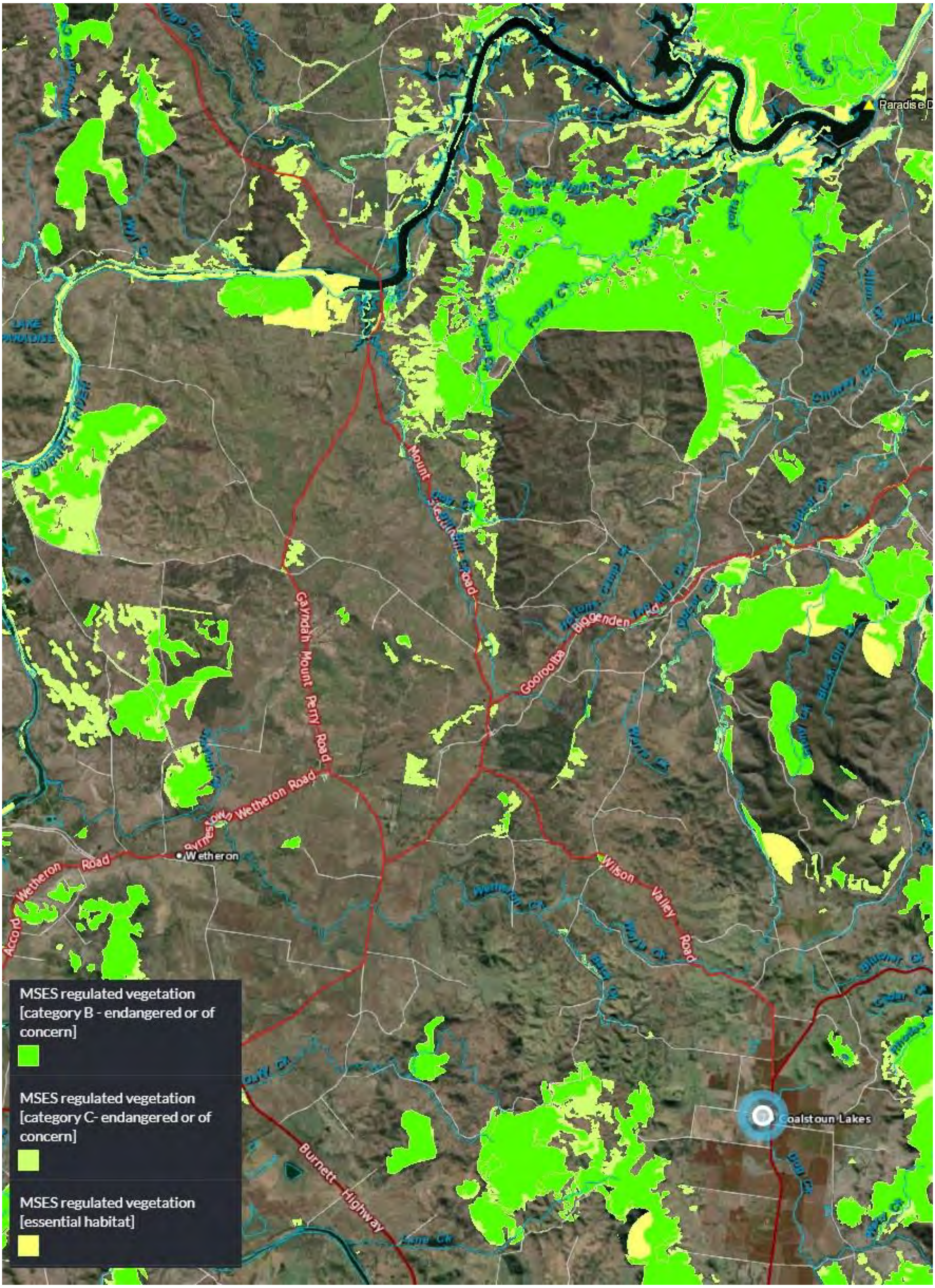
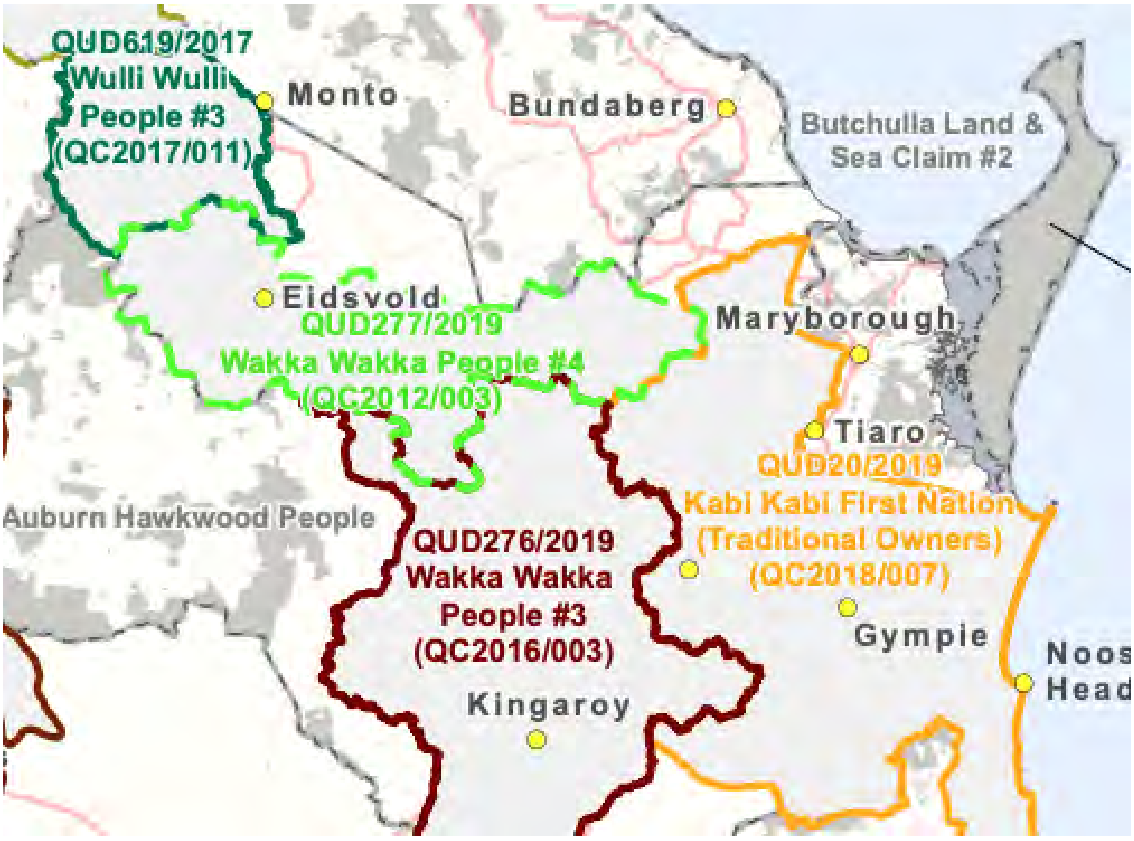
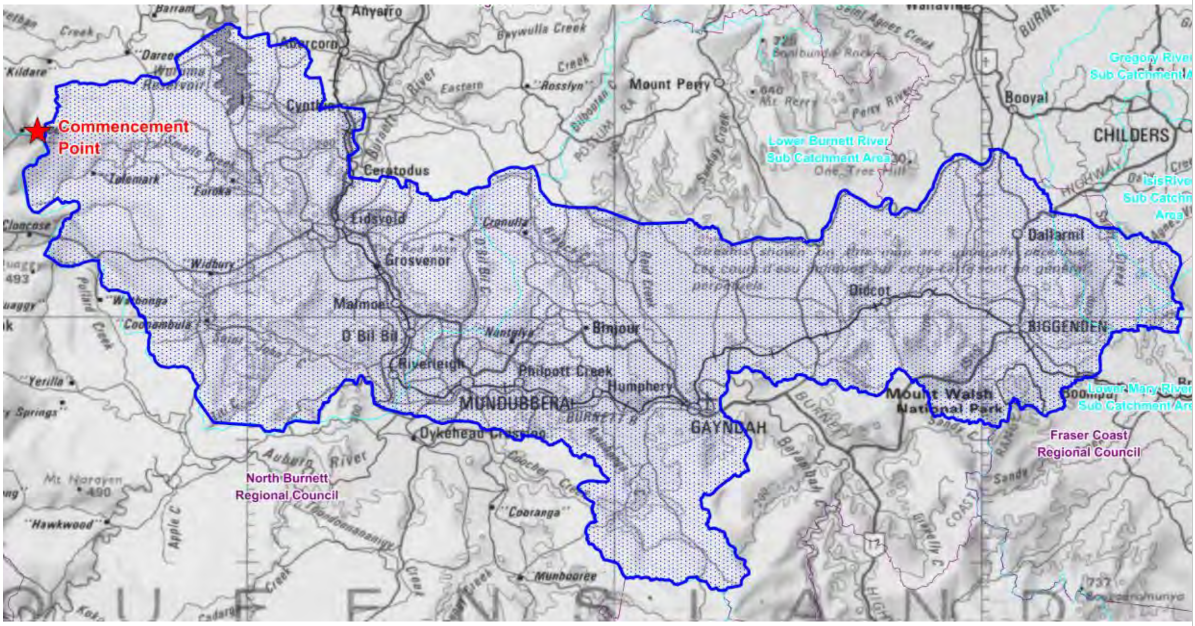


Table 8.5: **Build a pipeline from Paradise Dam to Coalstoun Lakes**

Aspect	Considerations
Planning and land use	This option requires purchases of water allocations held within Paradise Dam (noting that the future of Paradise Dam is currently uncertain). Consequently, no further planning approvals are required for water itself, just the pipeline route.
Property impacts	The proposed pipeline corridor predominantly traverses freehold land or road reserve and there are no national parks or areas of cultural or environmental significance known to be involved (depending on route). Existing road access is available along 90% of the corridor which is in general alignment with local road reserves for about half the length of the pipeline.
Noise and vibration	It is possible that noise may impact a very small number of neighbouring dwellings during construction. No ongoing operational impacts from noise are expected. Noise impacts during construction could be mitigated by operating within the hours of 7 am to 6 pm.
Landscape and visual amenity	The pipeline will be buried, which will result in no long-term environmental impact.
Cultural heritage[28]	Ban Ban Springs is of significance to Wakka Wakka people and is associated with stories of a great eel. According to tradition it was an area available to all people, subject to protocols and permission: a kind of 'common ground' where people could stay for short periods. Given the variability of rainfall and stream flow throughout the region wells, springs and soaks were an important element in the water management practices of indigenous people. The maintenance of water sources was, and still is, considered of paramount importance to ensure the preservation of all living things.
Native Title	The route of the proposed pipeline and irrigation network to Coalstoun Lakes is within the area of native title application QC2012/003 Wakka Wakka People #4. The determined native title area covered by National Native Title Tribunal determination QCD2017/010 held by The Bailai, Gurang, Gooreng Gooreng, Taribelang Bunda People includes the Burnett River at the southern border of the Good Night Scrub National Park. It is possible that the pipeline route from Paradise Dam to Coalstoun Lakes may intersect this native title area. **Map of native title applications and determinations in the study area** 

[28] Extract from The Burnett Weirs Study, 1999.

Aspect	Considerations
	Source: Native Title Tribunal, March 2020 **Map of claimant area for QUD91/2012 Wakka Wakka People #4**  *Source: Native Title Application QUD91/2012.*

8.5 Construct a re-regulating weir on the Barambah Creek (Barlil Weir)

Jointly with the State of Queensland, the Commonwealth Minister for Environment and Heritage granted environmental approvals for Barlil Weir, Jones Weir Stage 2 and Eidsvold Weir in late 2001, under the provisions of the EPBC Act.[29]

[29] Department of Environment and Resources Management, *Aquatic Conservation Assessments using AquaBAMM, for the riverine and non-riverine wetlands of the Wide Bay-Burnett catchments*, version 1.1, Queensland Government, November 2010, https://wetlandinfo.des.qld.gov.au/resources/static/pdf/assessment-monitoring/aquabamm/wide-bay/wbb_aca_report_v1_1_161111_web.pdf.

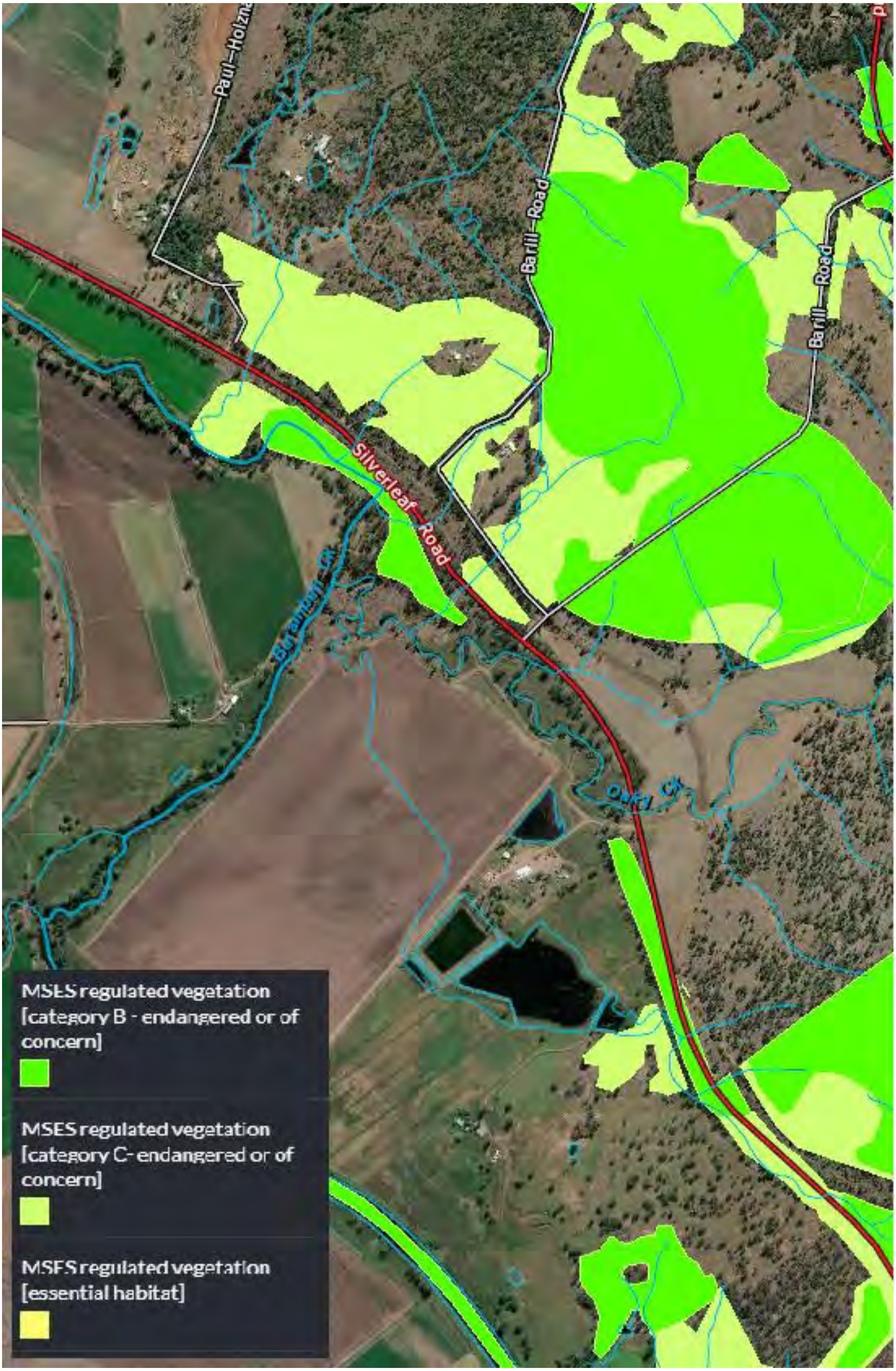

Paul–Holzna
Baril Road
Baril Road
Silverleaf Road
Barambah Ck
Oaky Ck
MSES regulated vegetation [category B - endangered or of concern]
MSES regulated vegetation [category C- endangered or of concern]
MSES regulated vegetation [essential habitat]

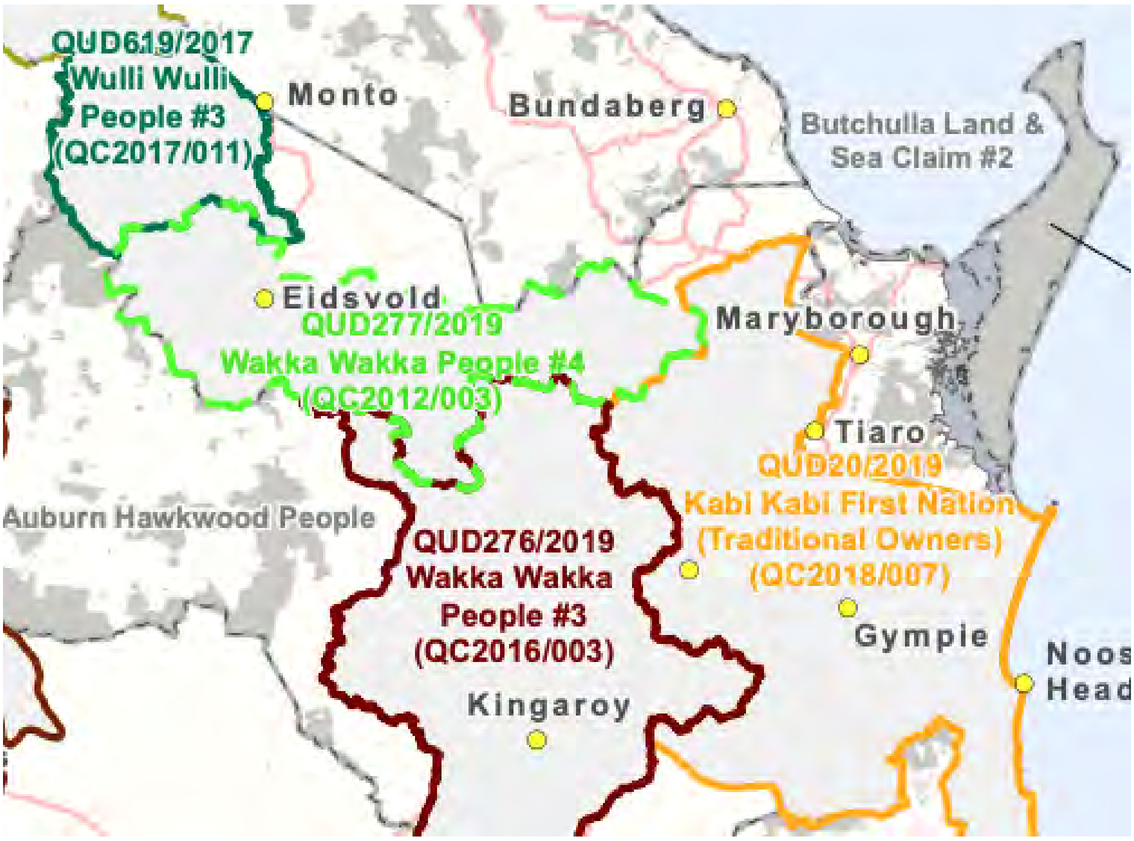
Table 8.6: Barlil Weir

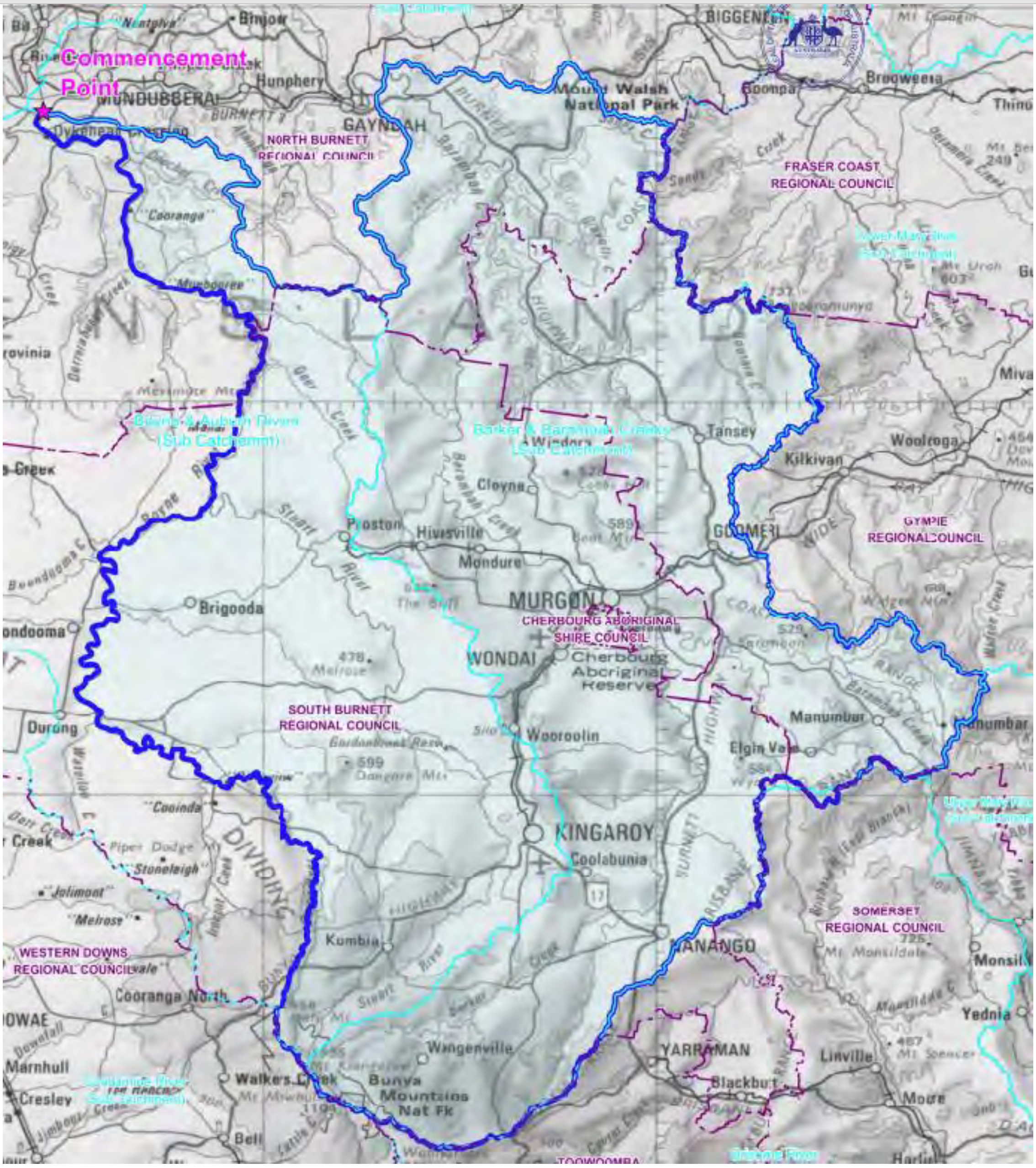
Aspect	Considerations
Legislation and permit requirements	This option has been subject to environmental review and has been approved by the Commonwealth Government, subject to the satisfaction of conditions designed to mitigate any likely determine impacts of the expanded infrastructure. The Department of Natural Resources commissioned a review of environmental factors in 1998.[30] This review identified the environmental impacts of this option and proposed mitigation actions for the planning and construction. An Environmental Management Plan was prepared for this option, which covered predevelopment, construction and operational phases. The Queensland Government provided certification that the proposal had been assessed to the greatest extent possible. Commonwealth Government approval under the EPBC Act was granted in 2001.
Planning and land use	**Objectives** ▪ Facilitate public amenity of the waters of Barambah Creek. ▪ Maintain communication with groups that use the Ficks Crossing Recreation Reserve. ▪ Provide controlled access, restricted to the storage adjoining the Reserve for certain specified recreational activities, to ensure that impacts on the storage by these activities are minimised. ▪ Require watercraft to be free of undesirable flora and fauna if used on Barambah Creek. **Performance outcome** ▪ Maximise amenity of the waters of Barambah Creek available to the public. ▪ Control of recreation such that the water quality and infrastructure is not degraded. **Potential management actions** ▪ The operator should liaise with organisations involved with recreational use of the reserve. ▪ All facilities that are provided with water, toilets, and waste disposal should conform with the local authority requirements. ▪ Access to areas where particular recreational activities are impacting on the bank stability and riparian vegetation should be controlled if the need arises. ▪ Fish stocking should be subject to approval from the Department of Primary Industries.
Property impacts	A small number of property holders would be directly impacted. wo landholders would be impacted by construction (one on each side of the river).
Water quality	**Objectives** ▪ Assess water quality, relative to the ANZECC Water Quality Guidelines. ▪ Establish water quality monitoring stations to be used during the preconstruction, construction and operational phases of the Barlil Weir development, for protection of aquatic ecosystems, recreational water quality and aesthetics and for agricultural water use. ▪ Obtain pre-construction water quality data in order to improve the existing database for Barambah Creek. ▪ Use the water quality database to support determination of the effects of the construction and operational phases on water quality both within and downstream of the storage. **Performance outcomes** ▪ Pre-construction water quality data should allow assessment of impacts of the construction and operational phases. ▪ Sampling should be undertaken on three occasions, at not less than three-monthly intervals, under non-flood flow conditions. ▪ At least two water quality monitoring sites are to be used for pre-construction water sampling. These are to be situated at Ficks Crossing and downstream of the proposed storage. ▪ Reporting should be done on enhanced data set (over the existing DNR dataset).
Hydrology	This option would result in approximately 3,000 ML of additional medium priority water allocations.
Flora and fauna	**Terrestrial flora and fauna** **Performance outcomes** ▪ A permit under section 266 of the *Water Act 2000* (permit to destroy vegetation, excavate or place fill within a watercourse, lake or spring) is required when disturbance of water courses, as defined in the Water Act, is intended or is specified in the contract documents.

[30] The review of environmental factors report is only available as a hard copy in the DNRME library. At the time of writing, access was restricted due to Covid-19.

Aspect	Considerations
	▪ A vegetation disturbance site plan identifying proposed works, cut and fill, interim erosion control, access and no-go areas and identified species, including trees to be removed and those to be maintained and protection is to be prepared. ▪ A site rehabilitation plan showing permanent erosion control and vegetation replacement (similar to existing species) is to be prepared. ▪ Exotic flora should not be introduced to the construction site, the riparian zone or the floodplain. ▪ No clearing within the storage should be undertaken unless it is required for safety reasons. Vegetation left in place will minimise flora and fauna disturbance and facilitate the movement of fauna out of the area to be inundated. ▪ No animals are permitted on the construction site other than Indigenous-owned or riparian-farmer-owned animals. **Aquatic flora and fauna** **Objectives** ▪ Minimise the disturbance of aquatic flora and fauna arising from the various construction activities associated with the construction of the Barlil Weir. ▪ Ensure that acceptable conditions for aquatic flora and fauna are maintained during the construction phase. ▪ Prevent the introduction of undesirable aquatic flora and fauna. **Performance outcomes** ▪ A permit under section 266 of the Water Act 2000 (permit to destroy vegetation, excavate or place fill within a watercourse, lake or spring) is required when disturbance of water courses, as defined in the Water Act, is intended or as specified in the contract documents. ▪ Under no circumstances will there be an introduction of any fish species, any other aquatic fauna, or any flora into Barambah Creek. ▪ All remedial action should be undertaken in consultation with the proponent. ▪ Should the turtle be discovered within the inundation area and site works, a specific impact management plan must be prepared.
Noise and vibration	It is possible that noise may impact a very small number of neighbouring dwellings during construction. No ongoing operational impacts from noise are expected. Noise impacts during construction could be mitigated by operating within the hours of 7 am to 6 pm.
Landscape and visual amenity	The construction of a weir is not expected to create adverse visual and landscape impacts. There may be some visual improvement of additional ponded areas.
Cultural heritage[31]	'Settlers Bridge' is assessed as being of high significance (local level) under the *Queensland Heritage Act 1992*. Further investigation may disclose an even higher level of importance. According to the Draft Environmental Management Plan, it is considered unlikely that the construction and operation of Barlil Weir would impact on any indigenous sites that are culturally or archaeologically significant. This is because the works and construction sites occupy areas that have previously been significantly disturbed. **Vegetation** Blue gum occurs on the upper slopes, and dense stands of Callistemon along the watercourse. Dense stands of grass extend from the edge of the watercourse onto terraces and banks. Visibility is poor—less than 5% on the banks. Recent flooding and silting and the growth of grass cover affected visibility. The inundation area lies within the active watercourse of the creek and it is likely that flooding and scouring has destroyed or covered any surface artefact material. Trees, which may have scarring, usually occur on the higher slopes of the bank. Approximately 200 m upstream from the proposed weir the left bank (looking downstream) had been undercut and has collapsed, providing a 3 m deep by approximately 20 m cut-face. The exposed deposit consisted of uniform, in colour and texture, medium to coarse sands and no archaeological deposit or artefacts were visible. **Method** Survey was undertaken by boat and on foot. Approximately 5.6 km of Barambah Creek were traversed by boat, extending from AMTD 135.5 to 138.2 (downstream of Krebs Bridge on the Murgon-Wondai Road 389520 7096610 (AGD 66) and AMTD 141.6 to 144.5 (upstream from Ficks Crossing). The weir location was inspected on foot. Approximately 5.5 km of bank was walked north and south of Krebs Bridge. The right and left bank between Savages Pump and Krebs Bridge were surveyed on foot (approximately 4 km). The area of the

[31] Extract from The Burnett Weirs Study, 1999

Aspect	Considerations
	weir and 250 m upstream was surveyed on foot. The area from Ficks Crossing to the Wondai-Murgon road (circa 1.5 km) was inspected on foot. All rock outcrops, sandbars and exposed eroded areas were inspected on foot. **Results** A total of five scarred trees, two historical structures and one historical location were recorded. None of the scarred trees will be affected by the construction of the weir and the proposed inundation levels will be such that the health of the trees should not be impaired. Two bridges and one historical crossing were located. A plaque at Ficks Crossing records the location of a bullock crossing used around the turn of the century and into the early 1900s. According to (previous) mayor Percy Iszlaub (Wondai Shire), no structure was constructed at this location, but a crossing was cut to allow easy access up the banks. Approximately 300 m downstream of the crossing, another wooden structure was found. Mr Iszlaub says this was the first bridge for the Murgon–Wondai Road and was probably constructed in the period between 1907 and 1937. The old Murgon–Wondai Bridge of wooden construction overlayed with concrete and bitumen is still located just north of the Krebs Bridge. This bridge was constructed in the 1937 and is still in good condition. These structures are typical of road bridges of their time, in terms of the materials used and the method of construction. They have significance at a local level, as examples of early road infrastructure in the district. A mussel shell bed was exposed in point bar sediments on the eastern bank of the creek upstream of the weir location. The mussels consisted of large, articulated and, in some cases, live shells. The bed had been disturbed in recent flooding. Mussels were an important food resource and were often used as travelling food due to their ability to live for periods out of water. Mussels were also observed in the sands and gravels at Ficks Crossing.
Native Title	The location of the proposed Barlil Weir is within the area of native title application QC2016/003 Wakka Wakka People #3. Figure 1-01 shows the location of the native title claim within the study area, and Figure 1-02 shows the native title application area, which includes the location for Barlil Weir. This application was filed with the Federal Court on 3 May 2019 and is currently before the court for consideration. If this option proceeds to a detailed business case, then consideration will need to be given to the legal arrangements and possible compensation. **Map of native title applications and determinations in the study area**  *Source: Native Title Tribunal, March 2020.*

Aspect	Considerations
	 *Source: Native Title Application QC2016/003.*
Waste management	▪ Except as permitted by the Environmental Protection Act 1994, no contaminants are to be directly or indirectly discharged to Barambah Creek. ▪ A vegetation site disturbance strategy and plan identifying proposed works, cut and fill, temporary stockpiles, permanent spoil deposits, interim erosion control and access is to be prepared. ▪ A site rehabilitation strategy and plan showing permanent erosion control and vegetation replacement (similar to existing species) is to be prepared. ▪ Sedimentation traps and basins should be designed for a one-hour storm event of a return period of 10 years, draining over a 10-day period, and should be cleaned out regularly and managed to ensure the required capacity is maintained. **Potential management actions** ▪ Prior to work commencing in any particular stage or section, an erosion and sediment control sub-plan should be prepared and submitted to the proponent for approval. The sub-plan must be in compliance with the Environmental Protection Act 1994 and in accordance with the engineering guidelines for soil erosion and sediment control for Queensland construction sites published in 1996.[32] Measures to include, but not be limited to, are minimising the

[32] Witheridge, G & Walker, R, *Soil erosion and sediment control: engineering guidelines for Queensland construction sites*, Institute of Engineers, Queensland Division,1996.

Aspect	Considerations
	amount of topsoil disturbed, revegetating or mulching disturbed areas as quickly as possible, installing and maintaining control measures such as catch drains, hay bales, silt fences and energy dissipators. ▪ Erosion and sediment control activities should conform with the approved erosion and sediment control sub-plan. ▪ Before commencing earthworks on any part of the project, sufficient materials should be available onsite to protect against storm impacts. ▪ Vegetation clearing should be the minimum necessary for safe construction. ▪ Wherever practicable, the order of construction of surface protection works, including grassing, should be such that they provide erosion and sediment control to the parts of the works that they are designed to protect as those parts of the works are constructed. ▪ If basins are incapable of removing suspended matter effectively and standards for suspended solids content are being exceeded in the creek as a result of construction activity, then environmentally benign chemicals are to be added to aid settling, subject to approval from EPA. ▪ Work will be scheduled to ensure that temporary erosion works are in place by the end of work each day, where permanent erosion control works are not already in place and some form of erosion control works are required. ▪ Any erosion that occurs should be controlled as soon as possible and restoration carried out without delay.

8.5.1 Current approval status

Approvals obtained under the EPBC Act are current until 2032. State Infrastructure Community Facility of Significance is current, but the State Government Infrastructure designation has lapsed.

Under the Planning Act 2016, development in relation to infrastructure under a designation is accepted development, with no further approvals required. However, this does not exempt any approval requirements under other legislation.

The completion of ecological survey is required to update the project impact assessment and to inform the updated design to minimise and mitigate impacts. The timeframe to undertake these activities is 9 to12 months. Specific assessment and approval requirements will depend on the validity of existing approvals in relation to the updated proposal and the activities requiring approval.

When the project was first considered in 1997, public consultation, a review of environmental factors and a draft environmental management plan were completed as part of the environmental impact assessment for the project. The review concluded that the impacts to the aquatic, terrestrial and riparian vegetation as a result of Barlil Weir are likely to be minor. This was primarily attributable to the extent of existing disturbance and modifications that have occurred in the catchment.

The review found that the environmental values of the site have been significantly reduced due to widespread vegetation clearing and disturbance from grazing and agricultural activities.

Because the location is within a protected plant trigger area, a flora survey to confirm the presence or absence of protected plants will be required.

Aquatic fauna of conservation significance, such as the white-throated snapping turtle, lungfish and platypus, may occur in the area. Species management programs are likely to be required to manage potential impact on these and any other species identified.

An assessment of fish passage requirements will be undertaken to inform the detailed design of the fishway.

8.6 Future approvals

The environmental impacts of the project are considered in Chapter 11. A number of environmental approvals may be required for the short-listed options if they are progressed as the preferred option. As more detailed environmental impact assessment of the options is undertaken as part of the detailed business case, some of the identified approvals may be confirmed as not required.

8.6.1 Referral and assessment of controlled action

The EPBC Act provides for the protection of matters of national environmental significance (MNES). If the project will have, or is likely to have, a significant impact on any of the matters of MNES, approval is first required. To obtain approval, a referral must be made to obtain a decision on whether the 'action' will need formal assessment and approval under the EPBC Act.

This section sets out the government approvals that may be required for each of the shortlisted options. The exact nature of the approvals will be determined during a detailed business case.

8.6.2 Environmental impact statement

An environmental impact statement may be required under:

- the State Development Public Works Organisation Act (SDPWO Act) if a coordinated project
- the Environmental Protection Act
- if required by the Commonwealth Minister, the EPBC Act.

The bilateral agreement between the Commonwealth and Queensland governments allows the environmental impact assessment process directed under Queensland legislation to assess actions under the EPBC Act.

8.6.3 Environmental Authority

The Environmental Protection Act sets out offence provisions associated with environmental harm. An environmental authority will be required if any prescribed environmental relevant activities (ERAs) are to occur. At this stage, consideration should be given to whether:

- any of the extraction of materials from a watercourse bed or elsewhere during construction will result in the proponent requiring an environmental authority to authorise the extraction under prescribed ERA 16 for extractive activities
- waste management during the construction process will trigger any of the prescribed ERAs associated with waste.

The potential approvals that may be required for the project are listed below.

Table 8.7 : Government approvals

Approval	Legislation	Description/Action	Timing	Responsible authority
Decision on whether project involves a controlled action	*Environment Protection & Biodiversity Conservation Act 1999* (Cth)	A referral under the EPBC Act is to determine whether the action is a controlled project.	Following receipt, the Minister has 20 business days to determine whether the action is a controlled action.	Department of the Environment (Commonwealth)
Application for Infrastructure Designation	*Planning Act 2016* (Qld), section 35	An infrastructure designation of the project under the Planning Act will allow the project to proceed without development permits under the Planning Act.	The application is made once the decision to proceed is obtained. Allow 2–3 months. A consultation period will be required.	Minister for the Department of State Development, Manufacturing, Infrastructure and Planning

Approval	Legislation	Description/Action	Timing	Responsible authority
Development permits	*Planning Act 2016* (Qld) *Planning Regulation 2017* (Qld) *Vegetation Management Act* *Fisheries Act* *Water Supply (Safety and Reliability) Act 2008* (Qld) *Water Act 2000* (Qld) *Nature Conservation Act 1992* (Qld)	Should the designation not be achieved, development permits may be required for the following: • material change of use (solar facility) • operational work that is clearing vegetation • operational work that involves taking or interfering with water under the Water Act • operational work that is constructing or raising waterway barrier works.[33]	Allow up to 6 months. (applicable if Infrastructure Designation does not approve relevant development matters)	State Assessment and Referral Agency
Clearing permit (protected plants)	*Nature Conservation Act 1992* (Qld)	Required if the project will require the clearing of vegetation classified as endangered, vulnerable or near threatened under the NC Act.	Prior to clearing of vegetation	Department of Environment and Science
Damage mitigation permit (removal of wildlife) or species management program (SMP) for tampering with animal breeding place	*Nature Conservation Act 1992* (Qld)	A SMP is required if the project will interfere with a confirmed breeding place of a native animal (endangered, vulnerable, near threatened, special least concern or least concern wildlife under the NC Act). For activities potentially impacting breeding places of endangered, vulnerable or near threatened or special least concern species, a SMP will be required. Desktop investigations have indicated the potential for the project to impact threatened fauna. A DMP may be required for removal and relocation of wildlife during construction works.	Prior to construction	Department of Environment and Science
Development Permit for Environmental Relevant Activities (ERAs)	*Environmental Protection Act 1994* (Qld)	The proponent will be required to ensure that current environmental authorities cover any ERAs for the project.	Prior to construction	Department of Environment and Heritage/State Assessment and Referral Agency
Development permit for building works	*Planning Act 2016* (Qld) *Planning Regulation 2017* (Qld) *Building Act 1975* (Qld)	Not required	Not required	Not required

[33] Schedule 8, Table 4 of the Planning Regulation.

Approval	Legislation	Description/Action	Timing	Responsible authority
Road Corridor Permit	*Transport Infrastructure Act 1994* (Qld)	Conducting activities, works or construction within a State controlled road corridor.	Prior to construction	Department of Transport and Main Roads
Approval to carry out works in a local road	*Local Government Act 2009* (Qld)	Approval is required if local roads will be affected by the construction works.	Prior to construction	Relevant council
Riverine protection permit	*Water Act 2000* (Qld) (section 218)	The permit is required in order to excavate, place fill or destroy vegetation in a watercourse. It may not be required if part of the infrastructure designation proposal.	Prior to construction May not be required if part of infrastructure designation obtained	Department of Natural Resources, Mines and Energy
Fisheries permit	*Fisheries Act 1994* (Qld)	A permit may be required to salvage and relocate fish as part of construction across waterways.	Prior to construction	Department of Agriculture, Fisheries and Forestry
Oversize load permit	*Transport Infrastructure Act 1994* (Qld)	The permit is required for heavy machinery and oversized loads to be transported on the road network.	Prior to construction	Queensland Police
Consideration of any specific approvals/licences	*Work Health and Safety Act 2011* (Qld)	Depending on the chemicals or substances required to be used during construction, certain licences may be required to transport or use dangerous or hazardous materials or liquids.	Prior to construction	

8.7 Recommended next steps

The recommended next steps to be taken to progress the assessment of the environmental impacts of the project are summarised in Table 8.8.

Table 8.8 Recommended next steps

Option	Recommended actions
Option 1: Construct a re-regulating weir on the Boyne River	- Conduct a' self-assessment' of the project on MNES in accordance with the Matters of National Environmental Significance – significant impact guidelines 1.1 (2013) to determine if the project is likely to involve a controlled action. - In conjunction with the self- assessment, conduct a gap analysis of available project information relating to environmental impacts to identify additional technical investigations required to inform understanding of the nature and extent of project impacts on MNES and enable the self- assessment to be completed (e.g. aquatic and terrestrial ecology surveys of project impact area). - Complete the additional technical investigation required to complete the self-assessment - Refer the project to Department of Agriculture, Water and the Environment, if required - Engage with the Office of the Coordinator General to determine the need for an EIS and most appropriate assessment pathway.
Option 4I: Raise Jones Weir, Raise Claude Wharton Weir., build a weir on the Burnett River downstream of the confluence with the Barambah	A coordinated review of the existing environmental assessments and approvals should be undertaken to enable a combined and cumulative appraisal of the environmental impacts of these projects to be undertaken.

Option	Recommended actions
Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	- Review existing environmental assessments and REF (1998) to determine their currency and relevance to the current project. - Engage with DNRME to determine the need for an updated REF (Jones Weir). - Review EPBC Act approval to determine if it remains relevant to the current project (Jones Weir). - Engage with the Department of Agriculture, Water and the Environment to determine the need for amendment of existing approval or rereferral (if required). - Conduct a gap analysis to identify technical field investigations required to update environmental assessments. - Conduct the required field investigations e.g. aquatic and terrestrial ecology surveys to determine the actual presence of protected flora, fauna and/or fauna habitat within the project areas. - Where not already done (or outdated), conduct a 'self-assessment' of the project on MNES in accordance with the Matters of National Environmental Significance – significant impact guidelines 1.1 2013) to determine if the project is likely to involve a controlled action. - Refer the project to the Department of Agriculture, Water and the Environment, if required. - Engage with the Office of the Coordinator General to determine the need for an EIS and most appropriate assessment pathway.
Option 5: Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	- Review existing environmental assessments and REF (1998) to determine their currency and relevance to the current project. - Review EPBC Act approval to determine if it remains relevant to the current project. - Engage with the Department of Agriculture, Water and the Environment to determine the need for amendment of existing approval or rereferral (if required). - Conduct a gap analysis to identify technical field investigations required to update environmental assessments. - Conduct the required field investigations e.g. aquatic and terrestrial ecology surveys to determine the actual presence of protected flora, fauna and/or fauna habitat within the project areas. - Refer the project to Department of Agriculture, Water and the Environment, if required. - Engage with the Office of the Coordinator General to determine the need for an EIS and most appropriate assessment pathway.
Option 4B: Build a pipeline from Paradise Dam to Coalstoun Lakes	- Scope and conduct field investigations e.g. aquatic and terrestrial ecology surveys to determine the actual presence of protected flora, fauna and/or fauna habitat within the project area. - Review existing cultural heritage assessment to determine its currency and relevance to the project. Further cultural heritage field survey may be required. - Engage with the registered Aboriginal parties for the project area to discuss the project, identify matters/areas of interest and significance and scope any additional cultural heritage field survey. - Conduct a 'self-assessment' of the project on MNES in accordance with the Matters of National Environmental Significance – significant impact guidelines 1.1 (2013) to determine if the project is likely to involve a controlled action. - Refer the project to Department of Agriculture, Water and the Environment, if required. - Engage with the Office of the Coordinator General to determine the need for an EIS and most appropriate assessment pathway if required.

9. Sustainability assessment

9.1 Key points

- This chapter assesses the sustainability aspects of the shortlisted options under assessment.
- The options are assessed against the sustainability criteria set out in the Building Queensland guidelines.
- The shortlisted options are categorised into new (build) irrigation and urban, new (build) water re-use and better use.
- Across all categories, the regional context into which the projects will be established is considered thoroughly.
- Significant previous planning has been undertaken for many of the project options under the new irrigation and urban category.
- All projects will add to regional resilience to a variable extent.
- New irrigation and urban projects will have a significantly higher carbon and energy footprint.
- No analysis of the scope 1, 2 and 3 emissions has been undertaken for any of the project options under consideration.
- New irrigation and urban options will have the greatest environmental impacts.
- Key impacts from new irrigation and urban options include construction impacts and impacts on terrestrial and aquatic flora and fauna.
- Some listed threatened species will be impacted by new irrigation and urban projects.
- The new water re-use project seeks to develop a wastewater recycling project for use in an industrial facility.
- Significant stakeholder engagement is occurring across all options.
- The economic benefits of the projects are variable across the categories.
- The new irrigation and urban projects will provide the greatest regional economic benefits, as they will require construction workforces and add to long-term agricultural production.

9.2 Introduction

The shortlisted options have been categorised and then assessed against four aspects of sustainability identified by Building Queensland: governance, environment, social and economic. This chapter builds on previous work done as part of the strategic assessment and options analysis. The outputs of the sustainability assessment have informed the subsequent economic, financial and environmental analysis.

The 10 shortlisted options are categorised as follows:

- Options that require new infrastructure to be constructed to provide additional water for irrigation and urban supply (new irrigation and urban)
- Options that require new infrastructure for water reuse (new water reuse)
- Options that require changes to existing allocations and policies to provide for required supply (better use).

The following table provides a high-level description of the shortlisted options by category and key stakeholders.

Table 9.1: Shortlisted options by category and stakeholders

Category	Option	Stakeholders
New irrigation and urban usage	Construct a re-regulating weir on the Boyne River	Landholders Irrigators Local contractors Local businesses Local government Urban and industrial water users Sunwater Utilities State government departments Traditional owners Environmental groups
	Construct a re-regulating weir on Barambah Creek	
	Build a pipeline from Paradise Dam to Coalstoun Lakes	
	Up to 65,000 ML storage on Barambah Creek and irrigation network	
	Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	
New water re-use	Construct a recycling plant at Swickers facility in Kingaroy	Swickers Urban and industrial water users Local council Landholders Local contractors State government departments
Better use	Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	Stanwell Seqwater State government departments Local government Local businesses Urban and industrial water users Irrigators
	Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water use from Tarong Power Station)	
	Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water use from Tarong Power Station)	
	Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	

9.3 Methodology

Governance sustainability under the Building Queensland guidelines is considered to be the extent to which the project is planned and integrated within the wider system, how the project meets the strategic need identified and leaves a lasting legacy, how a culture of knowledge sharing and innovation has been incorporated into the project design, and how procurement will be undertaken.

The assessment was informed by internal consultation. It is acknowledged that as the options assessment was at an early stage when this assessment was undertaken further workshops will need to occur to refine the sustainability aspects of the project.

As per the Building Queensland detailed business case guidelines, the major issues used to assess sustainability are governance, environment, social and economic. A series of sub-principles as outlined in the guidelines were examined under these major principles and are presented. The level of achievement against each of the principles is rated as either advanced, moderate, basic, compliant or poor. Ratings for each category are described as follows in the Building Queensland framework.

Table 9.2: Sustainability ratings

Rating	Description
Advanced	Generates significant additional value and new opportunities not previously evident, such as changing a liability into an asset. 'Designs out' the problem upfront rather than relying on managing impacts later. Solutions generate benefits outside the project boundary.
Moderate	Solutions to significant issues result in multiple benefits through economic, social and or environmental outcomes. Meets immediate community and user needs and will be resilient and efficient into the future. Significant innovation and leading practice are incorporated into the project.
Basic	Avoids harm and negative effects. Solutions create project efficiencies. Solutions have an immediate or short-term focus.
Compliant	Meets legislative and regulatory requirements.
Poor	Fails to meet legislative and regulatory standards. Solutions may result in dis-benefits and negative effects.

9.4 Sustainability assessment

The following tables outlines the assessment of the governance, environment, social and economic aspects of the shortlisted options by category.

9.4.1 Governance

Table 9.3: Sustainability assessment of governance

Sustainability assessment—Governance	New irrigation and urban projects rating	New water re-use project rating	Better use projects rating
1. Context			
A need to improve the reliability and security of water in the North Burnett and South Burnett regions of Queensland has been identified. The region is already a major producer of agricultural products. It has been identified that the region has extensive areas of underutilised high-quality soils with significant potential for expanded production for domestic and export production. A strategic assessment in line with the Building Queensland guidelines has been completed and the context of the projects is advanced. The shortlisted options have been identified through an extensive process including stakeholder consultation. The specific benefits being sought through the shortlisted options are: • sustained increases in agricultural production • growth of agricultural exports for a wide range of high value crops grown in the region • improved economic resilience through a stronger agricultural sector • improved community resilience through improved urban and industrial water security.	**Advanced**	**Advanced**	**Advanced**
2. Strategic planning			
More than 60 planning studies focused on the issues of additional water supply for the Burnett region were identified in the strategic assessment and options shortlisting process. Existing studies identified three recurring themes for water in the region: 1) The North and South Burnett regions contain significant environmental, climatological and economic advantages for agricultural and industrial enterprises with associated regional economic benefits; 2) Improving water reliability and security is critical to these enterprises and the region; and 3) A range of solutions for the water challenges in the North and South Burnett exist, including some low-cost initiatives that focus on better use of existing resources without the need for large-scale investment.	**Advanced** New build initiatives for irrigation and urban in terms of storages, weirs and pipelines have been relatively	**Moderate** The project involves the construction of a water recycling plant and the current level of strategic planning is appropriate	**Basic** Changing the water supply arrangements to Tarong is complex and involves multiple stakeholders with extensive

	well explored with extensive planning occurring over the past 20 years for some of the individual projects	for options analysis	commercial negotiations required for the project to proceed
3. Sustainable procurement			
Procurement refers to the goods and services used in the construction of the infrastructure. If funding for the project is received, then procurement processes will need to follow the sustainable procurement principles outlined in the Australian Government Sustainable Procurement Guide. The core principle underpinning the guide is value for money, which has also been a key consideration for the development of the projects. Relevant financial and non-financial costs and benefits have been considered over the entire life of the project (financial and commercial analysis and economic analysis). Other procurement practices to enhance sustainability include: ▪ adopting strategies to avoid unnecessary future water consumption during construction ▪ minimising environmental impacts over the life of the infrastructure by using materials with low adverse impacts—for example, using locally sourced materials where possible to minimise climate impacts ▪ fostering innovation in sustainable products and services through the design and construction ▪ ensuring that fair and ethical sourcing practices are applied and that suppliers are complying with socially responsible practices ▪ identifying suppliers that have greenhouse gas reduction and sustainability strategies.	**Advanced** If new build projects proceed, then including sustainable procurement guidelines will meet this rating	**Advanced** If project proceeds, then including sustainable procurement guidelines will meet this rating	**Not assessed** The project involves the use of existing infrastructure
4. Resilience			
The projects will add to the resilience of agricultural production in the Burnett area and add to urban water security.	**Moderate**	**Basic**	**Advanced**
5. Innovation			
The innovation levels of the new build for irrigation and urban are dependent on the final infrastructure options chosen. Innovation in terms of construction and energy and water efficiency will be explored in the project design phases. The new water re-use option is innovative in that it seeks to use a previous waste product and to reduce pressure on urban water supply. The better use options seek to reconfigure existing infrastructure and allocations to meet the service need.	**Moderate** Dependent on innovation being included in detailed infrastructure design	**Advanced**	**Advanced**

9.4.2 Environment

Table 9.4: Sustainability assessment of the environment

Sustainability assessment—Environment	New irrigation and urban projects rating	New water re-use project rating	Better use projects rating
6. Energy and carbon			
The energy and carbon footprint of the new build for irrigation and urban will be significant. Construction and operational activities will have a significant carbon footprint. Pumping associated with the movement of water through the associated irrigation infrastructure will add to the carbon and energy footprint of the project. Sourcing materials from local suppliers will reduce the carbon intensity of the construction activities. Using the water from the project to grow food for the expanding Queensland market will reduce the need for importing food from interstate with the associated carbon- and energy-related consequences. Sourcing materials from local suppliers could reduce the carbon intensity of the construction activities. Procurement of construction and materials could identify suppliers that have greenhouse gas reduction and sustainability strategies in place. The increased agricultural activities due to increased water availability could result in land clearing and increased use of fossil fuels, which contribute to greenhouse gas emissions. The carbon and energy footprint of the new water re-use option will be minor with design opportunities to reduce impacts. The carbon and energy footprint of the better use will relate to the changes in the current system configuration. High-level modelling of carbon emissions and energy use for scope 1, 2 and 3 emissions for operational and construction impacts has not been undertaken for the new build options at this stage.	**Compliant**	**Compliant**	**Compliant**
7. Green infrastructure			
No opportunities to provide green infrastructure solutions have been identified to any significant degree at this stage in the option development.	**Not applicable**	**Not applicable**	**Not applicable**
8. Environmental impacts			
Key environmental impacts that have been identified as part of the new build for irrigation and urban projects in previous planning studies include: • vegetation clearing • flora and fauna impacts • impacts on listed EPBC species such as Brigalow, lowland rainforest and lungfish. • impacts on waterways from changes in flow regimes • impacts on riparian zones and stream stability • groundwater impacts • surface water impacts • construction impacts—dust, noise, air quality • additional greenhouse gas. The major environmental impacts of the new water re-use project will be increased energy usage and the disposal of biosolids. The better use options will not have any significant additional environmental impacts.	**Compliant**	**Moderate**	**Moderate**
9. Resources			

The new water for irrigation and urban will have the most significant impacts on resource use requiring additional construction activities. Waste could be generated by construction activities during the construction phase including earth, rock, vegetation matter, excess construction materials and oils. Runoff from exposed areas of land may also occur. Waste would be managed in accordance with an approved environmental management plan. Waste generation could be minimised through all materials that can be recycled being processed through local recycling facilities.	**Basic**	**Moderate**	**Advanced**
10. Water			
Water usage for productive purposes will increase under the new build for irrigation and urban options. Additional water usage during construction of the infrastructure supporting these options will be minimal. The new water re-use option will seek to more efficiently utilise an existing water source. The better use option can be expected to increase overall water consumption though under some of the options in this category greater usage will be made of manufactured water from the Western Corridor Recycled Water Scheme.	**Basic**	**Advanced**	**Moderate**

9.4.3 Social

Table 9.5: Sustainability assessment of social aspects

Sustainability assessment—Social	New irrigation and urban projects rating	New water re-use project rating	Better use projects rating
11. Stakeholder engagement			
A structured program is being undertaken to consult with targeted groups and representatives through meetings in person, phone calls, workshops, presentations and written communications. During the options analysis phase of the project, initial community and stakeholder engagement occurred. Engagement was intentionally collaborative, with most stakeholder engagement taking the form of workshops and discussions. Stakeholder engagement took place within the Project Working Group and Project Steering Committee, which represents a broad cross-section of interested parties.	**Advanced**	**Moderate**	**Moderate**
12. Heritage			
The new water for irrigation and urban projects will have the most significant impacts on heritage values. Previous planning studies have identified traditional owner and European heritage values that will be impacted. The heritage impacts of the options is expected to be minimal.	**Basic**	**Moderate**	**Moderate**
13. Workforce sustainability			
The increases in water availability under all the options will add to the long-term sustainability of the workforce in the region for agricultural production and urban supply to varying extents. The new build for irrigation and urban and better use will provide substantially more water access.	**Moderate**	**Basic**	**Moderate**

9.4.4 Economic

Table 9.6: Sustainability assessment of economic aspects

Sustainability assessment—Economic	New irrigation and urban projects rating	New water re-use project rating	Better use projects rating
14. Options assessment and business case			
The options are currently under assessment. Previous studies of the new build options have completed various elements of analysis consistent with a business case. The preferred options will be further investigated through a detailed business case process in alignment with Building Queensland guidelines.	**Moderate**	**Basic**	**Basic**
15. Benefit realisation			
Within the region, security of urban water supply is poor and deteriorating, harming community welfare and limiting industrial expansion. Existing agricultural supplemented water allocations are highly unreliable, resulting in reduced agricultural output, jobs and investment. Large areas of fertile land have no access to a reliable source of water hindering crop yields, values, diversity and the expansion of exports due to dependence on unreliable seasonal rains. The benefits sought from the project are: • sustained increases in agricultural production • improved community (urban) resilience • improved economic resilience • growth of efficient local supply chain industries.	**Moderate**	**Basic**	**Moderate**

9.5 Conclusions

Significant planning has been undertaken previously for many of the project options in the new irrigation and urban category. All projects will add to regional resilience, to a variable extent.

New irrigation and urban projects will have a significantly higher carbon and energy footprint. Likewise, new irrigation and urban options will have the greatest environmental impacts.

Key impacts from new irrigation and urban options include construction impacts and impacts on terrestrial and aquatic flora and fauna. Some listed threatened species will be impacted by new irrigation and urban projects.

The new irrigation and urban projects will provide the greatest regional economic benefits, as they will require construction workforces and add to long-term agricultural production.

10. Willingness and capacity to pay

10.1 Summary

This section identifies the likely amount that might be paid for water in specific areas of the North Burnett and South Burnett. It also identifies the uncertainties that still exist.

This assessment focused on the capacity and willingness to pay of water users in each region. This was done using:

- interviews and consultation with local stakeholders
- water trading data analysis
- a net margin assessment.

In some instances, previous demand assessments have been undertaken, which provided further guidance.

10.2 Interviews and consultation

Jacobs conducted targeted interviews and consultation with water customer representatives from each of the region's water supply schemes. These interviews helped test and reconfirm the assessment metrics. They also improved the understanding of the appropriateness of the net margins and water trading analysis, and the current and future crop mix and water use for each shortlisted option. The table below outlines the results of these interviews.

Table 10.1: Willingness to pay interviews and consultation

Water supply scheme	Demand information collected	Consultation	Consultation findings
Barker Barambah (Barlil Weir)		Jacobs conducted site visits and one-on-one conversations with over 10 irrigators in the Barker Barambah Scheme in addition to 6 Moffatdale irrigators. Jacobs spoke with two representatives from the Barker Barambah Boyne River, including the chairperson.	• Cotton is the largest crop type in the region. Customer representatives in the area confirmed that expansion would occur, subject to additional water availability. • Wheat is often grown in rotation with cotton and would expand with cotton. • Lucerne hay is being grown by Moffatdale irrigators. It is a strong commercial crop when water reliability is low. Growers would double production with greater reliability and/or more water resulting from Barlil Weir.
Boyne River & Tarong (Boyne River Weir)	Permanent sales of high priority water to citrus growers at $2,000/ML have occurred in region significant amounts of medium priority water at the current reliability have also been acquired at $800–$1,000/ML. Smart Berries could conservatively expand between 50–100 ha which would result in an increase in usage of 250–500 ML. Quebec Citrus uses about 900 ML per annum of 200 ha of citrus. It could expand up to 250 ha on the existing farm. This would result in an increase in usage of 200–600 ML. It values medium priority water at $500/ML and have bought water in the past from unused sleepers.	Jacobs conducted multiple one on one conversation with 5 to10 irrigators in the region. Jacobs spoke with two representatives for the Boyne River including the chairperson of the Boyne River and Tarong's Irrigator Advisory Committee.	• Customers representatives highlighted the growth in table grapes, pecans and avocados in the area. • Citrus (mandarins) is still the largest perennial crop in area (over 5 farms producing). One of the largest producers in the region, Quebec Citrus, could expand up to 250 ha on existing farm. This would result in an increase in usage of 200–600 ML. • Large capital investments have been made by Smart Berries in the region. The current farm manager outlined plans for expansion if water was available. Estimates are that Smart Berries could conservatively expand between 50 and100 ha, which would result in an increase in usage of 250–500 ML. • Consultation highlighted the growth in pecan farming in the area (2 known farms expanding). Strong evidence exists that pecans can be grown successfully in the area. Expansion is based on getting more water. One irrigator outlined that if they were to get more yield that has sufficient volume, then they could process on site. • The Burnett is one of the fastest-growing wine areas in Queensland. Customers representatives highlighted the growth in table grapes in the area. • Consultation confirmed that many irrigators would use the increase in reliability as part security water and part expansion depending on the individual circumstances. The combined water security for citrus farmers (scheme plus on-farm storages and investment) used to give 3–5 years'

Water supply scheme	Demand information collected	Consultation	Consultation findings
			water security. However, revised security is now 2.5 years (2–3 years), which causes genuine stress in the farming community. It also prevents planting of new trees from the nursery—so the opportunity cost is forgone expansion of citrus or other crops. • There was a minor adjustment to the blueberry net margin. Respondents agreed with the revised crop mix and net margins. It was agreed broadly that citrus margin was conservative. Local reports and assessments helped develop the pecans and table grapes net margins. • The region has proven that it can provide, house, attract and sustain international workers (backpackers). It also has access to markets including Wellcamp Airport (which means 24 hours to Asian breakfast tables) and Brisbane.
Coalstoun Lakes	Coalstoun Lakes Development Group provided willingness to pay for the proposed irrigation scheme estimated the upfront customer contribution to be $1,400/ML (total contribution of $29 million). One of the key findings from the local consultation was the desire for the region to transition into an irrigation area focusing on high-value crops (including irrigated peanuts, green vegetables and macadamias). Currently, rainfed broadacre cropping is the primary land use.	Jacobs conducted multiple visits to Coalstoun Lakes for discussions in person and workshops with 12 of the largest irrigators in the region. Jacobs also spoke with three representatives from the Coalstoun Lakes Development Group—due to Covid-19 restrictions, these were conducted over the phone.	• Positive responses in support of the project and to purchase water were received in most cases. Respondents supported the proposed crop mix and net margins. There was a minor adjustment to the water use and yield of the peanut and corn net margins. • Growers in the region have indicated that they would predominately undertake irrigated peanut cropping in the first one to three years before a gradual conversion to more capital intensive and larger downside risk perennial and high value tree crops, once more reliable water is available. Corn is currently is one of the other main broadacre rotation crops in the region. Growers used it in rotation with peanuts. • The region has the correct soils and ability to grow green vegetables. Limited access to water has restricted the expansion of cropping in the area. The expectation is that there will be a slower uptake in this crop mix as the region transitions. It is expected to also attract outside investment from the broader Wide Bay–Burnett area. • Many growers in the region have indicated that they would predominately undertake a gradual conversion to more capital intensive and larger downside risk perennial and high-value tree crops, particularly macadamias. There is also strong soil suitability in the area which will also attract outside investment in macadamias from the broader Wide Bay–Burnett area. • There is a known track record of melons being grown in the region. Talks were held with three farmers in the region to determine water use,

Water supply scheme	Demand information collected	Consultation	Consultation findings
			margins and yield. Many are having success using drip tape to grow seedless melons. Further growth in melon production would occur with greater access to water. • Consultation confirmed the upfront cost per hectare of $5,000 for the areas crop mix.
Blackbutt customers	Jacobs' assessment revealed non-binding expression demand of 2,500 ML with an upfront payment of $850/ML and an annual charge of $1,200 ML (see table 1.4 for details).	A preliminary demand assessment was conducted with more than 15 irrigators and customers in the region. This process was conducted through in-person discussions and over the telephone.	• Positive responses were received in support of shortlisted option, as well as a strong uptake in the demand assessment process. • Crop mix and net margins were sourced directly from information received during consultation process. There is strong demand for continued expansion of avocado production. • Customers in the region are already currently paying $1,100/ML annual charge for water.

10.2.1 Blackbutt irrigators

The demand assessment undertaken with the potential customers in Blackbutt resulted in demand provided as non-binding expression of interests. The demand assessment assumed an upfront capital contribution for water of $850/ML.

The annual charge was estimated to be $1,200/ML. Irrigators provided the non-binding demand shown in Table 10.2.

Table 10.2: Blackbutt irrigation non-binding expressions of interest

Name	Entity name	Enterprise	Low (ML)	Likely (ML)	High (ML)
Names removed for publication	Entity name removed for publication	Avocados	450	525	600
		Vegetables	400	400	400
		Avocados	275	288	300
		Irrigation	175	188	200
		Avocados	150	163	175
		Irrigation	150	163	175
		Avocados	100	115	130
		Avocados	50	75	100
		Vegetables	50	60	70
		Avocados	40	58	75
		Irrigation	50	50	50
		Recreation	40	45	50
		Macadamias and lychees	10	13	15
		Avocados	100	200	300
		Vegetables	25	38	50
		Avocados	20	35	50
		Vegetables	15	33	50
		Avocados	10	30	50
		Vegetables	-	25	50
Total			**2,110**	**2,500**	**2,890**

The information provided by irrigators suggests that approximately 2,500 ML could be purchased at the assumed price.

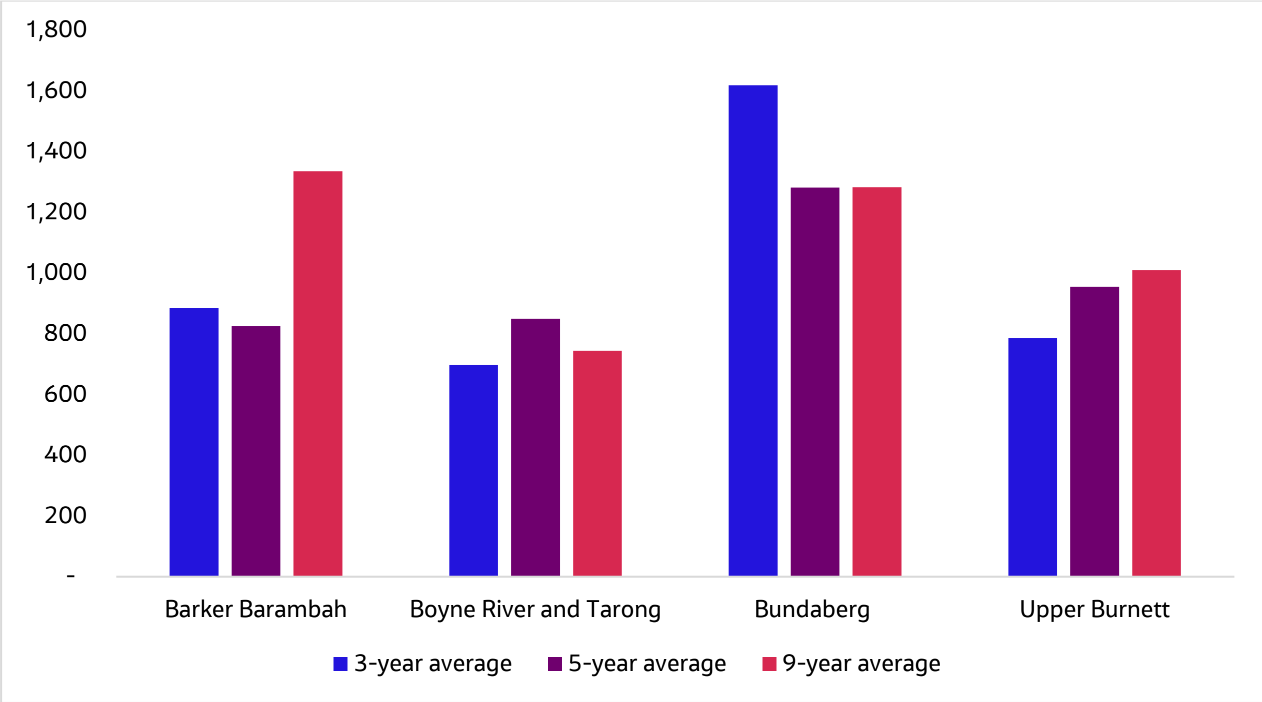
10.3 Revealed capacity to pay: water trading

The prices paid by irrigators for medium priority water in the trading market are a relatively objective and robust means of identifying the value that customers place on water where there is regular water trading. Water trades for high values in a scheme suggest that irrigators expect a high return on agriculture into the future and that there is likely to be a high capacity to pay for additional water.

DNRME records the volume and trading value of all permanent transfers of water allocations. The best data is for trades of allocations in bulk water supply schemes. Although this provides an indication of the relative willingness to pay, the water allocations in each region are not perfectly comparable. The reliability, or years a full allocation is available, of medium priority allocations usually used for agriculture varies from region to region. Further, the volumes of trades are relatively low in any given year, so the tradeable value should be used in isolation of other evidence.

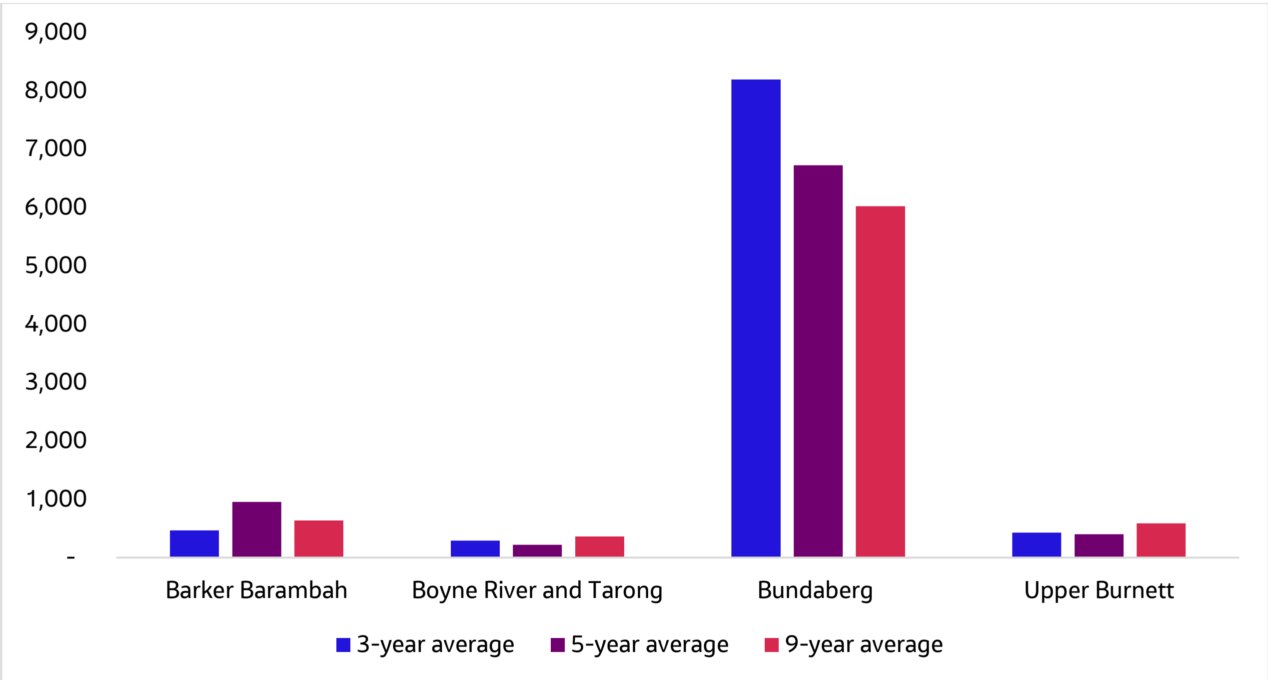
Jacobs has reviewed the historical water trading data for water supply schemes within the Burnett Basin.

Figure 10.1: Weighted average price ($/ML)—permanent medium priority water allocation trades



The weighted average price has remained relatively consistent during the assessment period. Across all supply schemes the five-year weighted average price is over $800/ML for medium priority water.

Figure 10.2: Total volume (ML/a)—permanent medium priority water allocation trades



The total volume of water traded in each scheme has remained relatively stable, except for Bundaberg, which has seen significantly higher volumes traded in recent years. This is likely due to developments around Paradise Dam. Structural problems have led to reducing the amount of water held in the dam, reducing the amount of water available for irrigation.

Water trading values and what they mean for capacity to pay are summarised in the table below.

Table 10.3: Summary of Burnett Basin Medium Priority water trading values

Water supply scheme	Average traded price over recent 5 years ($/ML)
Barker Barambah	$850
Boyne River & Tarong	$700
Bundaberg	$1,280
Upper Burnett	$950

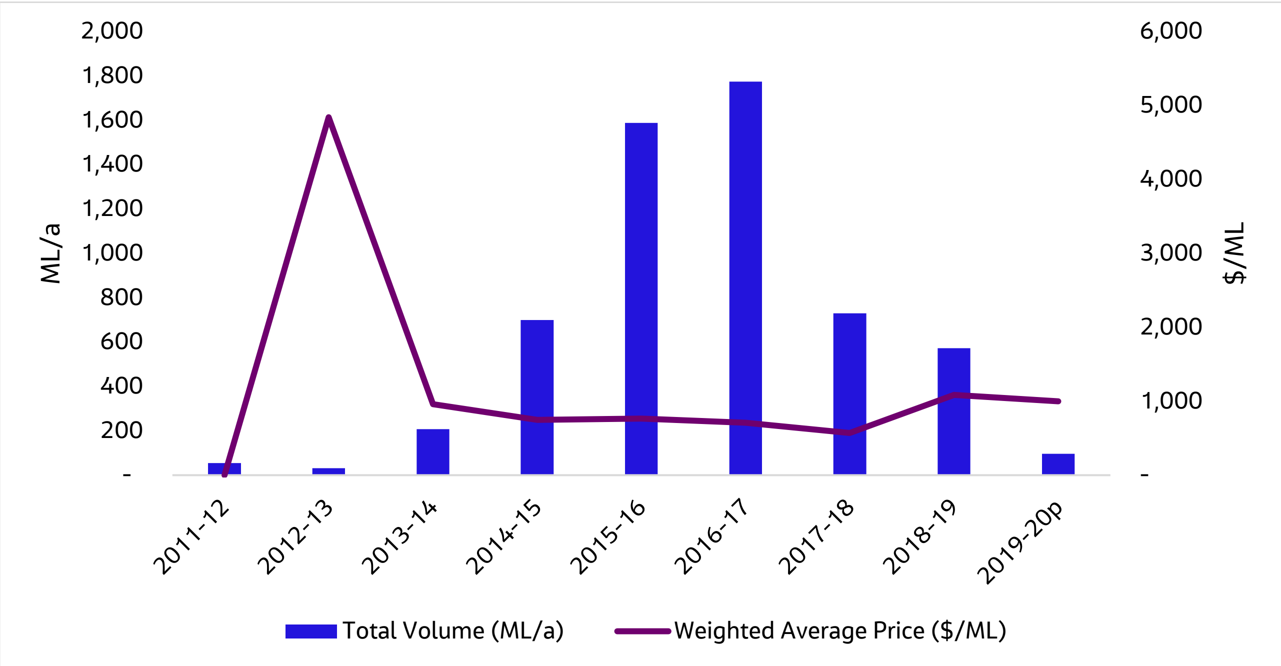
The following section provides a breakdown of this analysis for each water supply scheme in the region.

10.3.1 Barker Barambah

In the Barker Barambah Scheme, water has been traded at an average of $850/ML over the most recent five years. An average of 952 ML was traded each year. Water volumes have been lower than the historical average over the last three years.

Figure 10.3 outlines the historical total volumes and prices for medium priority water in the Barker Barambah scheme.

Figure 10.3: Barker Barambah—permanent medium priority water allocation trades

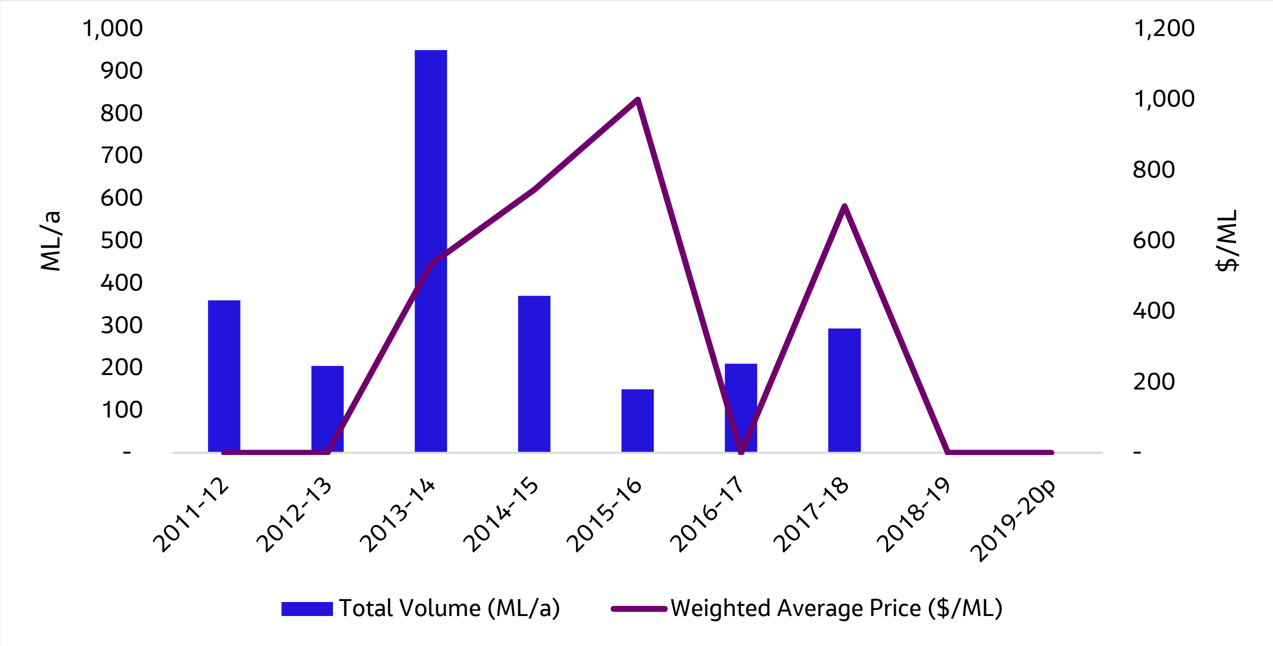


10.3.2 Boyne River and Tarong

In the Boyne River and Tarong Water Supply Scheme, water has been traded at approximately $700/ML over the most recent five years. In 2016 water traded at $1,000 ML. Trading volumes in this scheme have been considerably lower than others in the region, with some years recording no valued permanent trades at all. The average volume traded in the last five years was 218 ML per year (approximately 2 per cent of total medium priority volumes)

Figure 10.4 outlines the historical total volumes and prices for medium priority water in the Boyne River and Tarong scheme.

Figure 10.4: Boyne River and Tarong—permanent medium priority water allocation trades

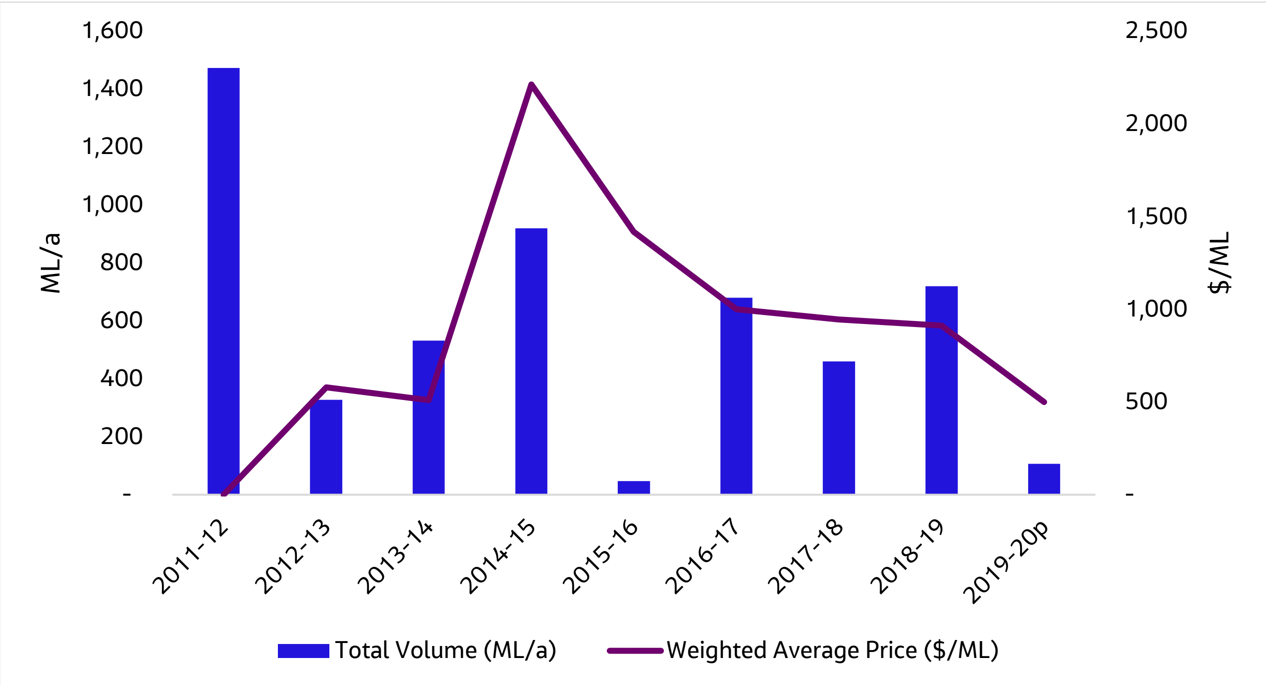


10.3.3 Upper Burnett

In the Upper Burnett scheme, water has been valued by customers at approximately $950/ML over the most recent five years. This is consistent with the nine-year average of $1,000/ML.

The average volume traded over the last five years is just over 400 ML per year. This has fluctuated between 47 ML recorded in 2016 to 919 ML in 2015. Figure 10.5 outlines the historical total volumes and prices for medium priority water in the Upper Burnett scheme.

Figure 10.5: Upper Burnett—permanent medium priority water allocation trades



10.4 Net margin and profit analysis

An analysis of net margins (i.e. profit per megalitre of water applied to a crop) can also provide an indication of a customer's capacity to pay for water. Jacobs has examined net margins for typical enterprises that may benefit from the shortlisted options.

10.4.1 Methodology

Each crop has a different net margin, depending on the yield, costs, and commodity prices. It is also often specific to an area (e.g. Coalstoun Lakes). Profit will also vary across farms and seasons.

Jacobs determined the net margins for each crop in the respective sub-regions through the following steps:

1) Undertaking a review of current agricultural production within North Burnett and South Burnett (using ABS agricultural production and ABARES data).
2) Undertaking a literature review of crop and soil suitability in each specific area. From that, it could be determined what has been and can be grown, and if the correct soil suitability allows for higher value crops to be grown with greater water reliability.
3) Deriving gross and net margin data from the Queensland Government's Agbiz and AgMargins websites. These were modified to reflect regional growing conditions, water requirements, and recent prices. Jacobs also reviewed previous literature on the region to compare and update crop margin information.
4) Consulting directly, which resulted in local producers' region-specific crop yields, water application and costs being provided.
5) Updating the net margins for each sub-region, based on the local evidence, and conducting interviews to determine the extent of stakeholder's agreement with the net margin used for assessing each shortlisted option.

Once the net margins were calculated, they were then converted to a net present value with an investment profile of 20 years and discount rates of 10–15 per cent to account for uncertainty. The average water use percentage for each WSS was used to adjust the NPV of each net margin so that it could be compared with the scheme specific permanent water trading data.

In summary, a low return required increases the NPV of water per megalitre, which increases the capacity to pay for water as an input cost. By contrast, a high-return expectation reduces the NPV of the net margin, reducing the capacity to pay for water as an input cost. An irrigator seeking higher returns will expect lower input costs.

The following section outlines a summary of the chosen net margins for each crop type by sub-region. A full breakdown is provided in chapter 12.

10.4.2 Barker Barambah (Barlil Weir)

The following table outlines the net margins relevant to Barker Barambah irrigators. The method to select the crops, and their weightings, are described in Appendix I. The margins were annualised to allow comparison of annual and tree crops.

Table 10.4: Annual net margin comparison—Barker Barambah

Item	Cotton	Lucerne hay	Navy beans	Wheat	Citrus	Table grapes	Peanuts
Gross margin ($/ha)	2,768	2,335	957	553	27,111	10,000	3,200
Irrigation water use required (ML/a)	7	12	3	4	10	6	3
Upfront fixed costs ($/ha)	9,065	–	5,000	2,000	100,000	20,000	5,000

Item	Cotton	Lucerne hay	Navy beans	Wheat	Citrus	Table grapes	Peanuts
Ongoing fixed costs ($ per annum)	100,000	667	15,000	180,000	180,000	75,000	45,000
Net Margin ($/ha)	1,752	1,668	404	212	24,025	6,902	2,617
Net margin ($/ML)	**270**	**139**	**135**	**53**	**2,403**	**1,150**	**872**

The net margins for these crops vary from $53/ML for wheat to $2,403/ML for citrus. The weighted net margin for the proposed crop mix used to assess the economic benefit of Barlil Weir is $396/ML of delivered water

The scheme-specific historical average water use of 43 per cent was used to adjust the net margins of the selected Barlil Weir crops over 20 years, to give an indication of the capacity to pay the upfront capital charge.

Table 10.5: Adjusted net margins of selected Barlil Weir crops ($/ML)—NPV over 20 years

Discount rate	Weighted crop mix	Cotton	Lucerne hay	Navy beans	Wheat	Citrus	Table grapes	Peanuts
Low (10%)	1,458	994	512	497	195	8,847	4,234	3,210
Medium (12%)	1,240	845	435	423	166	7,525	3,601	2,731
High (15%)	1,072	731	376	365	143	6,504	3,113	2,360

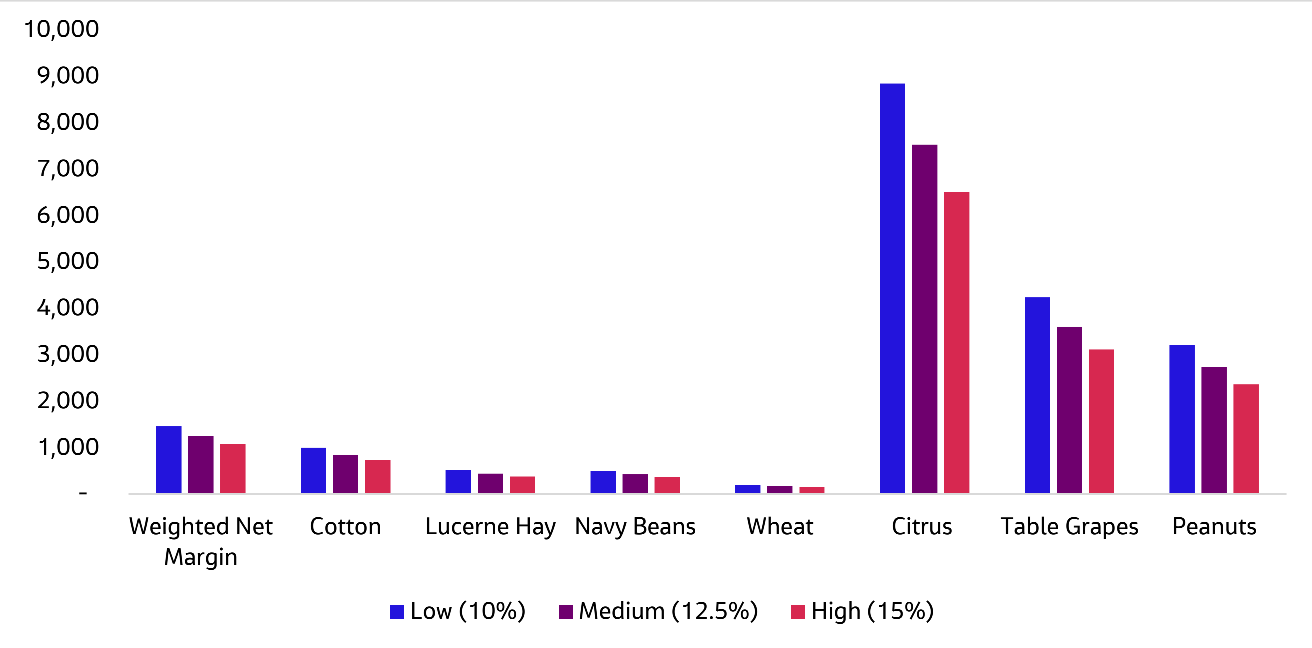
The adjusted net margins range from $143/ML for wheat to $8,847/ML for citrus and tree cropping.

The crop mix proposed to calculate the economic benefit of Barlil Weir has a weighted adjusted net margin of $1,072/ML to $1,458/ML.

The region's weighted crop mix has a significant allocation in broadacre cropping, reflecting the current practices. It is important to note that most of these crops will be unable to meet this level without using a greater portion of the individual crops' net margin to purchase water. If the proposed shortlisted option is to be viable, there will have to be a transition into higher-value cropping. We have already seen this start to occur in very small instances, and with greater water security this would need to continue.

Our assessment suggests that there is some probability that the new supply will not be taken up. There is evidence to suggest that the current weighted crop mix in the region does not have the capacity to afford the shortlisted option, without some transformation into higher-value crop production.

Figure 10.6: Adjusted net margins of selected Barlil Weir crops ($/ML)—NPV over 20 years



10.4.3 Coalstoun Lakes

The following table outlines the net margins for crop relevant to Coalstoun Lakes. The margins were annualised to allow comparison of annual and tree crops.

Table 10.6: Annual net margin comparison—Coalstoun Lakes

Item	Peanuts	Beans (green vegetables)	Macadamias	Melons	Corn
Gross margin ($/ha)	3,200	800	32,500	4,087	1,200
Irrigation water use required (ML/a)	3	3	12	3	5
Upfront fixed costs ($/ha)	5,000	-	5,000	5,000	5,000
Ongoing fixed costs ($ per annum)	45,000	10,000	180,000	50,000	12,500
Net margin ($/ha)	2,617	700	19,611	3,184	672
Net margin ($/ML)	**872**	**233**	**1,634**	**1,061**	**134**

The net margins for these crops vary from $134/ML for corn to $1,634/ML for peanuts. The weighted net margin for the proposed crop mix used to assess the economic benefit of Coalstoun Lakes is $773/ML.

The upfront capacity to pay for water is the net present value of the net margin. For this analysis, we used a 10 per cent, 12 per cent and 15 per cent discount rate to represent a return on capital, and the risk involved in agricultural production.

The proposed specific average water use of 70 per cent was used to adjust the net margins of the selected Coalstoun Lakes crops.

Table 10.7: Adjusted net margins of selected Coalstoun Lakes crops ($/ML)—NPV over 20 years

Discount rate	Weighted crop mix	Peanuts	Green vegetables	Macadamias	Melons	Corn
Low (10%)	4,607	5,197	1,389	9,738	6,323	799
Medium (12%)	3,918	4,420	1,181	8,283	5,378	679
High (15%)	3,387	3,821	1,021	7,159	4,649	587

The adjusted NPV of the net margins range from $587/ML for corn to $9,738 for macadamias.

The crop mix proposed to calculate the economic benefit of the Coalstoun Lakes options has a weighted adjusted net margin of $3,387/ML to $4,607/ML. Given the large sunk capital costs of permanent plantings and downside risk involved with perennial crops, customers require a much higher return to warrant investment.

It is important to note that most broadacre cropping in the region will be unable to meet this level without using a greater portion of the individual crops net margin to purchase water.

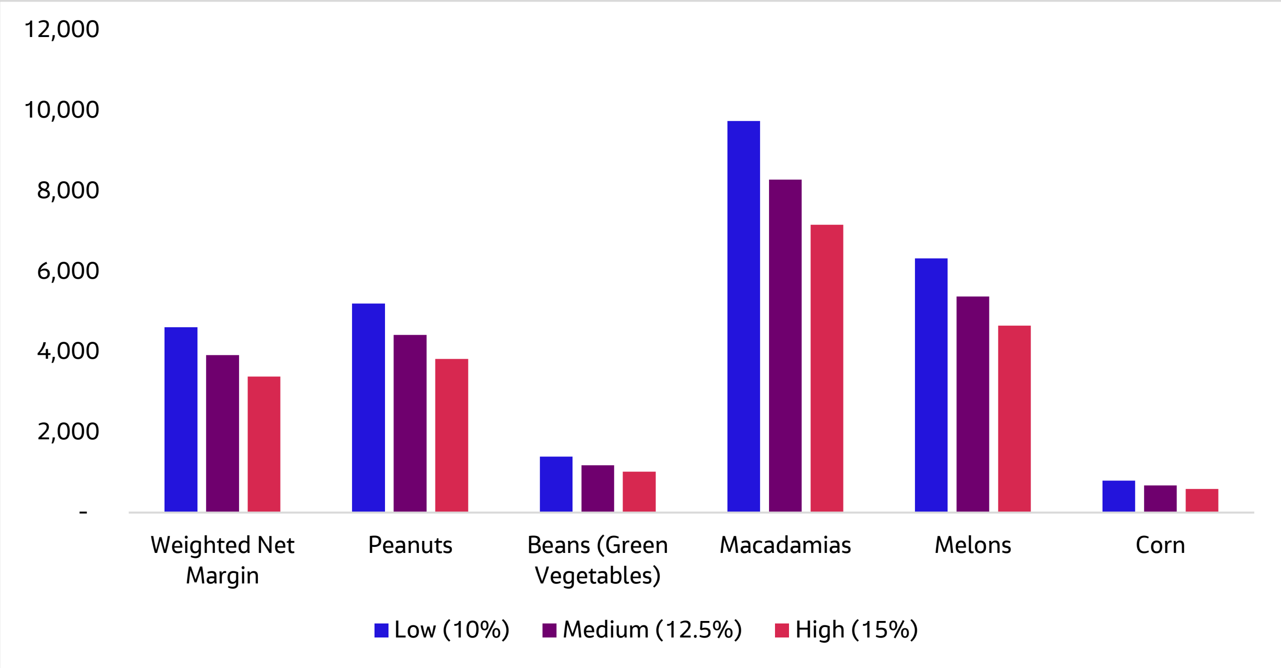
The previous investigation conducted by the Coalstoun Lakes Development Group into the willingness to pay for the proposed irrigation scheme estimated the upfront customer contribution to be $1,400/ML (total contribution of $29 million). Our estimate is that there is potentially a greater capacity to pay, based on net margins of likely crops, than the previous assessment.

One of the key findings from the local consultation was the desire for the region to transition into an irrigation area focusing on high-value crops (including irrigated peanuts, green vegetables and macadamias). Currently, rainfed broadacre cropping is the primary land use.

Many growers in the region have indicated that they would predominately undertake irrigated peanut cropping in the first one to three years before a gradual conversion to more capital intensive and larger downside risk perennial and high value tree crops (particularly macadamias), which generate a much higher net margin. The cost of the water and the suitability of soil would drive this transition over time. As this occurs it is expected that the permanent water trading price will be driven up to the match the higher value production that is assumed to occur.

Based on this assessment, we conclude that the evidence to support a willingness and capacity to pay for water for Coalstoun Lakes at or above the current value of permanent trading. However, there would need to be a transition into high-value crops to further support the viability of the shortlisted options.

Figure 10.7: Adjusted net margins of selected Coalstoun Lakes crops ($/ML)—NPV over 20 years



10.4.4 Boyne River weir

The following table outlines the net margins examined for the short-listed options that benefit the Boyne River irrigators. The margins were annualised to allow comparison of annual and tree crops.

Table 10.8: Annual net margin comparison—Boyne River

Item	Blueberries	Mandarins	Pecans	Mungbeans	Mangoes	Avocados	Table grapes
Gross margin ($/ha)	111,403	25,288	13,500	511	7,079	32,957	10,000
Irrigation water use required (ML/a)	10	6	4	3	6	7	6
Upfront fixed costs ($/ha)	100,000	100,000	20,000	2,500	26,762	40,000	20,000
Ongoing fixed costs ($ per annum)	100,000	180,000	180,000	10,000	180,000	180,000	75,000
Net margin ($/ha)	90,899	13,566	18,889	210	2,124	21,248	6,902
Net margin ($/ML)	**9,090**	**2,261**	**4,722**	**70**	**354**	**3,035**	**1,150**

The net margins for these crops vary from $70/ML for mungbeans to $9,090 for blueberries. The weighted net margin for the proposed crop mix used to assess the economic benefits of Boyne River Weir is $3,322/ML.

The scheme specific historical average water use of 51 per cent was used to adjust the net margins of the selected Boyne River Weir crops.

Table 10.9: Adjusted net margins of selected Boyne River crops ($/ML)—NPV over 20 years

Discount rate	Weighted crop mix	Blueberries	Mandarins	Pecans	Mungbeans	Mangoes	Avocados	Table grapes
Low (10%)	14,467	39,468	9,817	20,503	304	1,537	13,178	4,993
Medium (12%)	12,305	33,570	8,350	17,439	259	1,307	11,209	4,247
High (15%)	10,637	29,018	7,218	15,074	223	1,130	9,689	3,671

The adjusted NPV of the net margins range from $223/ML for mungbeans to $39,468 for blueberries. The crop mix proposed to calculate the economic benefit of the Boyne River Weir option has a weighted adjusted net margin between $10,637/ML to $14,467/ML.

The region has significant investment in permanent plantings and perennial crops which have a greater ability to pay for water but warrant a higher return due to the downside risk involved.

The analysis of the Boyne River and Tarong Water Supply Scheme permanent water trading revealed the average price of medium priority trades was approximately $700/ML, with the highest year being 2016 where trades averaged $1000/ML. Trading volumes in this scheme has been considerably lower than others in the region, with some years recording no valued permanent trades at all.

There currently is a large discrepancy between the capacity to pay from the crops grown in the region to the historical permanent water trading in the scheme.

Historically, medium priority water allocations in the Boyne scheme has been unreliable. In the last 17 years, medium priority allocation holders have only received their full allocation for the whole year four times. For irrigators in the region this does not provide the assurance to maximise planting and use their full entitlement each year. The historical average water use from MP customers is around 51 per cent over the last 10 years. This is primarily due to the volatile nature of the announced allocations and customers taking a conservative approach and keeping a large portion of their entitlement in reserve for worst case scenarios. This reserve essentially creates a proxy reliability level equal to what is required for the security of the specific crop. This means investment decisions within the scheme are based on the worst year rather than the typical average year.

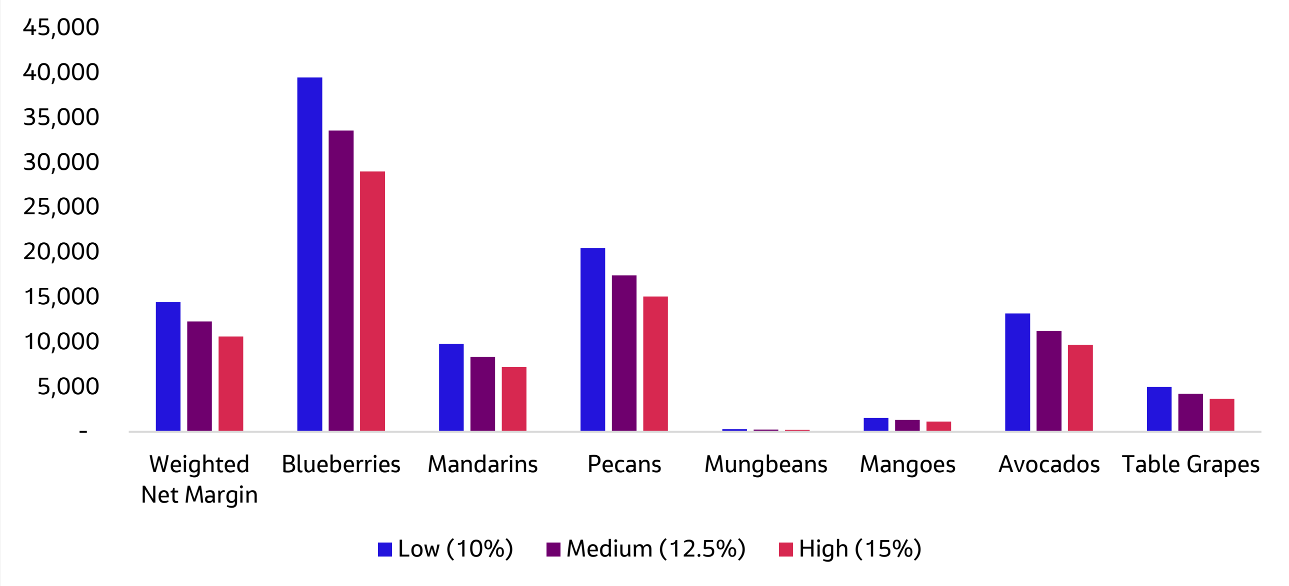
Customer representatives within the scheme highlighted the growth that is occurring in high-value cropping including expansion of table grapes, pecans and avocados, as well as the mandarin export opportunities. There is evidence within the scheme that customers are willing to pay greater amounts to acquire higher reliability water. Permanent sales of High Priority water to citrus growers at $2,000/ML have occurred in region. Medium priority water at the current reliability have also been acquired at $800/ML to $1,000/ML.

The current price of medium priority water in the permanent market is reflective of a product that is unreliable and offers customers minimal upside for their investment. Customers are currently implementing their own water security factor and risk management practices to create a reliability level that is suitable to the enterprise grown. This can be a costly exercise and the appetite to expand is low.

During consultation with local irrigators, there was evidence of a significant level of unmet demand and expansion in high value horticulture in the region. The primary factor outlined by customers restricting this expansion was reliability rather than new water.

Our assessment suggests that there is a high probability that the new supply will be taken up. There is evidence of a capacity to pay through the weighted net margins in the region and a willingness to pay that is higher than the average permanent trading value to support this conclusion.

Figure 10.8: Adjusted net margins of selected Boyne River crops ($/ML)—NPV over 20 years



10.4.5 Blackbutt irrigators

Our conversations asked growers what crops they would likely irrigate with this new water. The crop type and portion of new water used is provided in Figure 10.9.

Figure 10.9: Result from the Blackbutt interviews

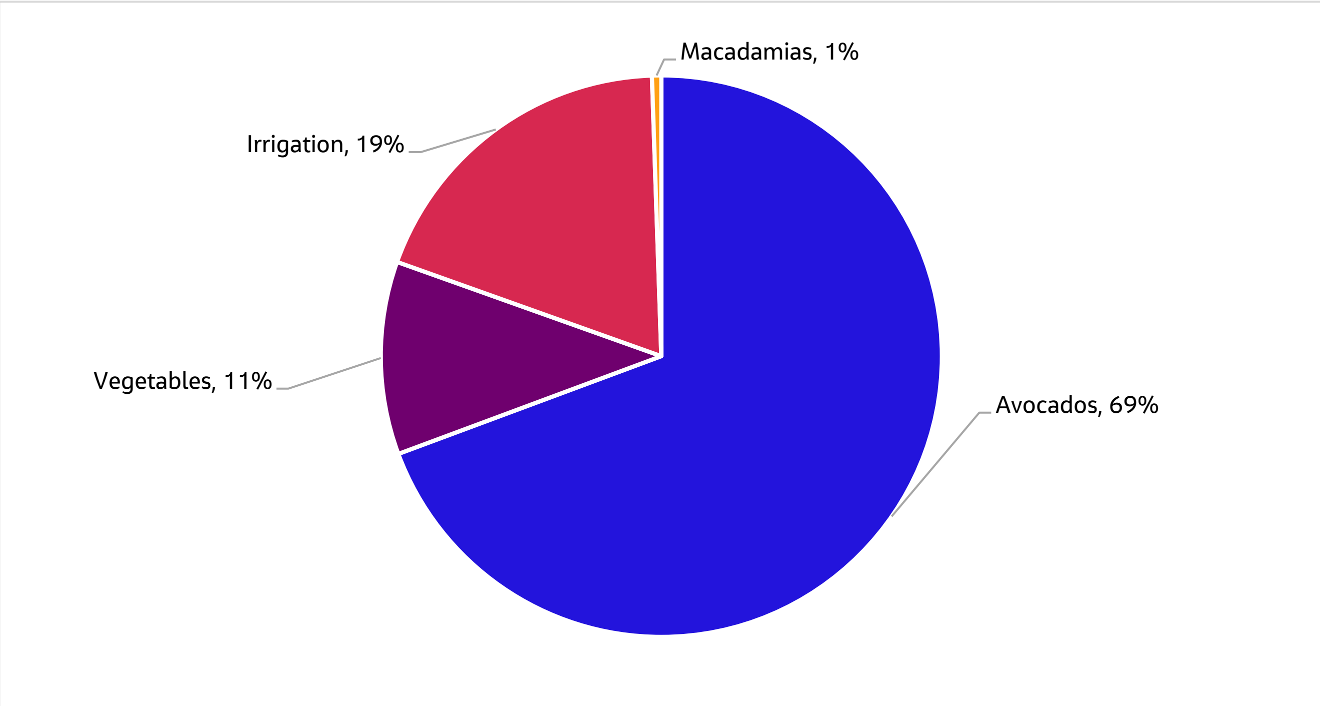


Table 10.10: Capacity to pay an upfront charge

Location	NPV weighted net margin for proposed crop mix over 20 years ($/ML)	5-year historical average value of medium priority permanent trading ($/ML)	Estimated capacity to pay	Comments
Barker Barambah (Barlil Weir)	1,072–1,458	850	1,000	The agricultural production will need to continue its progression towards higher value crops such as citrus, grapes and peanuts. This transition is occurring, and we expect it will accelerate should additional water become available.
Boyne River & Tarong (Boyne River Weir)	10,637–14,467	700 (upper limit 1,000)	n.a.	The proposal is to increase the reliability of water delivery, not increase the volume of water allocations. Consequently, there will be no upfront capital charge
Coalstoun Lakes	3,387–4,607	n.a.	$1,400	The irrigators have already proposed an upfront capital charge of $1,400. Based on net margins analysis, this is within their capacity to pay.
Blackbutt Customers	9,689 (avocadoes)	n.a.	850	The customer interviews revealed a willingness to pay of $850/ML. Based on net margins analysis, this is within their capacity to pay.

Table 10.11: Capacity to pay increased annual charges

Location	Net margin for proposed crop mix ($/ML)	Increase in fixed ongoing charge: low ($/ML)	Increase in fixed ongoing charge: medium ($/ML)	New fixed ongoing charge: high ($/ML)	Comments
Barker Barambah (Barlil Weir)	$53 (wheat) to $2,403 (citrus). The weighted net margin is $396.	50	100	150	The agricultural production will need to continue its progression towards higher value crops such as citrus, grapes and peanuts. This transition is occurring and we expect it will accelerate should additional water become available.
Boyne River & Tarong (Boyne River Weir)	$70 (mungbeans) to $9,090 (blueberries). The weighted net margin is $3,322.	50	75	110	The net margins are influenced by the very high margins of blueberries. However, most of the crops have a very high value. The weir will increase water reliability by 14%, rather than produce new water allocations. This approach means that all customers will benefit from the reliability increase and need to pay for it. The increase in charges will be collected across all existing water allocations through higher annual charges. This method to cost recovery will reduce the scheme's overall capacity to pay increased charges, as some customers have lower returns, but are still obligated to participate. 14 per cent of the weighted net margin is $465/ML. 14 per cent of the predominant crop (mandarin) net margin is $316/ML.

Location	Net margin for proposed crop mix ($/ML)	Increase in fixed ongoing charge: low ($/ML)	Increase in fixed ongoing charge: medium ($/ML)	New fixed ongoing charge: high ($/ML)	Comments
					Irrigators previously told Sunwater that $200/ML increase is too high, as irrigators are unwilling to invest in new water unless they can retain a substantial amount of the return, after paying for the water. We consider that the capacity to pay ranges from $50 to $110, depending on the eventual crop mix.
Coalstoun Lakes	$134 (corn) to $1,634 (peanuts). The weighted net margin is $773.	150	200	300	Local consultation outlined the desire for the region to transition into an irrigation area focusing on high-value crops (including irrigated peanuts, green vegetables and macadamias). This transition will support these prices.
Blackbutt customers	$3,035 (avocados)	1,200			The capacity to pay was undertaken at this amount, and demand of 2,500 ML was identified.

11. Economic analysis

11.1 Key points

- A cost–benefit analysis was undertaken on the shortlisted options in comparison to the base case, capturing the material economic impacts for an options analysis level assessment.
- Key elements of the base case include the existing agricultural production in the North Burnett and South Burnett; urban water security issues in Kingaroy; and water security issues also affecting production at the Swickers value-added food production facility.
- Key benefits for the options included increased water availability and reliability—increasing irrigated agricultural production—improved urban water security and increased profitability of industrial production.
- Benefit–cost ratios (BCRs) and net present values (NPVs) were generated (Table 11.1 and Table 11.2) for the five major infrastructure options at P90 and P50 costs.[34]

Table 11.1: Major infrastructure options—BCRs and NPVs at P90 costs (7% real discount rate)

Option (2020 dollars)	P90	
	BCR	NPV ($ million)
Re-regulating weir on the Boyne River	1.01	0.24
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	0.94	−0.79
Build a pipeline from Paradise Dam to Coalstoun Lakes	1.25	33.9
65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	0.71	−60.7
Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	1.31	37.6

Table 11.2: Major infrastructure options—BCRs and NPVs at P50 costs (7% real discount rate)

Option (2020 dollars)	P50	
	BCR	NPV ($M)
Re-regulating weir on the Boyne River	1.52	9.60
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	1.29	2.58
Build a pipeline from Paradise Dam to Coalstoun Lakes	1.35	45.45
65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	0.84	−28.77
Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	1.57	61.63

The remaining options relate to use of existing infrastructure and the BCRs and NPVs are shown in Table 11.3.

[34] Forecasting costs includes some uncertainty. An options analysis requirement is for raw costs to be risk adjusted to a P50 and P90 estimate. This means that there is a 50 or 90 per cent probability that a P50 or P90 cost estimate will not be exceeded (or a 50 or 10 per cent probability that it will be exceeded). This reduces the uncertainty of cost estimates.
There are two risk adjustments:
- intrinsic risk based on the range of price and quantities of each line item
- contingent risk based on risks from the risk register which may affect the cost.

A Monte Carlo simulation then runs 10,000 simulations to determine a P90 estimate. The risk-adjusted cost is the base capital cost (raw cost) plus the intrinsic and contingent risk adjustment.

Table 11.3: Existing infrastructure options—BCRs and NPVs at medium costs (7% real discount rate)

Option (2020 dollars)	BCR	NPV ($M)
Construct water recycling plant at Swickers facility in Kingaroy	4.50	36.6
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	1.32	12.09
Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	2.47	15.94
Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	2.15	6.58
Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	2.13	5.98

Forecast jobs created through construction and increased agricultural production are also provided for each option.

11.2 Approach

The approach adopted to undertake the economic analysis was as follows:

- Describe the base case.
- Where economic impacts are material and quantifiable, quantify the economic benefits and costs (i.e. net cash flows) relative to the base case.
- Estimate the net economic impact as BCRs and NPVs of the project relative to the base case.

The economic assessment measures the economic benefit over time, and then converts them to today's dollars using a range of discount rates. The economic costs and benefits are considered independently of the financing option and the interest paid, which is considered in the financial analysis chapter.

The general parameters and assumptions include model start year, assessment period and discount rates. The starting year and assessment period are shown in Table 11.4.

Table 11.4: Starting year and assessment period

Parameter	Unit	Value
Starting year	Year (period)	2020
Assessment period	Number of years	30

Discount rate scenarios, with the medium scenario (7% real) being the central scenario, are shown in **Table 11.5**.

Table 11.5: Discount rate scenarios

Discount rates	Real, pre-tax (%)
Low	4
Medium (central)	7
High	10

11.3 Base case

The base case for the cost–benefit analysis includes:

- a description of what will occur should the proposed project not proceed, including implications for the expected level of service

- impacts of the continuation of the existing situation with all relevant costs and benefits.

It also includes expected actions to be taken if none of the proposal options are implemented and service levels are reasonably maintained. The base case is described for:

- irrigated agricultural production
- urban water security in Kingaroy
- value-added food production.

11.3.1 Irrigated agriculture

The base case as it relates to irrigated agriculture is fully described in Chapter 4. The base case for this study assumes the mix of crops and overall value of agricultural production observed in 2019 remains steady over the evaluation period.

In North Burnett and South Burnett livestock production accounts for more than 57 and 71 per cent of respective total agricultural production. Under the base case, we expect that it is unlikely new areas will be cropped with the current reliability level in the schemes. Therefore, some existing areas may convert to higher value agriculture under the options.

Table 11.6: Livestock production in the Wide Bay–Burnett Region

Land use	Gross value of agricultural production	Total area	GVAP/ha
Cattle and other livestock	$453,886,764	3,180,413 ha	$142.71

**ABS Gross Value of Agricultural Production (2018/19) & Queensland Ag Land audit.*

Further, for Coalstoun Lakes, through consultation, it is understood that there are significant areas of dryland broadacre cropping including peanuts, corn, maize and sorghum. Under the base case, we expect this to continue.

Table 11.7: Value of Coalstoun Lakes in base case

Land use	Portion of agricultural production benefit (%)	Total return for production ($/ML)
Cattle and other livestock	70	99
Dryland broadacre cropping	30	174
Simple average ($/ha)	**100**	**274**

Under the base case, the annual net benefit for the production which may be lost due to the impact of the options is summarised below. This has been included in the economic assessment as an opportunity cost of implementing these options. These impacts are categorised by each option for clarity and ease but are derived from the land use of each area.

Table 11.8: Base case – current annual return for each shortlisted option

Shortlisted option	Base case ($ annual net benefits)
Construct a re-regulating weir on the Boyne River	16,318
Build a pipeline from Paradise Dam to Coalstoun Lakes	1,074,115
65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	966,703
Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	1,074,115

Shortlisted option	Base case ($ annual net benefits)
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	52,898
Greater utilisation of the Wivenhoe to Tarong pipeline	45,741

11.3.2 Urban water security

Urban water insecurity for Kingaroy was identified as a key concern for stakeholders in South Burnett. Currently, Kingaroy's total demand is 1,400 ML per year, and Kingaroy is currently on level 3 water restrictions. In 2019, the Queensland Government DNRME undertook a Regional Water Supply Security Assessment (RWSSA) for Kingaroy. This assessment, which is yet to approved by South Burnet Regional Council, concluded that current annual demand of 1,400 ML for Kingaroy had a supply failure of one in 13 years (7.7%). The forecast demand in 2020–21 of 1,600 ML for Kingaroy had an expected failure rate of approximately one in eight years (13%).

The failure rate is the number of times during a 10,000-run simulation that annual demand was greater than available supply. A key driver of the failure rate was that Kingaroy's allocation in Boondooma Dam is 1,250 ML, which is lower than the 1,400 ML current demand. Therefore, in the simulation, additional water is sourced from nearby Gordonbrook Dam, which also has a high failure rate, as appropriate quality water can only be accessed above 50 per cent of the dam level. The modelling undertaken by DNRME shows that Gordonbrook Dam is below the 50 per cent level (3,250 ML) at a rate of one in four years.

In the event of failure, it is assumed that Kingaroy will be supplied through an emergency purchase of additional water from Boondooma Dam. The costs of purchasing water from Boondooma Dam are discussed in section 11.5.3.

11.3.3 Value-added food production

Value-added food production is the processing and packaging of agricultural production that results in a higher value product. A key food production facility in South Burnett is Swickers, which processes pigs into pork products. A base case cost is where a facility is currently constrained by the lack of access to water. Other facilities in South Burnett, such as BEGA PCA and Alkaloids of Australia, were not considered to be constrained by access to water.[35]

Consultation with Swickers revealed that the lack of reliable and water supply reduces the average net profit margin per megalitre of water. An option, such as a new water recycling system, that provides reliable water will enable Swickers to avoid this profit reduction.

11.4 Economic benefits

The economic benefits of the options are categorised by improved:

- irrigated agricultural production
- urban water security in Kingaroy
- value-added food production.

11.4.1 Irrigated agriculture

The primary economic benefits of the project relate to increased irrigated agricultural output. To calculate the benefits, we have:

- determined the amount of water likely to be used for each crop type and crop area
- determined the net margin of each crop (per megalitre) based on public sources and industry experience; each crop has a different net margin, depending on the yield, costs, and commodity prices

[35] A potential economic cost to value-added food production from water is the lack of access to inputs (or inputs to a higher price). Global supply chains mean that it is difficult to justify a cost for constrained access to inputs.

- multiplied amount of water by the net margin to obtain the annual economic benefit and convert the annual benefits to a single net present value. The total economic benefit is determined by multiplying amount of water by the net margin to obtain the annual economic benefit and convert the annual benefits to a single net present value.

The critical value is the net margin produced per megalitre of water applied. This is calculated by determining the gross margin and then subtracting fixed (upfront and ongoing) costs. This has been done separately for each crop, considering individual parameters.

Each crop has a different net margin, depending on the yield, costs, and commodity prices. Therefore, the overall economic benefit depends on the crop mix.

The net margins adopted in the analysis were gathered from a range of sources (Table 11.9).

Table 11.9: Summary of the sources and publications reviewed—gross margins

Sources	Enterprise
Local stakeholder consultation with irrigators on ground in region	All included in the assessment
Previous literature provided by client and state government	All included in the assessment
Agbiz farm budgeting tools—Queensland Government	All included in the assessment
AgMargins Gross Margin Calculator—Queensland Government	All included in the assessment

The type of irrigated crops differs across the region and the reliability of the water allocation, so net margin details were collected for each of the key regions and water allocation reliability. Key regions and reliability included in the assessment are:

- Coalstoun Lakes
- Boyne River
- Barker Barambah
- Blackbutt.

The following tables show key irrigated crops and net margins per hectare/per megalitre.

Table 11.10: Net margin by crop, Coalstoun Lakes

Enterprise	Net margin ($/ha)	Net margin ($/ML)
Peanuts	2,617	872
Beans (green vegetables)	700	233
Macadamias	19,611	1,634
Melons	3,184	1,061
Corn	672	134

Table 11.11: Net margin by crop, Boyne River

Enterprise	Net margin ($/ha)	Net margin ($/ML)
Blueberries	90,899	9,090
Mandarins	13,566	2,261
Pecans	18,889	4,722
Mungbeans	210	70
Mangoes	2,124	354

Avocados	21,248	3,035
Table grapes	6,902	1,150

Table 11.12: Net margin by crop, Barker Barambah

Enterprise	Net margin ($/ha)	Net margin ($/ML)
Cotton	1,752	270
Lucerne Hay	1,668	139
Navy Beans	404	135
Wheat	212	53
Lemons and limes (citrus)	24,025	2,403
Table grapes	6,902	1,150
Peanuts	2,617	872

Table 11.13: Net margin by crop, Blackbutt

Enterprise	Net margin ($/ha)	Net margin ($/ML)
Avocados	21,248	3,035
Beans (green vegetables)	700	233
Lucerne hay	1,668	139
Macadamias	19,611	1,634

The full breakdown of each net margin, including water use, fixed and ongoing costs and revenue is included in chapter 11.

11.4.1.1 Timing of irrigated agricultural benefits

It is important when determining the economic benefits of particular crop types to consider the time frame in which they will be realised. Firstly, the project's infrastructure must be built (1–3 years depending on the option) and then the crops must be planted and harvested. Annual crops such as fodder, cereal crops and cotton will require the full water use in the first year that expansion occurs, whereas for perennial and tree crops it takes an extended period of time before any commercial harvesting can occur.

Water use is also consistent with this timing, meaning the economic benefit from increased water availability needs to be consistent with the specific crop being grown.

The following timing has been adopted for this assessment. This is consistent with local and state-based practices for each crop type.

Table 11.14: Timing of irrigated agricultural benefits for assessment

Crop type	Timing until full benefit is realised	Comment
Blueberries	Year 5	Slow increase in from year 1 until full production occurs from year 5
Peanuts	Year 1	Annual crop—assumed full production from year 1
Avocados	Year 7	Slow increase from year1 until full production occurs from year 7
Citrus	Year 11	Slow increase in from year 3 until full production occurs in year 11

Crop type	Timing until full benefit is realised	Comment
Macadamias	Year 11	Slow increase in from year 4 until full production occurs in year 11
Pecans	Year 11	Slow increase in from year 3 until full production occurs in year 11
Mangoes	Year 6	Slow increase in from year1 until full production occurs in year 6
Table grapes	Year 3	Slow increase in from year1 until steady state in year 3

The remaining crop types used in this assessment including cotton, green vegetables, mungbeans and corn have all been assumed to have an annual benefit due to the nature of these crops. The benefits have therefore been realised in full, from the first year of water availability.

11.4.1.2 Uptake of water from water sales

Jacobs has also provided sensitivities on the uptake of water for each shortlisted option to account for the risk that not the full allocations will be purchased by irrigators. These sensitivities are provided the economic assessment of each shortlisted option below.

11.4.1.3 Water use for new and existing crops

The use of water for agricultural purposes will materially increase the economic value of production. This benefit has been calculated specifically for the region around the project and will be used for two broad purposes. The first is to expand agricultural production onto land that is not currently used for crops but may be currently used for unimproved grazing. The second is to use the water to achieve additional water security and productivity for existing irrigation crops (e.g. grape vines and fruit trees).

Given the large sunk capital costs of permanent plantings such as an orchard, there is a large benefit in access to a reliable water source that will allow a permanent planting to survive and produce during a drought.

The following table outlines Jacobs' assumptions around the use of water for each shortlisted option. In turn, this determines quantum of the economic benefit for each option.

Table 11.15: Water use assumptions for each option

Shortlisted option	Assumption (water use)
Construct a re-regulating weir on the Boyne River	This shortlisted option delivers improved reliability to customer in the Boyne River and Tarong Scheme. This scheme has a significant area under perennial and high-value tree crops. Therefore, we have assumed that over 35 per cent of the water will be used to achieve additional water security in the area. No economic benefit has been calculated on this water, which is a conservative approach considering the value ($/ML) can often be the same if not higher than expansion due to the downside risk involved with losing an orchard or planting. The Emu Swamp Dam detailed business case revealed that net margin ($/ML) for existing crops was only 2% less that than for new crop production. Consultation outlined in the 'capacity and willingness to pay' assessment revealed irrigators in the region would also use a portion of water from the improved reliability on expansion. Further, there is also annual cropping in the region that would expand. The historical average water use from medium priority customers is around 51% over the last 10 years. This is primarily due to the volatile nature of the announced allocations and customers taking a conservative approach. We expect that it is not likely to see an increase in water use above the possible 14% improvement in reliability that the project delivers.
Build a pipeline from Paradise Dam to Coalstoun Lakes	This is a greenfield site, and we expect that the additional water delivered by this project will be used to expand crop production. The base case dryland farming has also been considered in the assessment and the ability to plant a crop will be improved with access to a more reliable water source.

Shortlisted option	Assumption (water use)
65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	This is a greenfield site, and we expect that the additional water delivered by this project will be used to expand crop production. The base case dryland farming has also been considered in the assessment and the ability to plant a crop will be improved with access to a more reliable water source.
Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	This is a greenfield site, and we expect that the additional water delivered by this project will be used to expand crop production. The base case dryland farming has also been considered in the assessment and the ability to plant a crop will be improved with access to a more reliable water source.
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	This option delivers additional water supply to the Barker Barambah scheme. The scheme crop mix is predominately weighted towards annual crop production. Therefore, we have adopted the same net margin for existing security and expansion water.

11.4.2 Urban

The urban water security benefits result from:

- lifting and then avoiding level 3 water restrictions in Kingaroy
- reducing the expected (probability weighted) cost of emergency supply for Kingaroy.

Water restrictions in Kingaroy create an economic cost by:

- reducing residential garden amenity
- pushing businesses to alternative sources or reduced output due to water restrictions
- increasing compliance actions by council water businesses.

An assessment of the economic cost of water restrictions in South East Queensland was undertaken by Synergies Economics Consulting in 2017. The results of this study are shown below.

Table 11.16: Cost of water restrictions in South East Queensland

Level	Target (L/person/day)	Impact of restrictions (Synergies calculation) ($2020/ML)
No restriction	352	
Water conservation (Level 1)	215	
Level 2	185	1,732
Level 3	160	5,602
Level 4	140	7,505
Level 5	120	19,786
Emergency supply (failure)	100	26,323

Source: Synergies Economic Consulting (2017); Jacobs.

The level 3 restrictions in Kingaroy of 160 litres per person per day for residential and commercial aligns with the level 3 restrictions in the South East Queensland study. The economic impacts of level 3 restrictions are $5,602/ML in 2020 dollars. The economic benefit of removing and then avoiding these restrictions is the impact multiplied by the difference in water use target between level 3 restrictions and no restrictions.

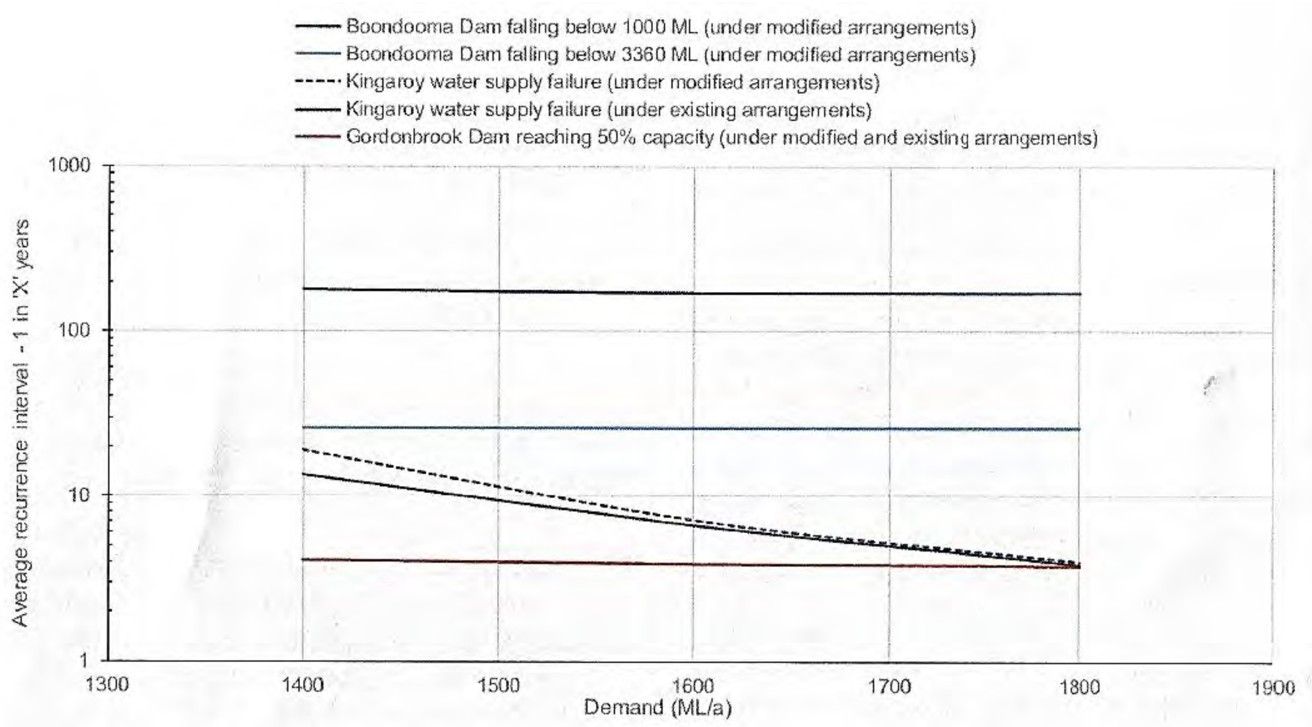
Given the high failure rate of the current water supply system and the lack of other options for improving water security, it is likely that Kingaroy will remain under level 3 restrictions for the foreseeable future. This assumption can be tested using simulation modelling as part of a detailed assessment.

The proposed purchase of 1,300 ML is based on the option assessment undertaken on the RWSSA. This report modelled the impact of a purchasing 1,300 ML of high priority water in Boondooma Dam. Given current allocations, this purchase would be made from the Tarong Power Station (TPS).

The modelling indicated that the purchase of 1,300 ML of high priority water allocations from TPS, along with the continued use of Gordonbrook Dam for urban water supply, could reduce the likelihood of failure for Kingaroy's water supply from one year in 8 years to one year in 312 years for 1,600 ML of annual demand.

The RWSSA did not model a scenario where the 1,300 ML is purchased and Gordonbrook Dam is converted to irrigation. However, the RWSSA did indicate that the likelihood of failure of Boondooma Dam (defined as Boondooma Dam falling below 1,000 ML as provided the Burnett Resource Operation Plan) occurs in one year in 109 years. This is shown in **Figure 11.1**. The use of the 1,000 ML level reflects the result of our consultation that the dead storage will be accessed for Kingaroy to 1,000 ML rather than the current 3,360 ML level.

Figure 11.1: Average recurrence of supply failures occurring and dam volumes falling to various levels



The one year in 109 years failure rate associated with 1,600 ML per year demand has been adopted for where Gordonbrook Dam is converted to irrigation, as Kingaroy will be solely dependent on Boondooma Dam.

The options that relate to Kingaroy urban water security are shown below.

Table 11.17: Options impacting Kingaroy urban water security

Option	2020–21 target demand (ML/a)	High priority allocation purchased from Tarong Power Station (ML)	Lifting of level 3 water restrictions	Kingaroy supply failure rate post-purchase	Gordonbrook Dam converted to irrigation
Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	1,600	1,300	Yes	1 in 109	Yes
Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and	1,600	1,300	Yes	1 in 109	Yes

supplement urban supply with additional water allocation from Tarong Power Station)					
Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	1,600	1,300	Yes	1 in 312	No

The benefits of each option are calculated based on the target failure rate, lifting and avoiding level 3 restrictions, and the economic benefits of increased irrigation.

The cost–benefit analysis represents best available estimations of the water security improvements for Kingaroy. Further analysis should be undertaken on the hydrological benefits of the preferred option including the optimal high priority allocation amount to be purchased.

11.4.3 Value-added food production

Swickers advised that an appropriate water recycling system for the facility would result in economic results (**Table 11.18**).

Table 11.18: Swickers profitability with and without water security

Swickers profitability	$/ML
Average profitability (net margin) per ML—now	6,400
Average profitability (net margin) per ML—with water security	11,600
Change in net margin from water security—economic benefit	5,200

Source: Consultation with Swickers.

The recycling project could also result in an improvement in water security for Kingaroy. For example, if the recycling project reduces Swickers demand for reticulated water by 200 ML per year in 2020–21, then the likelihood of water supply failure for Kingaroy reduces from one year in 8 years to one year in 13 years.

However, Swickers may use the improvement in water reliability generated by the recycling system to increase its production, which may reduce the water security benefits to Kingaroy. For this analysis, a conservative approach is used, which does not include a benefit to Kingaroy's water security. An assessment of urban security benefits should be included in a detailed assessment of this option upon consultation with Swickers.

11.5 Economic costs

The economic costs include all the costs that are incurred to realise the economic benefits. The net margin for new crops considers establishment costs (i.e. it is derived by subtracting from revenue the fixed and variable costs for each enterprise).

The project capital and operational expenditure costs are detailed in Chapter 11 and are summarised for each option below.

11.5.1 Risk-adjusted capital cost

Forecasting costs includes some uncertainty. An options analysis requirement is for raw costs to be risk adjusted to a P90 estimate. This means that there is a 90 per cent probability that a P90 cost estimate will *not* be exceeded (or a 10 per cent probability that it will be exceeded). This reduces the uncertainty of cost estimates.

There are two risk adjustments:

- intrinsic risk based on the range of price and quantities of each line item
- contingent risk based on risks from the risk register which may affect the cost.

A Monte Carlo simulation then runs 10,000 simulations to determine a P90 estimate. The risk-adjusted cost is the base capital cost (raw cost) plus the intrinsic and contingent risk adjustment.

11.5.1.1 Raw capital costs and the intrinsic risk adjustment

To establish the range of price and quantity for each cost line item for each infrastructure option, Jacobs convened a workshop of engineers experienced in the delivery of water infrastructure projects.

The low-cost estimate represents the best-case scenario where everything goes perfectly well; the high cost estimate is the worst-case scenario where everything goes badly; and the most likely estimate is the cost estimate most likely to be correct, based on years of engineering experience. Nevertheless, there will be a balance of under- and overspends.

To determine a cost profile a Monte Carlo simulation is undertaken to provide a risk-based estimate. This method runs 10,000 simulations to determine a cost profile (show in the financial analysis chapter). These profiles show the gap between the most likely and the P90 estimate. This in turn generates the intrinsic risk component of the capital cost.

11.5.1.2 Contingent risk adjustment

Several contingent risks are included for each infrastructure option. The likelihood of the risk manifesting, and the cost impact if the event does occur is shown. These factors are combined to estimate a total contingent risk and to adjust the capital cost estimate.

A Monte Carlo simulation is performed to convert these estimates into a P90 estimate. This forms the contingent risk adjustment.

11.5.1.3 Options summary

The P10, P50 and P90 capital costs are provided for each of the infrastructure options is shown in **Table 11.19**. The assessment of the infrastructure options is undertaken using the P90 costs.

Detailed capital and operating costs are provided in Chapter 12.

Table 11.19: Risk-adjusted capital costs of infrastructure options

Option ($m) (2020 dollars)	P10 ($m)	P50 ($m)	P90 ($m)
Re-regulating weir on the Boyne River	11.31	17.98	26.92
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	6.98	8.20	11.35
Build a pipeline from Paradise Dam to Coalstoun Lakes	45.99	47.82	57.42
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	91.00	96.04	130.12
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	48.86	52.19	71.43

The capital costs for the remaining options are provided as low, medium and high as shown in the table below. The medium costs are used in the economic analysis.

Table 11.20: Capital costs for other options ($m)

Option ($m) (2020 dollars)	Low cost ($m)	Medium cost ($m)	High cost ($m)
Construct water recycling plant at Swickers facility in Kingaroy	2.48	3.1	3.72
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	.61	1.17	1.73
Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	11.1*	27.5*	43.9*
Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	15.7*	36.6*	59.1*
Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	9.9*	25.2*	40.5*

**Options involving Tarong Power Station have capital costs based on a present value of compensating TPS for sourcing additional water from Seqwater for 15 years. The actual capital costs may be different to the present value above if the period, price paid by TPS to Seqwater or amount of allocation purchased is different.*

Table 11.21: Operating costs

Option (2020 dollars)	Medium annual operating costs ($)
Re-regulating weir on the Boyne River	309,300
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	75,300
Build a pipeline from Paradise Dam to Coalstoun Lakes	7,074,000
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	8,330,000
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	6,039,733
Construct water recycling plant at Swickers facility in Kingaroy	610,000
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	3,200,000
Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	455,000
Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	455,000
Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	455,000

11.5.2 Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)

The cost of this option is highly dependent on the price from Seqwater for water from Wivenhoe Dam and the price for the use of the Tarong-Wivenhoe pipeline. These prices are commercially confidential and have not been released for this study. Jacobs has set a target price for the Seqwater water and use of the Wivenhoe to Tarong pipeline based on discussions with the Blackbutt irrigators. It is recognised that prices between Seqwater and Stanwell for the use of the Tarong–Wivenhoe pipeline may not be open for renegotiation to accommodate an irrigation supply, and, in the event that renegotiation was to occur, commercial prices would apply.

The proposed capital costs for the this option include:

- development of implementation plan and adequacy study
- stakeholder consultation.

This preliminary analysis seeks to highlight the potential economic benefits associated with these prices. It is recognised that the final decision on the price of water from Wivenhoe Dam will be made by Seqwater. During any subsequent engagement with Seqwater, it is possible that the assumptions of price and ability to access Wivenhoe Dam used in this analysis may prove to be incorrect. The ability for Blackbutt irrigators to use the Wivenhoe to Tarong pipeline is also unclear, as the use of this pipeline is prioritised for TPS.

Further discussions with Seqwater and Tarong Power Station are critical for the further exploration of this option.

11.5.3 Purchasing water from Tarong Power Station to improve urban water security in Kingaroy options

The central cost of the options to purchase high priority water allocations in Boondooma Dam from TPS is the likely compensation to be paid to TPS to source additional water from Seqwater, owner of Wivenhoe Dam and the Western Corridor Recycled Water Scheme, and transport this water to TPS. The analysis has been undertaken on the basis that TPS will experience no change in water security and the compensation paid to TPS for additional high priority water from Boondooma Dam reflects the increase in costs from TPS increasing its water purchases from Seqwater.

The current water purchasing arrangements between Seqwater and TPS are not publicly available, so the costs of Wivenhoe Dam and Western Corridor water are modelled using scenario analysis. Key public data points include the recent price determination for councils that purchase water from Seqwater of $3,122/ML in 2020–21. The other data point is the variable costs associated with the operation of the Western Corridor Water Recycling Scheme (**Table 11.49**).

Table 11.22:Variable costs of the Western Corridor Recycled Water Scheme

Category	Cost ($/ML)
Variable costs, including electricity per kWh charges and chemicals	600
Semi-fixed costs, including membranes and electricity per kW charges	400
Total	1,000

Based on these data points, Jacobs' estimated cost per megalitre of TPS sourcing more water from Seqwater is:

- Wivenhoe Dam water at $2,000/ML, as it is likely that TPS, in conjunction with Boondooma Dam allocation, does not need Wivenhoe Dam at the same reliability as Brisbane City or Ipswich City Council and is not treated to drinking quality standard
- Western Corridor water (manufactured) medium scenario set at $2,600/ML, with additional variable cost of $1,000/ML from the Western Corridor but a reduction in the fixed costs of Seqwater associated with Wivenhoe Dam.

Table 11.23: Price scenarios—TPS payments to Seqwater ($/ML)

	Low	Medium	High
Wivenhoe Dam	1,000	2,000	3,000
Manufactured water	1,300	2,600	4.000

The estimated cost per megalitre is then multiplied by proposed purchase amount (1,300 ML) each year for 15 years as TPS will purchase 1,300 ML from Seqwater each year. The capital cost is the present value (discounted) of the future payments from TPS to Seqwater.

It should be noted that further analysis of this option should include critical considerations such as likely availability and pricing to ensure that:

- there is no impact on water security or prices for Seqwater's existing urban and irrigation customers
- there is no change in risk to Seqwater or its existing customers
- any new arrangements are consistent with the existing water management regime.

11.6 Cost–benefit analysis results and socio-economic narrative

Each option is explained in detail in the following sections including sensitivity analysis and wider economic benefits such as employment.

11.6.1 Re-regulating weir on the Boyne River

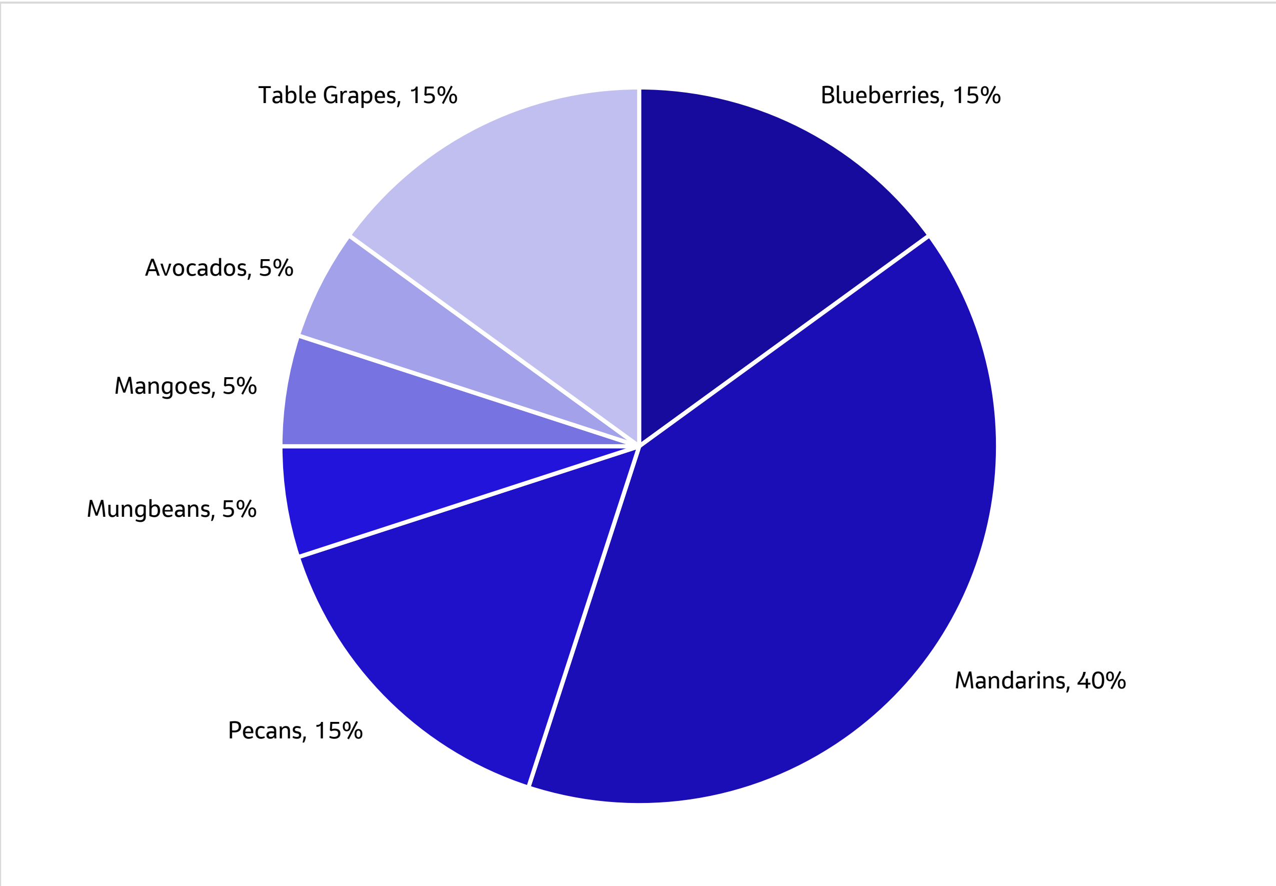
The construction of the re-regulating weir on the Boyne River will benefit irrigators by improving the reliability of existing medium priority water allocations by 14 per cent and increasing water availability from 73 to 87 per cent (**Table 11.24**).

Table 11.24: Boyne River Weir yield and reliability

Item	New allocation	Current reliability	Improvement in reliability
Medium priority (ML/a)	0 ML	73%	14%

The increase in reliability will lead to an agricultural benefit in the area. The following crop types have been adopted to determine the economic benefit of the project. This crop mix has been developed through stakeholder consultation and a comprehensive literature review. A detailed explanation of the crop mix selection is included as Appendix G for all relevant areas.

Figure 11.2: Boyne River Weir—crop mix



The total economic benefit over the life of the project is outlined in the table below.

Table 11.25: Total economic benefit—Boyne River Weir

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Agricultural net margin (including residual value beyond 30 years)	44.02	28.03	19.27

The total economic costs over the life of the project is outlined in the table below. The net economic benefits that accrue under the base case are taken in account.

Table 11.26: Total P90 economic costs—Boyne River Weir

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Ongoing opex	−4.76	−3.28	−2.38
Upfront capex	−25.39	−24.34	−23.36
Base case opportunity cost	0.27	−0.20	−0.15
Total	**30.43**	**−27.81**	**−25.89**

11.6.1.1 Total NPV and benefit–cost ratio

The NPV is $218,674 based on a real 7 per cent discount rate with a BCR of 1.01. The BCR falls below 1, with a high discount rate of 10 per cent.

Table 11.27: Economic costs and benefits—NPV and BCR ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Total benefits	44.02	28.03	19.27
Total costs	−30.43	−27.81	−25.89
Net benefits NPV	13.60	0.22	−6.62
BCR	**1.45**	**1.01**	**0.74**

11.6.1.2 Sensitivity of the economic result

Some of the key parameters were varied to understand the sensitivity of the inputs to the overall results. The following table outlines the NPVs and BCRs under different scenarios.

Table 11.28: Sensitivities – Economic NPV and BCRs

Sensitivity	NPV ($ Millions)	BCR
Capital expenditure—P50	9.60	1.52
Capital expenditure—increase by 20%	−3.48	0.89
Capital expenditure—decrease by 10%	3.59	1.15
Operational expenditure—increase by 20%	0.58	0.98
Operational expenditure—decrease by 10%	1.56	1.02
Water allocation sales—decreases by 10%	−2.62	0.91
Water allocation sales—decreases by 20%	−5.46	0.80
Benefits ($/ML)—decrease by 10%	−5.39	0.94
Benefits ($/ML)—decrease by 20%	−2.58	0.84

11.6.2 Construct a re-regulating weir on the Barambah Creek (Barlil Weir)

Barlil Weir is on Barambah Creek at 135.2 km AMTD, downstream of Bjelke-Petersen Dam and about 8 km north-west of the township of Murgon. Construction of this weir would lead to a 3000 ML per year increase in medium priority water for users in the Barker Barambah Water Supply Scheme (**Table 11.29**).

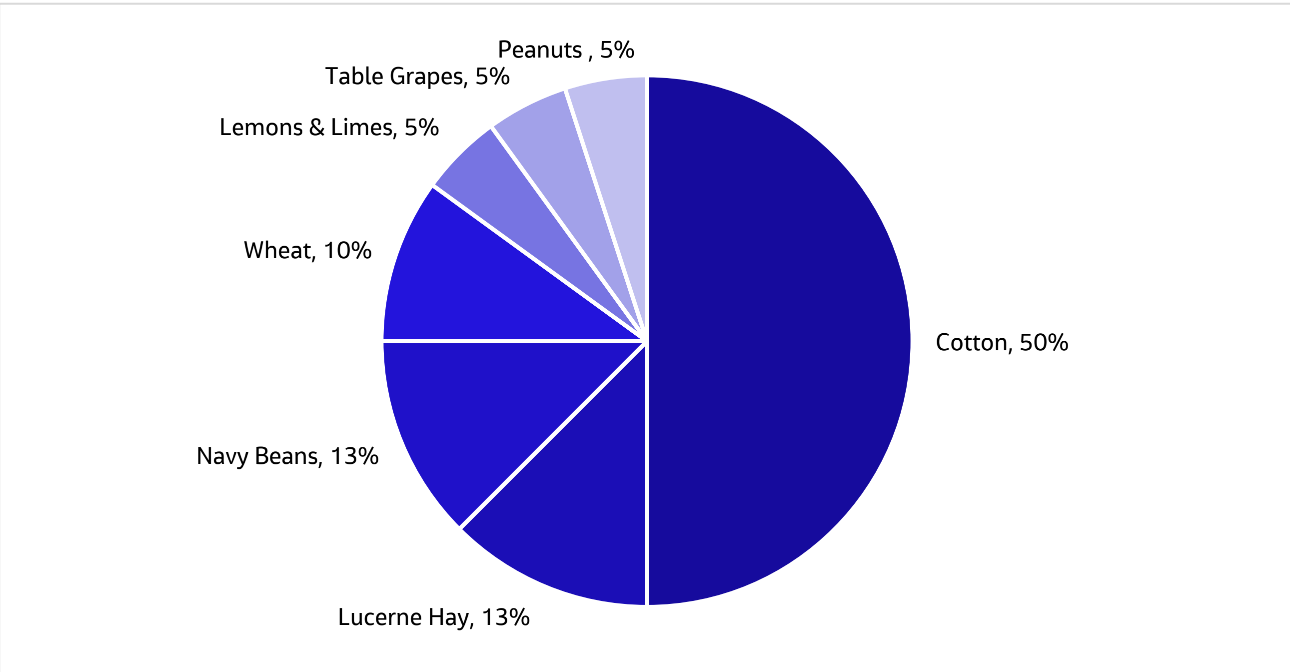
This option will also improve alignment of agricultural water allocations to demand in areas containing fertile soils.

Table 11.29: Barlil Weir yield and reliability

Item	New allocation (ML/a)	Current reliability	Improvement in reliability
Medium priority (ML/a)	3,000	77.7%	0%

The proposed crop mix for the improved reliability and allocation is shown in Figure 11.3.

Figure 11.3: Barlil Weir—crop mix



The total economic benefit over the life of the project is outlined in the table below.

Table 11.30: Total economic benefits ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Agricultural net margin (including residual value beyond 30 years)	17.97	11.49	7.92

The total economic costs over the life of the project is outlined in the table below. The net economic benefits that accrue under the base case are taken in account.

Table 11.31: Total economic costs—Barlil Weir

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Ongoing opex	−2.01	−1.38	−1.00
Upfront capex	−10.7	−10.26	−9.85
Base case opportunity cost	−0.81	−0.56	−0.41
Total	**13.52**	**−12.20**	**−11.25**

The NPV is −$0.71 million, based on a real 7 per cent discount rate with a BCR of 0.94.

Table 11.32: Economic net present value ($ million) and benefit–cost ratio

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Total benefits	17.97	11.49	7.92
Total costs	13.52	−12.20	−11.25
Net benefits NPV ($ million)	4.45	−0.71	−3.33
BCR	**1.32**	**0.94**	**0.70**

11.6.2.1 Sensitivity of the economic result

Some of the key parameters were varied to understand the sensitivity of the inputs to the overall results. The following table outlines the NPVs and BCRs under different scenarios.

Table 11.33: Sensitivities—economic NPV and BCRs (7% discount rate)

Sensitivity	NPV ($ million)	BCR
Capital expenditure—P50	2.58	1.29
Capital expenditure—increase by 20%	−2.76	0.81
Capital expenditure—decrease by 10%	−0.32	1.03
Operational expenditure—increase by 20%	−0.97	0.92
Operational expenditure—decrease by 10%	−0.57	0.95
Water allocation sales—decreases by 10%	−1.83	0.85
Water allocation sales—decreases by 20%	−2.94	0.76
Benefits ($/ML)—decrease by 10%	−1,.86	0.85
Benefits ($/ML)—decrease by 20%	−3.01	0.75

11.6.3 Build a pipeline from Paradise Dam to Coalstoun Lakes

This option proposes the construction of a 37km to 43 km (approximately) pipeline from Paradise Dam and Coalstoun Lakes to directly deliver reliable water to an area of high demand and highly fertile soils.

This option would provide new, reliable water to irrigators in Coalstoun Lakes. This option could facilitate the creation of 4,000 to 6,000 ha of new irrigation areas in Coalstoun Lakes utilising 20,000 ML to 30,000 ML of water annually.

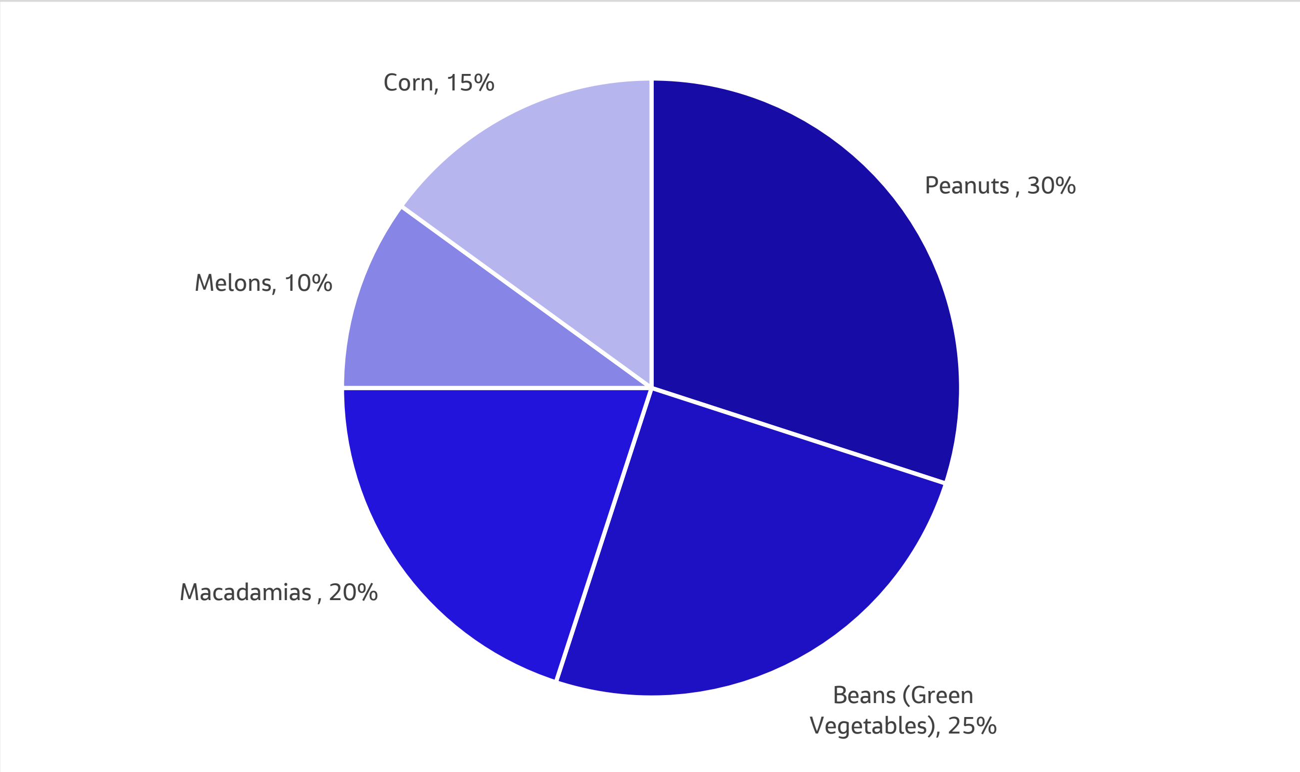
Table 11.34: Pipeline from Paradise Dam to Coalstoun Lakes yield and reliability

Item	New allocation	Reliability	Improvement in reliability
Medium priority (ML/a)	25,000	80% (further analysis required)	0%

The economic benefits of this option will be realised through the delivery of reliable new water directly from Paradise Dam, and the creation of new water allocations in the Barker Barambah Water Supply Scheme.

The following crop types have been adopted to determine the agricultural economic benefit of the option. This crop mix has been developed through stakeholder consultation and a comprehensive literature review.

Figure 11.4: Pipeline from Paradise Dam to Coalstoun Lakes—crop mix



The total economic benefit over the life of the project is outlined in the table below.

Table 11.35: Total economic benefits ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Agricultural net margin (including residual value beyond 30 years)	264.35	175.92	124.93

The total economic costs over the life of the project is outlined in the table below. The net economic benefits that accrue under the base case are taken in account.

Table 11.36: Total economic costs—pipeline from Paradise Dam to Coalstoun Lakes

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Ongoing opex	−111.91	−77.01	−55.87
Upfront capex	−54.15	−51.91	−49.83
Base case opportunity cost	−16.55	−11.39	−8.26
Total	**182.61**	**−140.30**	**−113.96**

The NPV is $35.62 million, based on a real 7 per cent discount rate with a BCR of 1.25. The BCR remains above 1.0, even with a high discount rate (**Table 11.37**).

Table 11.37: Economic net present value ($ million) and benefit–cost ratio

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Total benefits	264.35	175.92	124.93
Total costs	182.61	-140.30	113.96
Net benefits NPV ($ million)	81.74	35.62	10.97
BCR	**1.45**	**1.25**	**1.10**

11.6.3.1 Sensitivity of the economic result

Some of the key parameters were varied to understand the sensitivity of the inputs to the overall results. The following table outlines the NPVs and BCRs under different scenarios.

Table 11.38: Sensitivities—economic NPV and BCRs (7% discount rate)

Sensitivity	NPV ($ million)	BCR
Capital expenditure—P50	45.45	1.35
Capital expenditure—increase by 20%	25.24	1.17
Capital expenditure—decrease by 10%	40.81	1.30
Operational expenditure—increase by 20%	20.21	1.13
Operational expenditure—decrease by 10%	43.32	1.33
Water allocation sales—decreases by 10%	18.11	1.13
Water allocation sales—decreases by 20%	0.60	1.00
Benefits ($/ML)—decrease by 10%	18.03	1.13
Benefits ($/ML)—decrease by 20%	0.43	1.00

11.6.4 Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes

This option proposes the construction of a storage (small dam or large weir) on Barambah Creek upstream of its confluence with the Burnett River and an irrigation network to transport and distribute water to irrigators in the Coalstoun Lakes area.

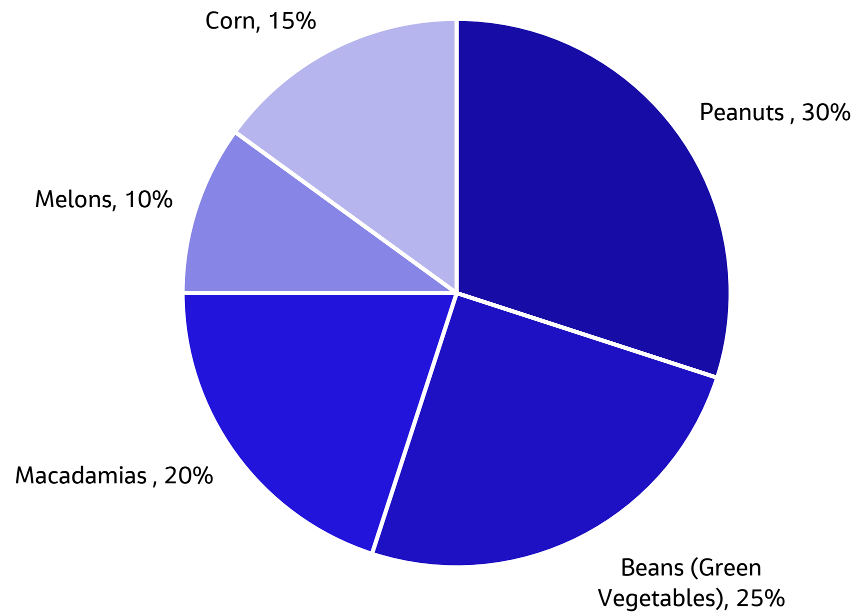
Previous studies suggest that a dam on Barambah Creek at AMTD 43 km with a full supply level of 160 m, a capacity of 65,000 ML and dead storage of 18,500 ML could yield 22,500 ML at an annual reliability of 80 per cent. Further detailed assessment using IQQM is required to confirm this yield and product based on a detailed design.

Table 11.39: Storage on Barambah Creek and irrigation network yield and reliability

Item	New allocation (ML/a)	Reliability	Improvement in reliability
High priority (ML/a)	22,500	80%	0%

The following crop types have been adopted to determine the agricultural economic benefit of the option. This crop mix has been developed through stakeholder consultation and a comprehensive literature review.

Figure 11.5: Storage on Barambah Creek and irrigation network—crop mix



The total economic benefit over the life of the project is outlined in the table below.

Table 11.40: Total economic benefits ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Agricultural net margin (including residual value beyond 30 years)	223.82	146.17	101.55

The total economic costs over the life of the project is outlined in the table below. The net economic benefits that accrue under the base case are taken in account.

Table 11.41: Total economic costs—pipeline from Paradise Dam to Coalstoun Lakes

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Ongoing opex	−120.91	−81.49	−57.80
Upfront capex	−120.35	−113.78	−107.78
Base case opportunity cost	−14.03	−9.46	−6.71
Total	**−255.29**	**−204.73**	**−172.29**

The NPV is −$58.67 million, based on a real 7 per cent discount rate with a BCR of 0.71. The BCR remains below 1.0, even with low discount rate (**Table 11.42**).

Table 11.42: Economic net present value ($ million) and benefit–cost ratio

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Total benefits	223.82	146.17	101.55
Total costs	−255.29	−204.73	−172.29
Net benefits NPV ($ million)	−31.47	−58.67	−70.74
BCR	**0.89**	**0.71**	**0.59**

11.6.4.1 Sensitivity of the economic result

Some of the key parameters were varied to understand the sensitivity of the inputs to the overall results. The following table outlines the NPVs and BCRs under different scenarios.

Table 11.43: Sensitivities—economic NPV and BCRs (7% discount rate)

Sensitivity	NPV ($ million)	BCR
Capital expenditure—P50	−28.77	0.84
Capital expenditure—increase by 20%	−81.32	0.64
Capital expenditure—decrease by 10%	−47.19	0.76
Operational expenditure—increase by 20%	−74.87	0.66
Operational expenditure—decrease by 10%	−50.42	0.74
Water allocation sales—decreases by 10%	−73.79	0.64
Water allocation sales—decreases by 20%	−89.01	0.56
Benefits ($/ML)—decrease by 10%	−73.19	0.64
Benefits ($/ML)—decrease by 20%	−87.80	0.57

11.6.5 Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes

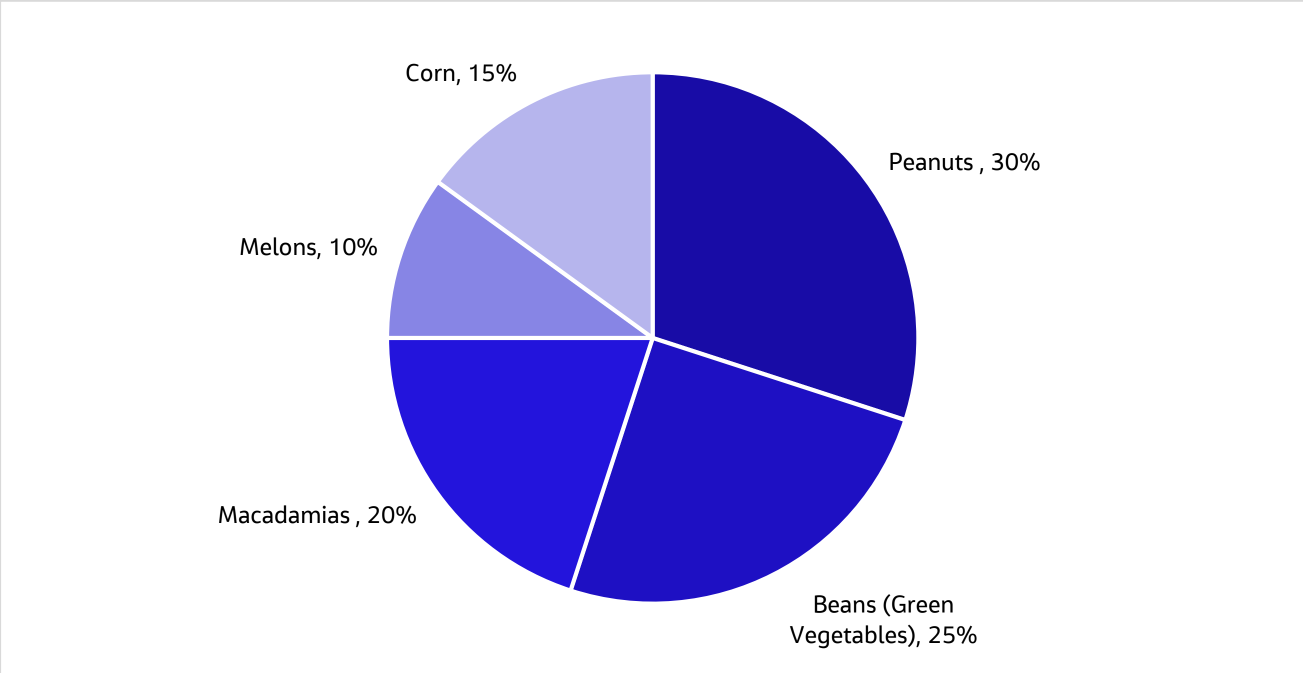
This option delivers new medium priority water to the highly fertile agricultural area around Coalstoun Lakes. This option has been designed in order to capitalise on the presence of potential water allocations in Upper Burnett and facilitate the movement of water to an area of high economic potential and growth.

Table 11.44: Yield and reliability

Item	New allocation (ML/a)	Reliability	Improvement in reliability
Medium priority (ML/a)	25,000	80% (further analysis required)	0%

The following crop types have been adopted to determine the agricultural economic benefit of the option. This crop mix has been developed through stakeholder consultation and a comprehensive literature review.

Figure 11.6: Multiple weir and irrigation network option—crop mix



The total economic benefit over the life of the project is outlined in the table below.

Table 11.45: Total economic benefits ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Agricultural net margin (including residual value beyond 30 years)	264.13	168.99	115.70

The total economic costs over the life of the project is outlined in the table below. The net economic benefits that accrue under the base case are taken in account.

Table 11.46: Total economic costs ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Ongoing opex	−83.11	−56.02	−39.73
Upfront capex	−66.06	−62.46	−59.16
Base case opportunity cost	−17.54	−10.51	−7.45
Total	**−166.71**	**−128.99**	**106.35**

The NPV is $40 million, based on a real 7 per cent discount rate with a BCR of 1.31. The BCR remains above 1.0, even with a high discount rate (**Table 11.47**).

Table 11.47: Economic net present value ($ million) and benefit–cost ratio

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Total benefits	264.13	168.99	115.70
Total costs	−166.71	−128.99	−106.35
Net benefits NPV ($ million)	99.36	39.99	9.35
BCR	**1.58**	**1.31**	**1.09**

11.6.5.1 Sensitivity of the economic result

Some of the key parameters were varied to understand the sensitivity of the inputs to the overall results. The following table outlines the NPVs and BCRs under different scenarios.

Table 11.48: Sensitivities—economic NPV and BCRs (7% discount rate)

Sensitivity	NPV ($ million)	BCR
Capital expenditure—P50	61.63	1.57
Capital expenditure—increase by 20%	27.50	1.19
Capital expenditure—decrease by 10%	46.24	1.38
Operational expenditure—increase by 20%	28.79	1.21
Operational expenditure—decrease by 10%	45.59	1.37
Water allocation sales—decreases by 10%	23.08	1.18
Water allocation sales—decreases by 20%	6.17	1.05
Benefits ($/ML)—decrease by 10%	23.09	1.18
Benefits ($/ML)—decrease by 20%	6.20	1.05

11.6.6 Construct water recycling plant at Swickers facility in Kingaroy

The results of the cost–benefit analysis of the Swickers water recycling plant is shown in **Table 11.49**.

Table 11.49: Recycling plant at Swickers cost–benefit analysis and sensitivity analysis by discount rate

Discount rate		4%	7%	10%
BCR	BCR	4.9	4.5	4.2
NPV of net economic benefit ($ million, 30 years)	NPV ($M)	52.0	36.6	27.2

The economic benefits of the water recycling plant outweigh the economic costs, with the net benefits being the net increase in profit margin for Swickers. Sensitivity analysis on the discount rate (**Table 11.49**) and total expenditure, consisting of capital and operating cost, (**Table 11.50**) does not result in a BCR less than 3.

Table 11.50: Recycling plant at Swickers—sensitivity analysis by total expenditure

Recycling project expenditure	Low total expenditure	Medium total expenditure	High total expenditure
BCR	5.84	4.51	3.60

Sensitivity analysis on the forecast improvement in net margin for Swickers was also undertaken and the results are shown in **Table 11.51**.

Table 11.51: Recycling plant at Swickers—sensitivity analysis by net margin

New net margin	–20%	0%	20%
BCR	2.50	4.51	6.52

A reduction in net margin to Swickers does reduce the BCR, so further analysis on the likely net margin to be generated by the water recycling facility should be undertaken.

The BCR could be higher if the option were assessed to generate urban security benefits to Kingaroy.

11.6.7 Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)

This option proposes increasing the usage of the Wivenhoe–Tarong Pipeline to access more water from Wivenhoe Dam for the South Burnett region and decrease the reliance on Boondooma Dam. Irrigators in the highly fertile areas along the pipeline route have advocated for access to greater water security and increased reliability.

This option would deliver water to these irrigators to allow for greater production of high-value agriculture in the area. Through a preliminary demand and willingness to pay assessment, the following nominal volume of water and reliability have been derived.

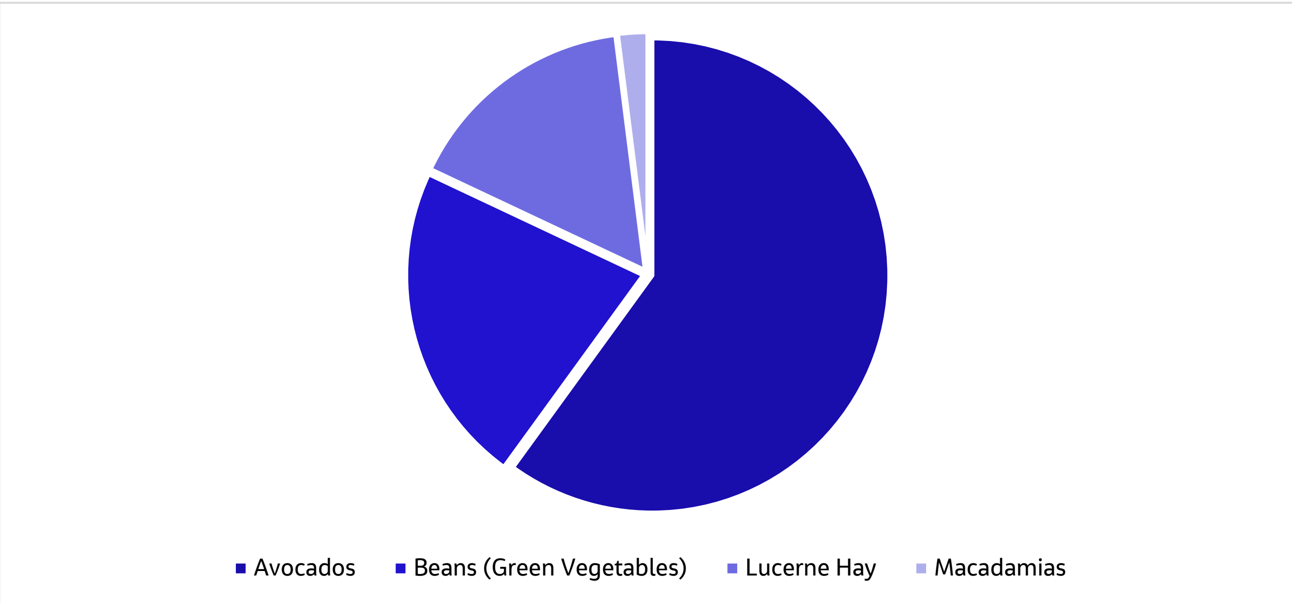
Jacobs had no visibility on the actual cost to Stanwell of sourcing additional water from Lake Wivenhoe as these are commercial in confidence. As a result, the economic analysis is based on Jacobs' estimates of the cost to Stanwell of sourcing additional water from Lake Wivenhoe.

Table 11.52: Greater utilisation of the Wivenhoe to Tarong pipeline—yield and reliability

Item	New allocation (ML/a)	Reliability	Improvement in reliability
High priority (ML/a)	2,500	85–90% (further analysis required)	0%

The following crop types have been adopted to determine the agricultural economic benefit of the option. This crop mix has been developed through stakeholder consultation and a comprehensive literature review.

Figure 11.7: Greater utilisation of the Wivenhoe to Tarong pipeline—crop mix



The total economic benefit over the life of the project is outlined in the table below.

Table 11.53: Total economic benefits ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Agricultural net margin (including residual value beyond 30 years)	71.15	49.90	37.00

The total economic costs over the life of the project is outlined in the table below. The net economic benefits that accrue under the base case are taken in account.

Table 11.54: Total economic costs ($ million)

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Ongoing opex	−3.27	−2.29	−1.71
Upfront capex	−1.12	−1.09	−1.06
Ongoing charge	−48.99	−34.42	−25.55
Total	**−53.38**	**−37.81**	**−28.32**

The NPV is $12.09 million, based on a real 7 per cent discount rate with a BCR of 1.32. The BCR remains above 1.0, even with a high discount rate.

Table 11.55: Economic net present value ($ million) and benefit–cost ratio

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Total benefits	71.15	49.90	37.00
Total costs	-53.38	-37.81	-28.32
Net benefits NPV ($ million)	17.77	12.09	8.69
BCR	1.33	1.32	1.30

11.6.7.1 Sensitivity of the economic result

Some of the key parameters were varied to understand the sensitivity of the inputs to the overall results. The following table outlines the NPVs and BCRs under different scenarios.

Table 11.56: Sensitivities—economic NPV and BCRs (7% discount rate)

Sensitivity	NPV ($ million)	BCR
Capital expenditure—increase by 20%	17.55	1.33
Capital expenditure—decrease by 10%	17.88	1.34
Operational expenditure—increase by 20%	17.12	1.32
Operational expenditure—decrease by 10%	18.10	1.34
Water allocation sales—decreases by 10%	15.55	1.31
Water allocation sales—decreases by 20%	13.33	1.29
Benefits ($/ML)—decrease by 10%	10.66	1.20
Benefits ($/ML)—decrease by 20%	3.54	1.07

11.6.8 Purchasing water from Tarong Power Station to improve urban water security in Kingaroy options

The three options to purchase high priority allocations from TPS to improve urban water security for Kingaroy are:

1) Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)
2) Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)
3) Tarong Power Station to source more of its water from Wivenhoe Dam keep Gordonbrook Dam).

The results of the cost–benefit analysis, with the central case being a 7 per cent real discount rate, are shown in **Table 11.57**.

Table 11.57: Urban water security options cost–benefit analysis results and sensitivity analysis by discount rate

Option	Unit	Discount rate		
		4%	7%	10%
1	BCR	2.45	2.47	2.48
2	BCR	2.13	2.15	2.16
3	BCR	2.11	2.13	2.14
1	NPV ($m)	20.85	15.94	12.65
2	NPV ($m)	7.63	6.58	5.63
3	NPV ($m)	6.69	5.98	5.28

The results suggest that the three options generate positive net benefits with the option where TPS sources water from Wivenhoe Dam, and Gordonbrook Dam is converted to irrigation, generating a higher NPV and a larger BCR due to the potential irrigation benefits—even though this option has a smaller reduction on the likelihood of supply failure. The additional cost of water from the Western Corridor means that the manufactured water option is lower than the Wivenhoe Dam options. The purchase of 1,300 ML in the first year of each option means that the discount rate impact is minimal.

Sensitivity analysis was undertaken on the price paid to TPS for 1,300 ML of high priority allocations. The actual price paid to TPS for the 1,300 ML is unknown, so the price was varied to examine the potential impacts on the BCR (**Table 11.58**).

Table 11.58: Urban water security options sensitivity analysis on BCR—price paid for Wivenhoe Dam water by TPS

Option	$1,000	$2,000	$3,000
1	4.9	2.5	1.7
3	4.2	2.1	1.4

The price sensitivity analysis shows that a price up to $3,000 ML would still result in a BCR for the two options that see TPS sources water from Wivenhoe Dam. A price less than $1,000/ML results in a substantial BCR.

Sensitivity analysis was also undertaken on the expected irrigated agriculture net margins to be generated by the conversion of Gordonbrook Dam (**Table 11.59**).

Table 11.59: Urban water security options sensitivity analysis on BCR—irrigated agriculture net margin

Net margin of irrigated agriculture	–50%	0%	50%
1	2.3	2.5	2.6
2	2.0	2.1	2.3
3	2.1	2.1	2.1

Lower net margins reduce the BCR of the relevant options, but none are lower than 2. The final sensitivity analysis was on the impact of the purchase of 1,300 ML not leading to the lifting and long-term avoidance of level 3 water restrictions in Kingaroy (**Table 11.60**).

Table 11.60: Urban water security options sensitivity analysis on BCR—lifting level 3 water restrictions in Kingaroy

Restrictions lifted?	Yes	No
1	2.5	0.4
2	2.1	0.3
3	2.1	0.0

The impact of not lifting and not avoiding level 3 water restrictions in the long term are BCRs well below 1. This sensitivity analysis indicates that purchasing 1,300 ML of high priority water to reduce the likelihood of supply failure, without lifting and avoiding level 3 water restrictions for the long term, may not represent a net economic benefit to Kingaroy.

11.7 Residual value sensitivities

A requirement of the Building Queensland Framework is to provide the BCRs of proposed options without a residual value beyond the standard 30-year evaluation period. This is primarily due to the inherent uncertainty in the forecast. However, we note that the long-life nature of the infrastructure options means that there is substantial net benefits generated by these options. The following table provides the BCRs of the major infrastructure options with no residual value included.

Table 11.61: Major Infrastructure options—BCRs at P90 costs with no residual value

Option (2020 dollars)	Discount rate		
	4%	7%	10%
Re-regulating weir on the Boyne River	1.16	**0.88**	0.68
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	1.08	**0.82**	0.65
Build a pipeline from Paradise Dam to Coalstoun Lakes	1.34	**1.20**	1.07
65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	0.80	**0.67**	0.57
Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	1.37	**1.18**	1.02

11.8 Economic impact assessment

The preceding economic assessment has been prepared in accordance with Building Queensland's business case guidelines and its cost–benefit analysis (CBA) guidelines. These guidelines specify the types of economic benefits and costs that are suitable to include in a CBA.

The Building Queensland guidelines also set out those costs and benefits that should not form part of the core economic assessment, but instead may be included in a broader economic impact assessment. The costs and benefits of the shortlisted options that fall in that category are presented below due to their obvious and significant impacts on regions and industries and in meeting state development aims.

The significant benefits presented below are excluded from the NPVs or BCRs set out in the preceding sections.

11.8.1 New jobs

The following table outlines the new full-time equivalent positions resulting from the delivery of each proposed option.

There are two main categories:

- full-time jobs of **direct** agricultural employment
- full-time jobs of **indirect** agricultural employment in support industries, such as farm input suppliers (e.g. fertilizer, seedlings, pesticides, packaging and fuel) and services (e.g. transportation, refrigeration, mechanical, food, accommodation and accountancy).

The estimates of new full-time jobs have been created by examining the input–output tables for the Burnett area produced by the ABS and are shown in **Table 11.62**. Jobs have been extrapolated from current levels of production and employment to the expected levels of production and assumed that jobs are created in accordance with the current ratios.

Table 11.62: Upper estimate of new agricultural jobs

Option	Direct agricultural employment	Indirect agricultural employment	Total
Re-regulating weir on the Boyne River	18	42	**60**
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	8	19	**27**
Build a pipeline from Paradise Dam to Coalstoun Lakes	138	316	**453**
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	127	291	**419**
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	138	316	**453**
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	44	102	**146**

The options assessed will also support additional economic activity in the local economy through and increase in gross agricultural production.

Table 11.63 presents the direct and indirect activity every year delivered from each option.

Table 11.63: Upper estimate of increased industry value-add

Option	Direct ($ million)	Indirect ($ million)	Total ($ million)
Re-regulating weir on the Boyne River	3.69	2.41	6.10
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	1.69	1.1	2.79
Build a pipeline from Paradise Dam to Coalstoun Lakes	26.99	17.60	44.59
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	24.29	15.84	40.13
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	26.99	17.60	44.59
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	9.04	5.9	14.94

In addition, **Table 11.64** outlines the total construction jobs created to build each infrastructure option.

Table 11.64: New construction jobs

Option	Direct	Indirect	Total
Re-regulating weir on the Boyne River	29	69	98
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	7	17	24
Build a pipeline from Paradise Dam to Coalstoun Lakes	41	99	140
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	65	158	225
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	46	111	157

The construction of water recycling plant at Swickers facility in Kingaroy will facilitate the ongoing operations at the expanded production output achieved through the upgrades to the facility completed in 2019. The expanded output, with the additional water sourced from the construction of the water recycling plant, is 800 (plus up to 100 seasonal jobs) up from 570 prior to the expansion.

11.8.2 Commercial investment in the region

The options analysis process identified multiple strategic opportunities for economic growth in North Burnett and South Burnett that have significant potential if a reliable water source can be introduced into key areas in the region. These strategic opportunities have been identified through intensive stakeholder engagement across the region, and through consultation with representatives of the Department of State Development, Tourism and Innovation (DSDTI). While these strategic opportunities cannot be included in the formal economic analysis of infrastructure options, it is important that they are identified and considered by the local and state government bodies responsible for implementing future water initiatives.

Examples of strategic opportunities are the following:

- The expansion of Swickers pig meat processing facilities through the securing of a new water source will provide a platform for increased investment in piggeries and pig farming in North Burnett and South Burnett. Any expansion in piggeries and pig farming will facilitate increased investment in grain production, transportation and processing in the region to service the pig farming operations. There is a strategic opportunity for vertical integration in the pig meat industry across North Burnett and South Burnett.
- The nut oil industry has the potential to attract significant new investment if nut growing and processing facilities in North Burnett and South Burnett are able to secure additional and/or reliable water. For example, Proteco Oils is currently undertaking a significant expansion and constructing a new facility, and other investment can be expected if greater water security can be achieved.
- There is potential for significant investment in avocado farming and processing operations with the investment in water infrastructure and supply in South Burnett, particularly Blackbutt. For example, Costa has invested in on farm storage at its avocado facility in Kumbia, and local avocado operations are actively exploring new export markets for their products transported through Wellcamp Airport.
- Moffatdale Ridge Winery is actively exploring adding significant acres of grapes to its vineyard. The vision being pursued for the South Burnett wine industry is innovative and seeking to create a ‘maker space’ facility for existing wineries to encourage boutique growers to explore new varieties and manufacturing methods.
- The region currently sends a significant volumes of navy beans to Victoria for processing, and with the creation of increased water security there is the potential to attract investment into the region for local navy bean processing operations.

11.9 South Burnett economic roadmap

11.9.1 Background

The South Burnett region has unique circumstances in relation to its water sources and opportunities in the short, medium and long term.

As outlined in this options analysis[36], South Burnett has multiple urban, industrial and agricultural areas that are currently experiencing systemically low water supply and/or reliability. The South Burnett shortlisted options include build and non-build projects that seek to address those water supply and reliability problems in the short and medium term, including purchasing of water from Tarong Power Station and Seqwater for urban and agricultural purposes respectively, and investigating further a re-regulating weir on the Boyne River.

However, the water environment in South Burnett will be subject to a significant transformation over the next 15–25 years due to the scheduled closure of Tarong Power Station in 2036–37. The closure provides both economic risks and opportunities for South Burnett. The risks include the loss of the largest non-government employer in the region and the potential for subsequent losses in jobs, population and economic activity.

The primary opportunity created by the closure is that the approximately 29,000 ML of high priority water presently allocated to the power stations in the Tarong and Boyne River Scheme will potentially be available for purchase and distribution to the industrial and agricultural sectors in the South Burnett. Further, the closure of the power stations will potentially facilitate the removal of the critical water supply arrangements for Boondooma Dam that prevent the extraction of water by medium priority allocation holders when the dam level falls below approximately 70,000 ML.[37] Both of these factors will potentially provide significantly improved water supply, reliability and flexibility for South Burnett and for long-term planning by the South Burnett Regional Council.

11.9.2 25-year economic roadmap

Based on the risks and opportunities facing the South Burnett, it is recommended that the South Burnett Regional Council undertake an economic planning process that seeks to address the critical issue of how the region will overcome the loss of the Tarong Power Station through investment in viable long-term industries.

As outlined in this options analysis, South Burnett is well positioned to identify existing and new sources of economic growth to capitalise on the future availability of water in the region. There are numerous value-added industries that have the potential to attract significant investment and growth with the injection of available and reliable water supply, including pig processing, high-value horticulture (berries and avocados), peanuts and others.

The planning and execution of a 25-year economic roadmap for South Burnett need to be undertaken in cooperation and partnership of key stakeholders in local government and state government, including DNRME, Stanwell Corporation, Seqwater, Sunwater and DSDTI. Stakeholder engagement should be approached strategically and in a timely manner. For example, consultation with potential stakeholders for irrigation supply from Gordonbrook Dam freed up as a result of the potential transformation initiatives should be included at an appropriate time in the consideration of feasibility/options, so that demand at different price points can be tested and the cost of any distribution model ascertained.

The 25-year economic roadmap should include further investigations into the crop types that will be most suitable for each strategic area within South Burnett and which will provide the highest economic return for the region. The investigation should include engagement with the Queensland Department of Agriculture and Fisheries and utilisation of the Irrigated Crop Suitability Tool to identify the optimal crop mix.

The 25-year economic roadmap should include strategies to implement the recommendations of this options analysis to secure the short- and medium-term water security of South Burnett, and effectively use the

[36] Section 3.4.
[37] *Boyne River and Tarong Water Supply Scheme Operations Manual,* 2020.

opportunities created by those water security measures to plan for the economic and water future of the region after the closure of Tarong Power Station.

The 25-year economic roadmap should build on the research in this options analysis to develop a collection of potential water projects that can be used to stimulate economic growth and attract new investment to the region, subject to further analysis and assessment of each project. Some of the issues to be considered in an economic roadmap include:

- the projects contained in the South Burnett Integrated Water Initiative, as outlined in Chapter 18
- further investigations into other projects that are presently unviable due to restrictions on available water allocations in the region, such as a proposed West Barambah Dam
- options for the negotiation of changes in allocations, government charging regime and interagency historic charging regimes
- water saving initiatives for high priority water that could be repurposed to high-value uses of secure water.

Actions and projects for investigation need to address short-, medium- and long-term potential and provide a roadmap for economic development over 25 years based on the economic potential of available water resources, the soil, the industry and the community.

12. Financial analysis

12.1 Key points

- The financial assessment generated capital and operating costs, residuals values, financial NPVs, net debt positions and likely customer charges, to consider the financial viability of each option.
- P90 capital costs were generated for the infrastructure options that include intrinsic and contingent risk modelling.
- Operating costs for the options have also been developed using a bottom-up approach including operations and maintenance, ongoing environmental conditions, land tax, council rates, land management costs and insurance.
- A financial assessment provides an indication of the cashflows associated with each option, net debt position over the life of the project and cost recovery prices (fixed and variable) where appropriate.
- A set of scenarios for government funding (60%, 30% and 0% of capital costs) have also been calculated for the options discussed at Chapter 12.

12.2 Approach

The financial analysis of the options focuses on the following questions:

1) What is the likely total cost (capital and operating costs) associated with the options?
2) If there is insufficient ability for customers to pay for the upfront capital costs of the project, what funding might fill this gap?
3) What is the difference between cost-reflective water charges under each scenario and the results of the demand assessment?

The financial outputs are net cash flow and net debt balances in each year over the evaluation period, discounted at an appropriate rate to calculate net cash flows as well as cost-reflective annual customer charges. The financial assumptions and scenario analysis are consistent with the parameters outlined in the Building Queensland framework.

12.3 Inputs and assumptions

The key inputs and assumptions for the financial assessment include:

- project timing assumptions
  - model start time, evaluation period
- financial assumptions
  - escalation rates, developing, owning and operating entities
- funding assumptions
  - customer contributions, Australian and Queensland government grant funding.

12.3.1 Timing assumptions

Table 12.1 outlines assumptions about the timing of cash flows.

Table 12.1: Timing assumptions

Component	Assumptions/inputs
Model start date	1 July 2020
Model evaluation period	30 years in total plus residual value for infrastructure options
Base date for escalating real construction and upfront capital cost forecasts	30 June 2019, as the cost estimates were developed in 2019–20 based on prevailing costs
Base date for escalating real ongoing operating cost forecasts	30 June 2019, as the cost estimates were developed in 2019–20 based on prevailing costs
Ongoing customer charges	Charges will be collected mid-year (on average) at the commissioning of the option
Discount rate (real, pre-tax)	Assumed WACC for a water infrastructure developer, owner and operator (Sunwater) of 3.22 per cent.
Discount date—base date applied to discount cash flows to determine the NPV	30 June 2020

12.3.2 Financial assumptions

The financial assumptions include escalation and discount rates that have been applied in the financial model.

Table 12.2: Financial assumptions

Component	Assumptions/inputs
Assessment	▪ All references to real dollars in this report refer to FY20 dollars. ▪ An evaluation period of 30 years has been adopted for the financial analysis, to align with Building Queensland guidance ▪ For infrastructure assets with a life greater than 30 years a residual value has been used to correctly match payback periods with asset lives.
Escalations	▪ Where nominal costs are provided: – capital and implementation costs are escalated by 2.29 per cent, the 10-year average annual increase of the ABS Producer Price Index for other heavy and civil engineering construction from FY08 to FY19 – other real costs (including operating costs) have been escalated by 2.5 per cent per annum. This rate has been determined to reflect the midpoint of the RBA's target interest rate range.

12.4 Funding sources

There are several funding sources for the project including:

- customer contributions
- Australian and Queensland government grant funding.

The type of funding available to the project proponent also depends on the type of entity that will construct and own the project.

12.4.1 Customer contributions—maximum revenue requirements

This section outlines the approach taken for calculating the maximum amount of revenue that could be recovered for the options and the resulting indicative charges for customers.

A maximum revenue requirement establishes the total amount of revenue that an efficiently operated business would need to remain commercially viable but not enjoy monopoly profits. The revenue requirement is not intended, nor should it become, a guaranteed level of revenue that the business will recover. Actual returns may fall short of the revenue level established by the maximum revenue requirement.

The maximum revenue requirement comprises the following building blocks:

- a return on capital
- a return of capital (depreciation and annuities)
- operating and maintenance costs.

The revenue building block components applied to this option are outlined below.

12.4.1.1 Return on capital

The generally accepted regulatory approach for establishing the rate of return is to estimate the weighted average cost of capital (WACC). The parameters used generally reflect the assumption that Sunwater could be the proponent for such a project, which enables financial analysis from the perspective of the Queensland Government or a Queensland government-owned company. The assumed parameters—or key inputs used to calculate the nominal discount rate—are outlined **Table 12.3**.

Table 12.3: WACC and return on capital parameters

Parameter	Value
Risk-free rate of return	1.01%
Market risk premium	6.50%
Equity beta	0.77
Gamma	0.41
Cost of equity	6.02%
Cost of debt	3.94%
Level of risk capital provided (equity)	60%
Level of borrowings (debt)	40%
Water industry WACC (real, pre-tax)	**3.22%**

12.4.2 Return of capital

The return of capital measures the decline in the value of an asset's service potential from its use. For this project, the return of capital should aim to provide cashflow to maintain the service provision of the pipeline.

There are broadly two approaches to establishing a return of capital charge:

- cost-based depreciation charges
- renewals annuities.

A cost-based depreciation charge has been applied for this option. The following table outlines the approach for the calculating the return of capital in more detail.

Table 12 4: Depreciation assumptions

	Assumption
Asset life	Depending on cost item
Depreciation method	Straight-line

12.4.3 Operating and maintenance costs

Each option has ongoing operating and maintenance project expenditure (operating costs) that are allocated into fixed and variable categories. These charges are based on efficient service delivery and are appropriate for the scale and nature of the business activity.

12.4.4 Bill impacts

Costs that are not covered by grant funding will have to be recovered through water price increases.

12.4.5 Australian and Queensland government grant funding

Australian and Queensland Government grant funding may be required to meet the capital costs of the project in addition to the customer contributions. This grant funding is assumed to not be repaid and reduces the capital cost of the project to be funded by concessional loans. Types of grant funding include:

- Queensland Government grant funding
- Australian Government grant funding, including from the National Water Infrastructure Development Fund.

The Queensland Government grant funding would be provided to the construction entity. The Australian Government grant funding would be provided to the Queensland Government for transfer to the construction entity as per the conditions of inter-government agreement. Other Australian Government funding could be provided in addition.

12.5 Funding scenarios

The financial assessment focuses on assessing the impacts on financial viability through three funding scenarios. There are potentially many funding scenarios, however these three scenarios best illustrate the implications of different funding types and meet the conditions of the relevant funding sources.

The three funding scenarios assume that in customer contributions, with the remaining provided by either grant funding or concessional loans. The scenarios are:

- Scenario 1 (High government funding): 60% of capital costs is provided as grant funding from the Australian and/or Queensland Government, with the remainder collected from customers.
- Scenario 2 (Medium government funding): 30% of capital costs is provided as grant funding from the Australian and/or Queensland Government, with the remainder recovered from customers.
- Scenario 3 (No government funding): All capital and operating costs are recovered from customers.

12.6 Financial analysis

The financial analysis consists of:

- determining the cost-reflective annual charges
- understanding the net debt position of the project over its lifetime.

12.6.1 Re-regulating weir on the Boyne River

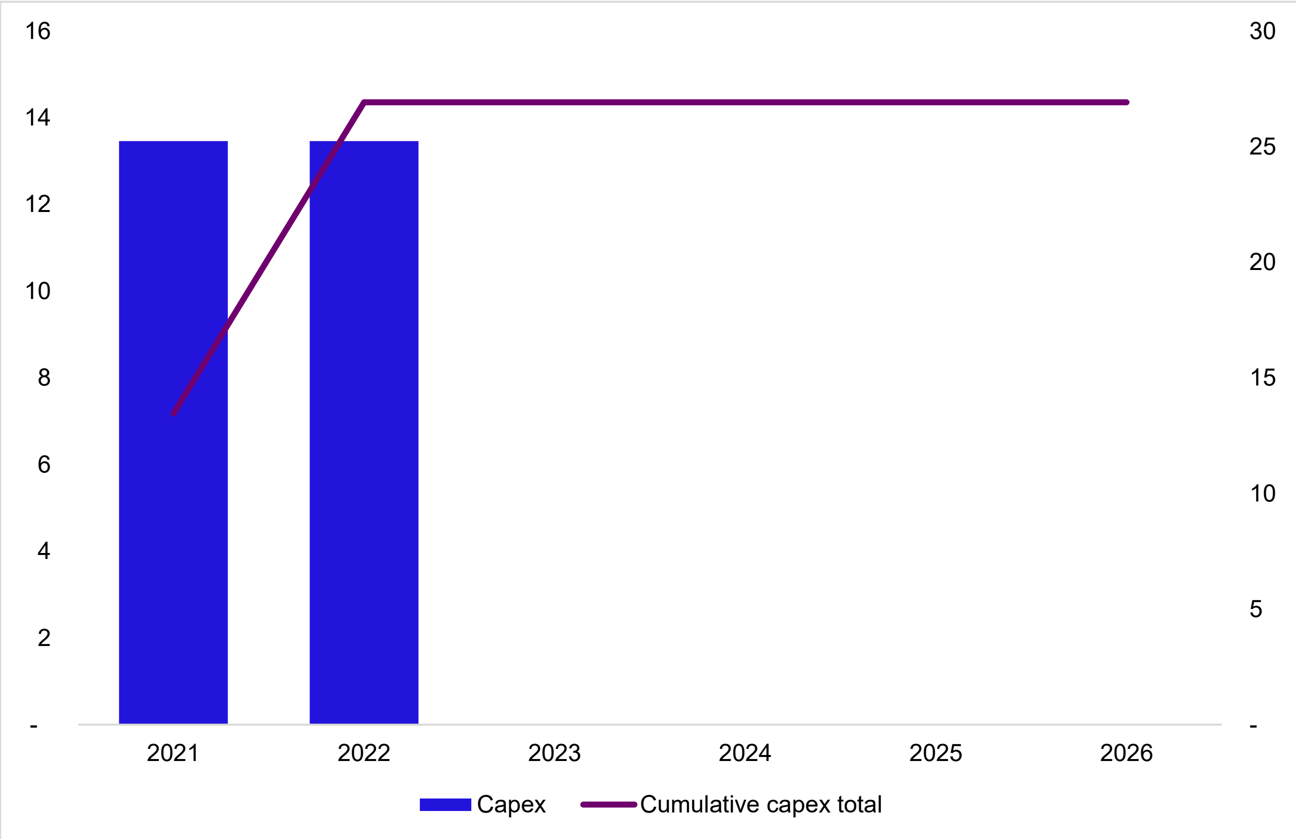
Capital costs for Boyne River Weir are assumed to be incurred in year 1, with construction expected to be completed in two years. The construction of Boyne River Weir is forecast to cost $26.92 million (**Table 12.5**). This weir will improve reliability, rather than increase water allocations, which mean that unsupplemented water allocations will not need to be purchased.

Table 12.5: Boyne River Weir risk-adjusted capital costs

Item	P10	P50	P90
Total ($ million)	11.31	17.98	26.92

The construction profile of the medium capital costs associated with Boyne River Weir are shown in **Figure 12.1**.

Figure 12.1: Boyne River Weir medium capital cost profile ($ million)



The ongoing operating costs for the Boyne River Weir were developed in conjunction with the capital costs. Operating costs are shown in **Table 12.6**.

Table 12.6: Boyne River Weir ongoing operational costs

Item	Low cost ($ per year)	Medium cost ($ per year)	High cost ($ per year)
Operations and maintenance	137,453	152,725	167,998
Ongoing environmental conditions	34,363	38,181	41,999
Land tax	17,182	19,091	21,000
Council rates	6,873	7,636	8,400
Land management costs	34,363	38,181	41,999
Insurance	13,745	15,273	16,800
Annualised refurbishment costs	34,363	38,181	41,999
Total fixed operations and maintenance costs	**278,342**	**309,269**	**340,196**

12.6.1.1 Residual values

Jacobs assumed that Boyne River Weir has a life of 100 years. This assumption is reflected in residual calculations in year 30 of the financial model.

Table 12.7: Residual value estimate for Boyne River Weir

	Residual value
Residual value in year 30 ($)	27,960,177
NPV	**8,620,645**

12.6.1.2 Revenues

The proposed funding under each scenario is detailed in the table below. If there is still outstanding capital contribution required for the project (after upfront water sales and grant funding), this will be funded through ongoing charges.

Table 12.8: Boyne River Weir funding scenarios

	Scenario 1	Scenario 2	Scenario 3
Water user contribution ($ million)	–	–	–
Queensland and Australian Government funding ($ million)	16.15	8.08	–
Capital funded through ongoing charges ($ million)	10.77	18.85	26.92

The required annual charges are based on the forecast ongoing costs of the project. These costs are attributed to the improved reliability of medium priority water within the scheme as shown in **Table 12.9**.

The annual charges have been developed to recover all remaining capital costs across all medium priority irrigators within the Boyne River and Tarong Water Supply Scheme. This increase in prices may require modification to the current Queensland Government's irrigation pricing policy, which caps price increases.

Table 12.9: Boyne River Weir—fixed and variable charge

	Scenario 1	Scenario 2	Scenario 3
Part A (fixed charge) ($/ML)	102.61	132.76	162.90
Part B (variable charge) ($/ML)	1.77	1.77	1.77

The total forecast annual revenue for Boyne River Weir annual charges is shown in **Table 12.10**.

Table 12.10: Boyne River Weir —total annual revenue from water charges

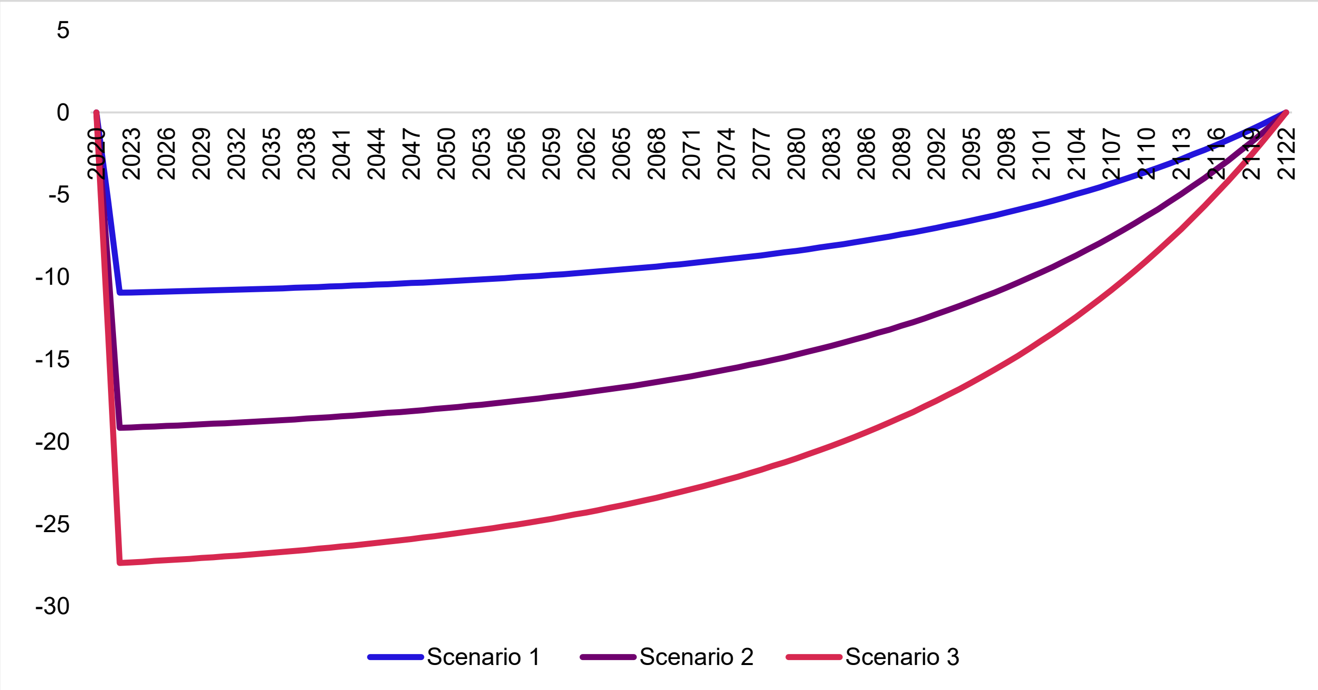
	Scenario 1	Scenario 2	Scenario 3
Part A & B ($ million)	676,761	952,379	1,227,998

12.6.1.3 Net debt

The implication of calculating cost-reflective charges based on forecast capital, operating and financing costs, and using these charges as the forecast revenue, is that the financial analysis will show a positive net present financial value. A better metric for considering a project's financial viability when revenues equal costs is the amount of debt held by the project.

The net debt of the three scenarios is shown in **Figure 12.2**.

Figure 12.2: Net debt under the three scenarios ($ million)



12.6.2 Construct a re-regulating weir on the Barambah Creek (Barlil Weir)

12.6.2.1 Raw capital and operating costs

Capital costs for Barlil Weir are assumed to be incurred in year 1, with construction expected to be completed in two years. The raw construction of Barlil Weir is forecast to range between $3.5 million and $17.1 million (**Table 12.11**). This range of uncertainty could be reduced subject to further investigation, especially in regard to the fish lock and offsets. A more detailed discussion of capital costs appears as Appendix H.

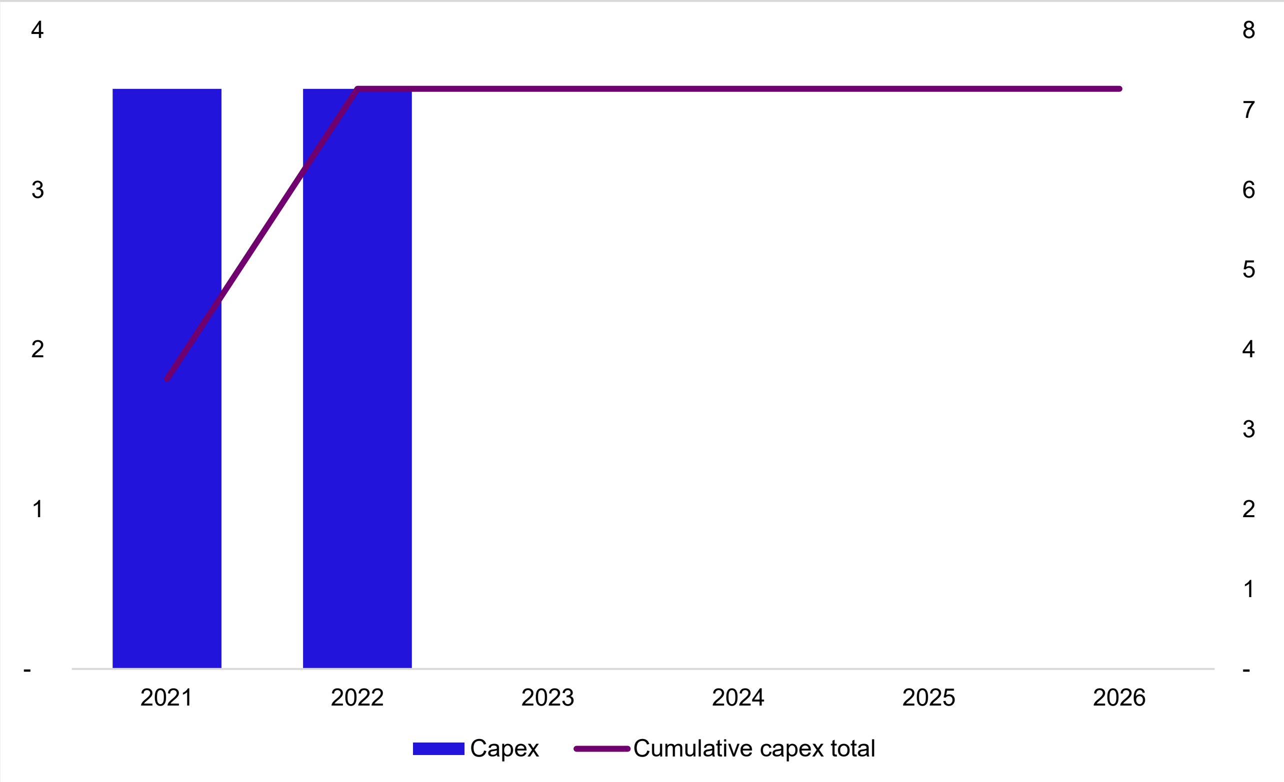
Table 12.11: Barlil Weir—raw upfront capital costs

Item	Low cost ($ million)	Medium cost ($ million)	High cost ($ million)
General	0.25	0.27	0.7
Weir construction	1.09	1.21	2.2
Outlet works	0.29	0.32	0.59
Control building	0.0	0.04	0.12
Protection	0.12	0.14	0.16
Landscaping	0.01	0.02	0.06
Upstream effects	0.61	0.68	1.29
Fish lock		1.8	2.14
Total direct cost			
Investigation and design	0.25	0.28	0.98
Project and contract management	0.14	0.16	1.88
Site supervision and administration	0.14	0.16	0.2
Land resumption	0.29	0.29	0.29
Approvals	0.25	0.55	2.02
Offsets		1.36	4.47
Total cost	**3.48**	**7.28**	**17.1**

Unsupplemented Water Allocations will need to be purchased in Barker Barambah Creek within the Barker Barambah Water Supply Scheme to fill Barlil Weir. Over the past six years, 888 ML have been traded across 13 transactions, at an average traded value of $0.

The construction profile of the medium capital costs associated with Barlil Weir are shown below.

Figure 12.3: Barlil Weir medium capital cost profile ($ million)



The ongoing operating costs for the Barlil Weir were developed in conjunction with the capital costs. Operating costs for are shown in **Table 12.12**.

Table 12.12: Barlil Weir ongoing operational costs

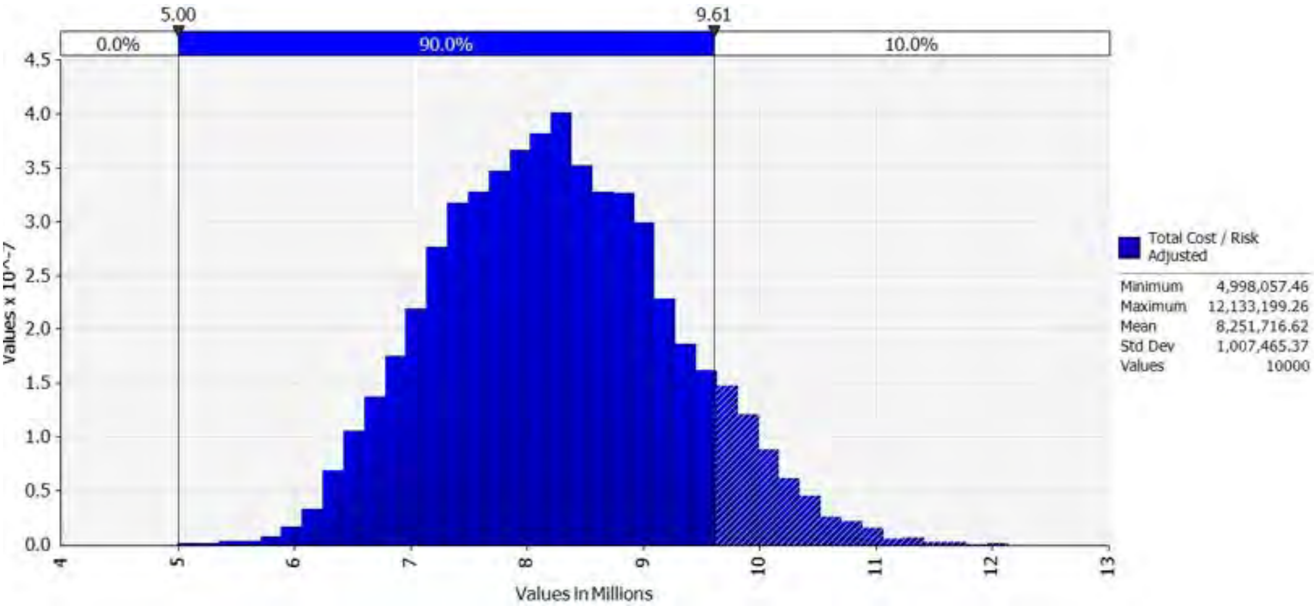
Item	Low cost ($ per year)	Medium cost ($ per year)	High cost ($ per year)
Operations and maintenance	33,444	37,160	40,876
Ongoing environmental conditions	8,361	9,290	10,219
Land tax	4,181	4,645	5,110
Council rates	1,672	1,858	2,044
Land management costs	8,361	9,290	10,219
Insurance	3,344	3,716	4,088
Annualised refurbishment costs	8,361	9,290	10,219
Total	**67,725**	**75,250**	**82,774**

12.6.2.2 Risk-adjusted capital costs

The intrinsic risk adjustment uses Monte Carlo simulation to develop a probability distribution (0 to 100 per cent) using the low, medium and high capital costs. The P90 cost is then taken from this probability distribution and the medium cost is subtracted from that to calculate the P90 intrinsic cost.

The probability distribution for the Barlil Weir capital costs is shown in the figure below.

Figure 12.4: Barlil Weir—intrinsic risk adjustment



The contingent risk adjustment accounts for risks that are outside the low, medium and high capital cost assessment.

Table 12.13: Barlil Weir—top contingent risks

Risk	Probability—post-mitigation (%)	Post-control consequence ($ million)
Wet weather—potential delay to progress as rain hampers construction activities	40	0.5
Diversion/flood event—potential delay to progress as structure overtopped and rework required	30	0.25
Availability of construction materials including cement	40	0.17
Design growth	50	0.13
Foundations may not be as simple, or bedrock may not be to the planned foundation line	50	0.12

The P90 capital cost for Barlil Weir is $11.35 million, as shown in the table below.

Table 12.14: Barlil Weir—P90 capital costs

Item	Weir ($ million)
Total—raw capital cost	**7.27**
Intrinsic risk allowance	2.34
Contingent risk allowance	1.74
Total—risk adjustment	**11.35**

12.6.2.3 Residual values

Jacobs assumed that Barlil Weir has a life of 100 years. This assumption is reflected in residual calculations in year 30 of the financial model. The residual value provided is net of all costs and is the remaining benefit of the asset.

Table 12.15: Residual value estimate for Barlil Weir

	Net residual value
Residual value in year 30 ($)	10,858,880
NPV (medium discount rate)	**1,426,500**

12.6.2.4 Revenues

Customer contributions for the purchase of water allocations from the project will be collected to offset the capital cost of the project. These amounts are based on the capacity and willingness to pay assessment (Chapter 10).

Table 12.16: Barlil Weir—assumed upfront customer contributions

	Scenario 1	Scenario 2	Scenario 3
Nominal volume (yield, ML)	3,000	3,000	3,000
Customer contributions per ML ($/ML)	**500**	**1,000**	**1,5000**
Total customer contribution ($ million)	**1,500,000**	**3,000,000**	**4,500,000**
Percentage of total capex	13%	26%	40%

Proposed grant funding under each scenario is detailed in the table below. If there is still outstanding capital contribution required for the project, this will be funded through ongoing charges.

Table 12.17: Barlil Weir funding scenarios

	Scenario 1	Scenario 2	Scenario 3
Water user contribution ($ million)	1.5	3.0	4.5
Queensland and Australian Government funding ($ million)	6.8	3.4	–
Capital funded through ongoing charges ($ million)	3.05	4.95	6.85

The required annual charges are based on the forecast ongoing costs of the project. These costs are attributed to the new allocations (**Table 12.18**). The annual charges have been developed on a full cost recovery basis and are standalone. It has been assumed that there is no cross-subsidy between new and existing customers.

Table 12.18: Barlil Weir— new fixed and variable charge

	Scenario 1	Scenario 2	Scenario 3
Part A (fixed charge) ($/ML)	91.51	105.38	119.25
Part B (variable charge) ($/ML)	4.60	4.60	4.60

The total forecast annual revenue for Barlil Weir annual charges is shown in **Table 12.19**.

Table 12.19: Barlil Weir—total annual revenue from water charges

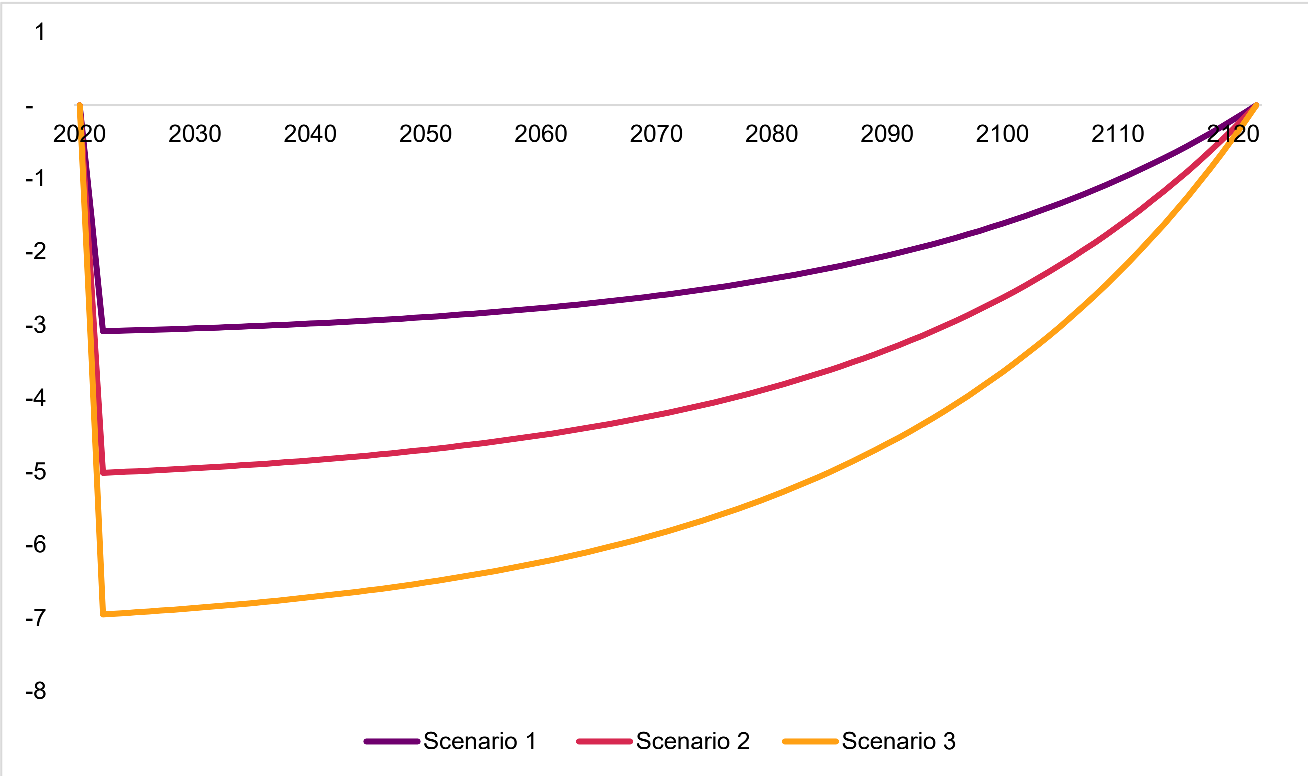
	Scenario 1	Scenario 2	Scenario 3
Part A & B ($ million)	234,020	298,986	363,953

12.6.2.5 Net debt

The implication of calculating cost-reflective charges based on forecast capital, operating and financing costs, and using these charges as the forecast revenue, is that the financial analysis will show a positive net present financial value. A better metric for considering a project's financial viability when revenues equal costs is the amount of debt held by the project.

The net debt of the three scenarios is shown in **Figure 12.5**.

Figure 12.5: Net debt under the three scenarios ($ million)



12.6.3 Build a pipeline from Paradise Dam to Coalstoun Lakes

12.6.3.1 Raw capital and operating costs

Capital costs for the pipeline from Paradise Dam to Coalstoun Lakes are assumed to be incurred in year 1, with construction expected to be completed in two years. The construction of the pipeline from Paradise Dam to Coalstoun Lakes is forecast to cost $46.86 million (**Table 12.20**).

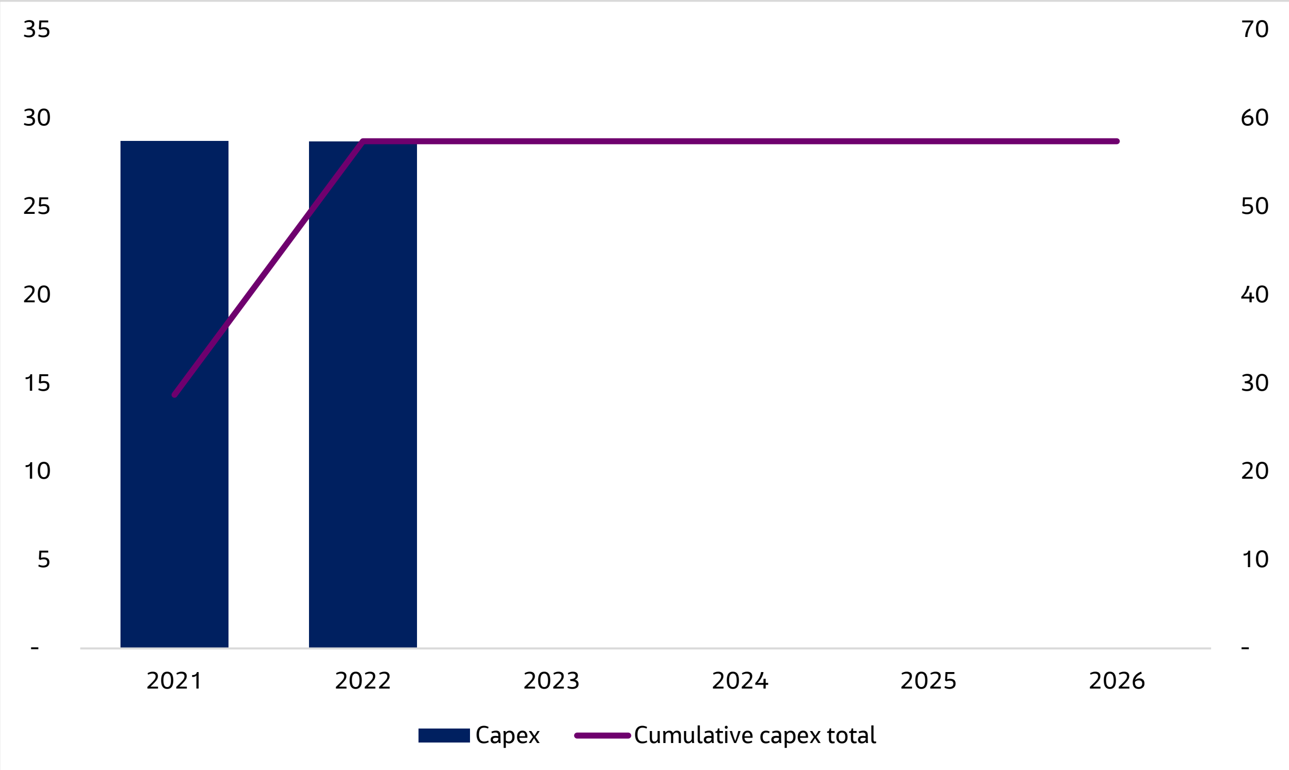
Table 12.20: Paradise Dam to Coalstoun Lakes pipeline upfront capital costs

Item	Low cost ($ million)	Medium cost ($ million)	High cost ($ million)
Establishment	0.20	0.25	0.30
Survey	0.75	1.00	1.50
Environmental	0.50	1.00	1.50
Disestablishment and rehabilitation	0.20	0.25	0.30
Pipe supply	8.40	9.30	12.00
String, lay and joint pipe	1.40	1.55	2.00
Trench excavation	1.68	1.86	2.40

Item	Low cost ($ million)	Medium cost ($ million)	High cost ($ million)
Bedding, shade, backfill	3.36	3.72	4.80
Restoration of ROW	0.28	0.31	0.40
Hydrostatic testing	0.14	0.16	0.20
Air valve, various sizes	0.50	0.50	0.50
Fittings and valves	1.58	1.74	2.23
Crossings	1.58	1.74	3.35
600 kW pump	1.12	1.26	1.40
Piping inside pump station	2.25	3.00	3.75
Fittings and valves	0.34	0.43	0.52
Electricals, switchboards, lighting etc	2.25	3.00	4.50
Power connection	4.50	6.00	7.50
Pipe supply	2.59	3.60	4.32
String, lay and joint pipe	0.43	0.60	0.72
Trench excavation	0.52	0.72	0.86
Bedding, shade, backfill	1.03	1.44	1.73
Restoration of ROW	0.08	0.12	0.14
Hydrostatic testing	0.05	0.06	0.07
Air valve, various sizes	0.30	0.30	0.50
Customer connection	0.75	1.00	1.25
Fittings and valves	0.58	0.78	1.44
Crossings	0.58	1.18	1.44
Total costs	**37.92**	**46.86**	**61.62**

The construction profile of the medium capital costs associated with the pipeline from Paradise Dam to Coalstoun Lakes is shown in **Figure 12.6**.

Figure 12.6: Paradise Dam to Coalstoun Lakes pipeline medium capital cost profile ($ million)



The ongoing operating costs for the pipeline from Paradise Dam to Coalstoun Lakes were developed in conjunction with the capital costs. Operating costs are shown in **Table 12.21**.

Table 12.21: Paradise Dam to Coalstoun Lakes pipeline ongoing operational costs

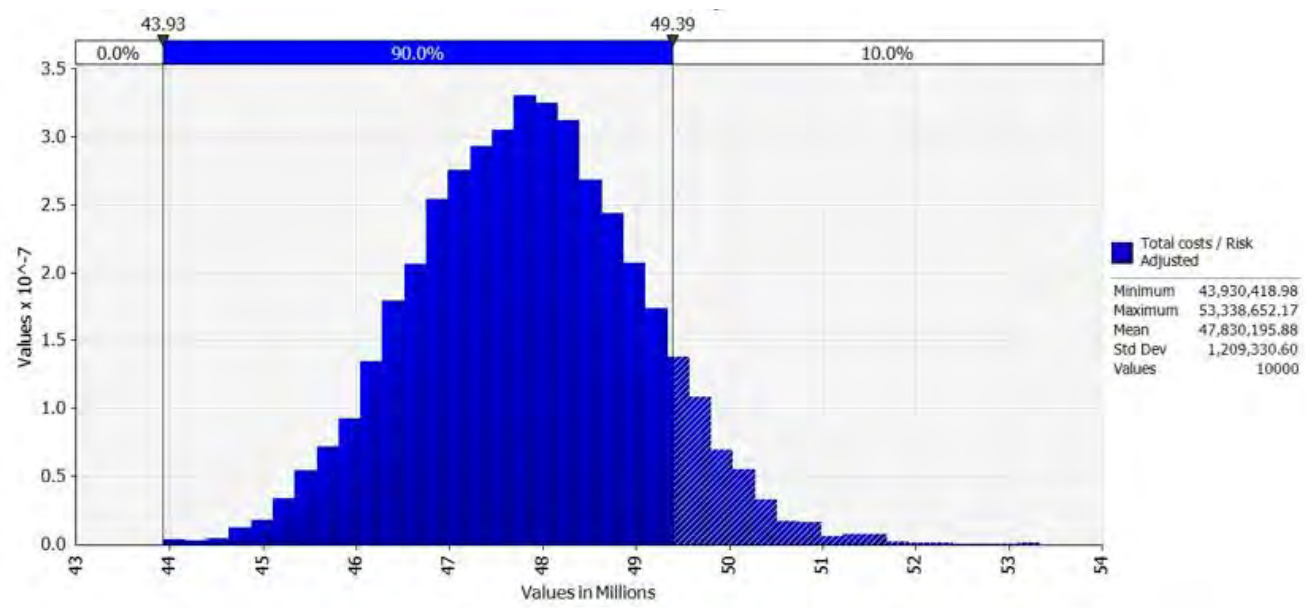
Item	Low cost ($ per year)	Medium cost ($ per year)	High cost ($ per year)
Maintenance costs	192,013	384,025	576,038
Overhead and administrative operating costs for whole scheme	80,100	89,000	97,900
Distribution operating costs for the pipeline (excluding overhead)	1,441,039	1,601,154	1,761,270
Total fixed operations and maintenance costs	**1,713,152**	**2,074,180**	**2,435,208**
Pumping costs	4,000,000	5,000,000	6,000,000
Total variable operations and maintenance costs	**4,500,000**	**5,000,000**	**5,500,000**
Total operations and maintenance costs	**6,213,152**	**7,074,180**	**7,935,208**

12.6.3.2 Risk-adjusted capital costs

The intrinsic risk adjustment uses Monte Carlo simulation to develop a probability distribution (0 per cent to 100 per cent), using the low, medium and high capital costs. The P90 cost is then taken from this probability distribution and the medium cost is subtracted from that to calculate the P90 intrinsic cost.

The probability distribution for the capital costs of the pipeline from Paradise Dam to Coalstoun Lakes is shown in the figure below.

Figure 12.7: Pipeline from Paradise Dam to Coalstoun Lakes—intrinsic risk adjustment



The contingent risk adjustment accounts for risks that are outside the low, medium and high capital cost assessment.

Table 12.22: Pipeline from Paradise Dam to Coalstoun Lakes—top contingent risks

Risk	Probability—post-mitigation (%)	Post-control consequence ($ million)
Design growth	50	2.73
Environmental offsets		2.50
Availability of staff/labour resources or requirement to attract staff/labour to remote location	50	1.37
Availability of construction materials including cement and fly ash	40	1.00
Diversion/flood event—potential delay to progress as structure overtopped and rework required.	30	0.25
Wet weather	40	1.00

The P90 capital cost for the pipeline from Paradise Dam to Coalstoun Lakes is $57.42 million, as shown in the table below.

Table 12.23: Pipeline from Paradise Dam to Coalstoun Lakes—P90 capital costs

Item	$ million
Total—raw capital cost	46.86
Intrinsic risk allowance	2.53
Contingent risk allowance	8.03
Total—risk adjustment	**57.42**

12.6.3.3 Residual values

Jacobs assumed that the pipeline has a life of 50 years. This assumption is reflected in residual calculations in Year 30 of the financial model. The residual value provided is net of all costs and is the remaining benefit of the asset.

Table 12.24: Residual value estimate for Paradise Dam to Coalstoun Lakes pipeline

	Net residual value
Residual value in year 30 ($)	78,816,416
NPV (medium discount rate)	**10,353,885**

12.6.3.4 Revenues

Customer contributions for the purchase of water allocations from the project will be collected to offset the capital cost of the project.

Table 12.25: Paradise Dam to Coalstoun Lakes pipeline assumed upfront customer contributions

	Scenario 1	Scenario 2	Scenario 3
Nominal volume (yield, ML)	25,000	25,000	25,000
Upfront customer contributions per ML ($/ML)	**500**	**1,000**	**1,5000**
Total upfront customer contribution ($ million)	**12,500,000**	**25,000,000**	**37,500,000**
Percentage of total capex	22%	44%	65%

Proposed grant funding under each scenario is detailed in the table below. If there is still outstanding capital contribution required for the project, that will be funded through ongoing charges.

Table 12.26: Paradise Dam to Coalstoun Lakes pipeline funding scenarios

	Scenario 1	Scenario 2	Scenario 3
Water user contribution ($ million)	12.5	25.0	37.5
Queensland and Australian Government funding ($ million)	34.5	17.2	–
Capital funded through ongoing charges ($ million)	10.4	15.2	19.9

The required annual charges are based on the forecast ongoing costs of the project. These costs are attributed to the new allocations as shown in **Table 12.27**. The annual charges have been developed on a full cost recovery basis and are standalone. It has been assumed that there is no cross-subsidy between new and existing customers.

Table 12.27: Paradise Dam to Coalstoun Lakes pipeline—fixed and variable charge

	Scenario 1 ($/ML)	Scenario 2 ($/ML)	Scenario 3
Part A (fixed charge) ($/ML)	117.92	124.37	130.82
Part B (variable charge) ($/ML)	251.31	251.31	251.31

The total forecast annual revenue for Paradise Dam to Coalstoun Lakes annual charges is shown in **Table 12.28**.

Table 12.28: Paradise Dam to Coalstoun Lakes pipeline—total annual revenue from water charges

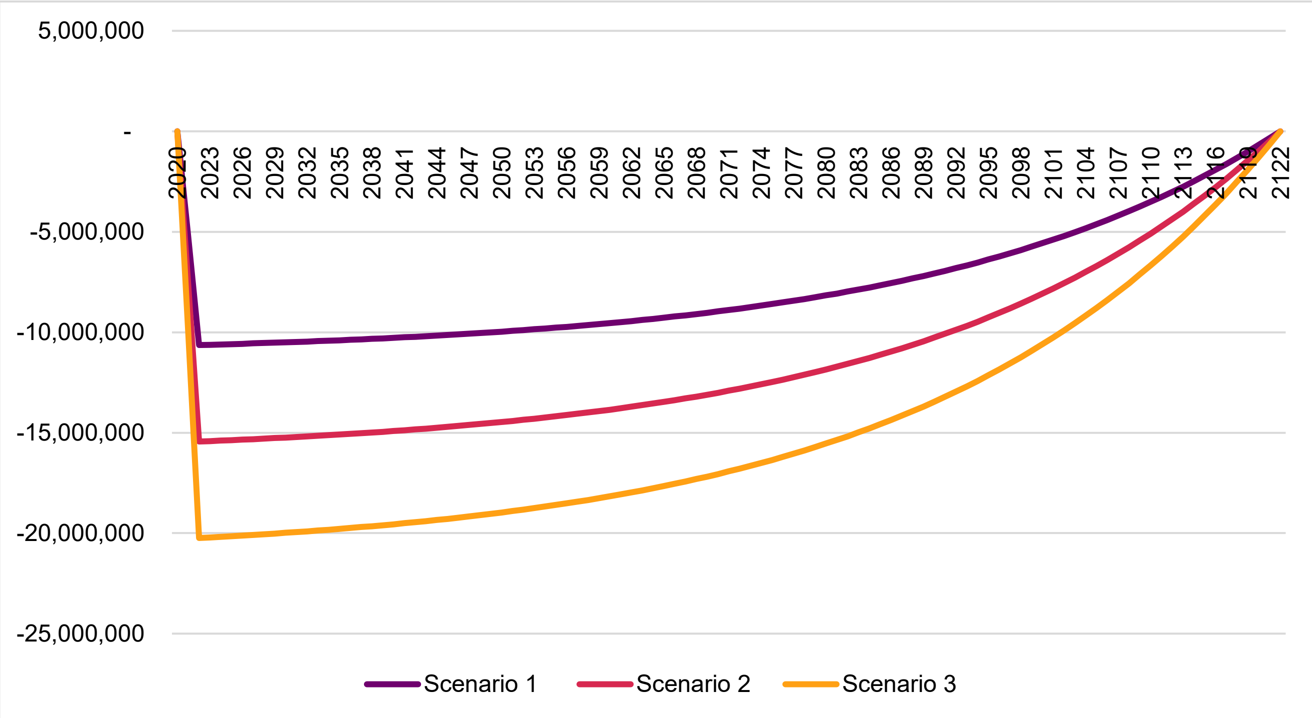
	Scenario 1	Scenario 2	Scenario 3
Part A & B ($ million)	7.62	7.78	7.95

12.6.3.5 Net debt

The implication of calculating cost-reflective charges based on forecast capital, operating and financing costs, and using these charges as the forecast revenue, is that the financial analysis will show a positive net present financial value. A better metric for considering a project's financial viability when revenues equal costs is the amount of debt held by the project.

The net debt of the three scenarios is shown in **Figure 12.8**.

Figure 12.8: Net debt under the three scenarios ($ million)



12.6.4 Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes

12.6.4.1 Raw capital and operating costs

Capital costs for the storage on Barambah Creek and irrigation network are assumed to be incurred in year 1. The construction of the storage on Barambah Creek and irrigation network is forecast to cost $91.18 million.

Table 12.29: Raw capital costs—Barambah Creek Dam

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Clearing storage	0.58	0.72	0.95
Access Road	11.86	14.82	19.56
Boonara Creek Bridge	–	–	16.68
Land resumption	0.08	0.10	0.14
Excavation	0.34	0.42	0.56
Rockfill zone	4.99	6.24	8.24
Transition zone	0.72	0.90	1.18
Plinth concrete	0.39	0.48	0.64
Face slab concrete	1.76	2.20	2.91

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Drilling grout holes	1.68	2.10	2.77
Wave wall concrete	0.55	0.69	0.91
Reinforcement	0.32	0.39	0.52
Outlet works	8.00	10.00	12.00
Excavation	4.06	5.07	6.70
Approach apron concrete	0.28	0.35	0.46
Crest concrete	3.17	3.96	5.23
Flip bucket concrete	1.18	1.48	1.95
Chute floor concrete	2.61	3.26	4.31
Walls concrete	1.03	1.29	1.70
Flip bucket apron concrete	0.46	0.58	0.76
Reinforcement	0.94	1.18	1.55
Bridge deck	1.62	2.02	2.67
Bridge weirs	0.07	0.09	0.12
Environment	2.00	3.00	6.00
Total cost	**48.67**	**61.34**	**130.86**

Table 12.30: Raw capital costs—irrigation network

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Establishment	0.20	0.25	0.30
Survey	0.75	1.00	1.50
Environmental	0.50	1.00	1.50
Disestablishment and rehabilitation	0.20	0.25	0.30
Pipe supply	2.40	3.00	5.40
String, lay and joint pipe	0.40	0.50	0.90
Trench excavation	0.48	0.60	1.20
Bedding, shade, backfill	0.96	1.20	2.25
Restoration of ROW	0.08	0.10	0.23
Hydrostatic testing	0.04	0.05	0.08
Air valve, various sizes	0.20	0.20	0.20
Fittings and valves	0.46	0.57	1.03
Crossings	0.46	0.57	1.03
600 kW pump	0.36	0.60	0.88
Piping inside pump station	0.75	1.00	1.25
Fittings and valves	0.11	0.16	0.21
Electricals, switchboards, lighting, etc.	2.25	3.00	3.75
Power connection	4.50	6.00	7.50
Pipe supply	2.88	3.60	5.18
String, lay and joint pipe	0.48	0.60	0.86
Trench excavation	0.58	0.72	0.86
Bedding, shade, backfill	1.15	1.44	2.16
Restoration of ROW	0.10	0.12	0.14

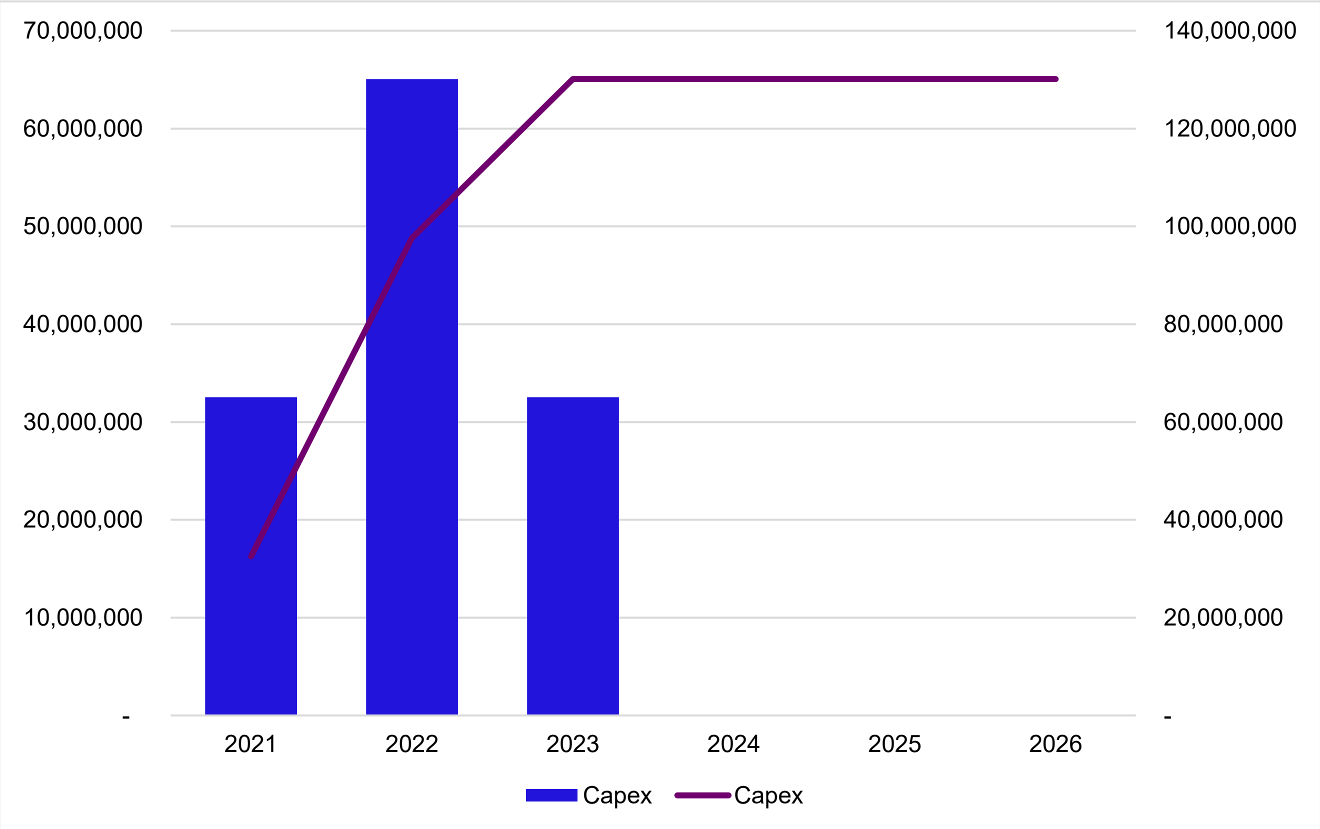
Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Hydrostatic testing	0.05	0.06	0.07
Air valve, various sizes	0.30	0.30	0.50
Customer connection	0.75	1.00	1.25
Fittings and valves	0.63	0.78	1.66
Crossings	0.63	1.18	1.66
Total cost	**22.63**	**29.84**	**43.84**

Table 12.31: Barambah Creek Dam and irrigation network upfront capital costs

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Dam capex	48.67	61.34	130.86
Distribution cost (irrigation network)	22.63	29.84	43.84
Total	**71.3**	**91.18**	**174.7**

The construction profile of the medium capital costs associated with the Barambah Creek Dam and irrigation network is shown in **Figure 12.9**.

Figure 12.9: Barambah Creek Dam and irrigation network medium capital cost profile ($ million)



The ongoing operating costs for the Barambah Creek Dam and irrigation network were developed in conjunction with the capital costs. Operating costs are shown in **Table 12.32**.

Table 12.32: Barambah Creek Dam and irrigation network ongoing operational costs

Item	Low cost ($ per year)	Medium cost ($ per year)	High cost ($ per year)
Overhead costs—dam and distribution	90,000	100,000	110,000
Dam (fixed)	900,000	1,000,000	1,100,000
Distribution (fixed)	4,255,849	4,728,721	5,201,593
Total fixed operations and maintenance costs	**5,245,849**	**5,828,721**	**6,411,593**
Pumping costs—variable	2,250,000	2,500,000	2,750,000
Total variable operations and maintenance costs	**2,250,000**	**2,500,000**	**2,750,000**
Total operations and maintenance costs	**7,495,849**	**8,328,721**	**9,161,593**

12.6.4.2 Risk-adjusted capital costs

The intrinsic risk adjustment uses Monte Carlo simulation to develop a probability distribution (0 to 100 per cent) using the low, medium and high capital costs. The P90 cost is then taken from this probability distribution and the medium cost is subtracted from that to calculate the P90 intrinsic cost. Accordingly, the intrinsic risk for the Barambah Creek Dam is $8.37 million.

The probability distribution for Barambah Creek Dam and irrigation network capital costs is shown in the figures below.

Figure 12.10: Barambah Creek Dam—intrinsic risk adjustment

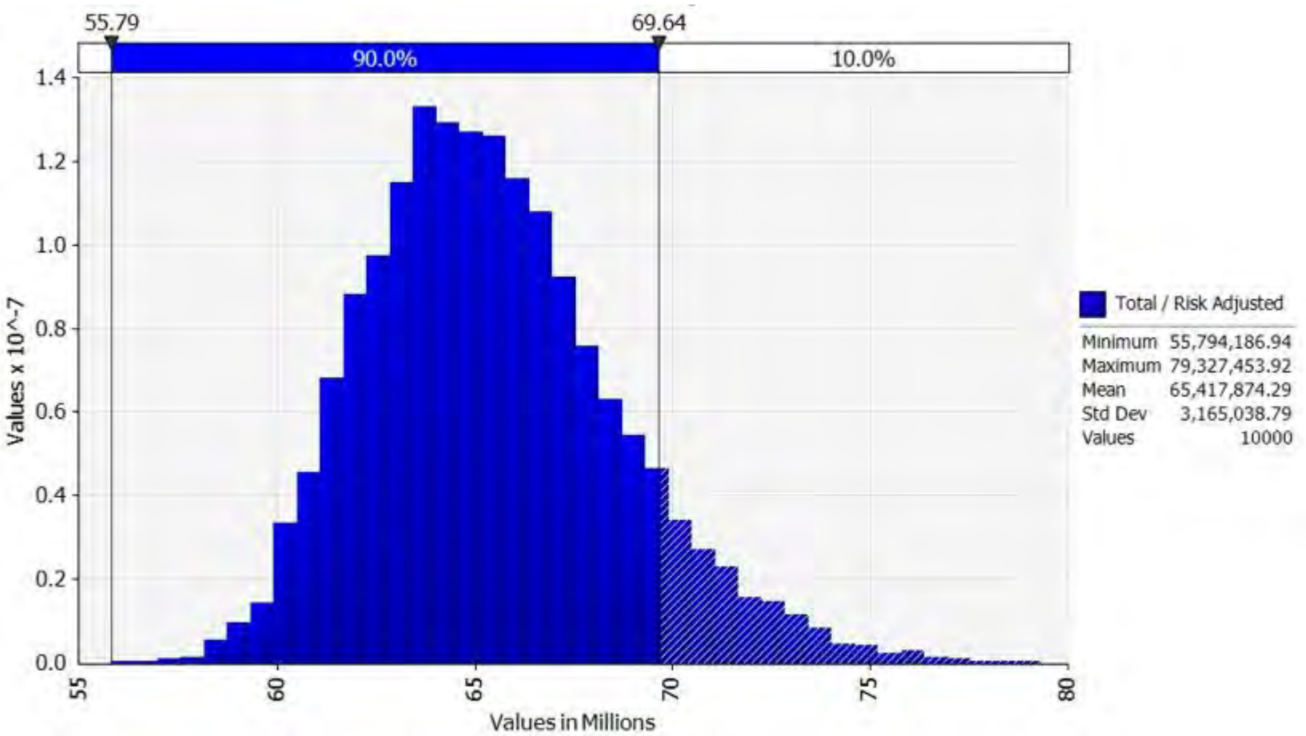
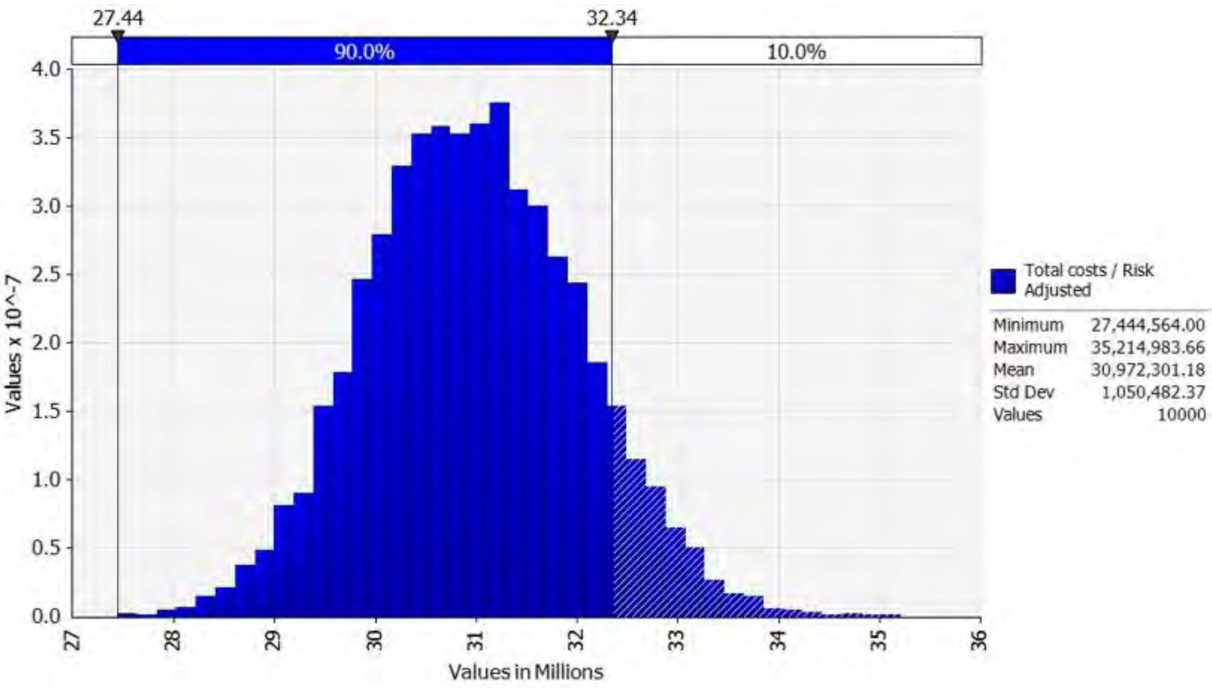


Figure 12.11: Irrigation network—intrinsic risk adjustment



The contingent risk adjustment accounts for risks that are outside the low, medium and high capital cost assessment.

Table 12.33: Barambah Creek Dam—top contingent risks

Risk	Probability—post-mitigation (%)	Post-control consequence ($ million)
Design growth	50%	6.54
Availability of staff/labour resources or requirement to attract staff/labour to remote location	50%	3.27
Foundations may not be as simple, or bedrock may not be to the planned foundation line	50%	3.27
Availability of construction materials including cement	40%	1.23
Potential delay to progress as rain hampers construction activities	40%	0.50

Table 12.34: Irrigation network – Top contingent risks

Risk	Probability – post mitigation	Post-control consequence ($ million)
Design growth	50%	2.73
Environmental offsets		2.50
Availability of staff/labour resources or requirement to attract staff/labour to remote location	50%	1.37
Availability of construction materials including cement and fly ash	40%	1.00
Cultural Heritage significant findings - Time delays and costs associated with assessing and removing the finding from the area.	50%	0.25
Wet weather	40%	1.00

These contingent risks were included in a Monte Carlo simulation to calculate the likely contingent risk. The intrinsic and contingent risk assessment for the dam and irrigation network is summarised below.

Table 12.35: Barambah Creek Dam and irrigation network —P90 capital costs

Item	Barambah Creek Dam ($ millions)	Irrigation network ($ million)
Total—raw capital cost	61.34	29.84
Intrinsic risk allowance	8.37	2.50
Contingent risk allowance	19.98	8.09
Total—risk adjustment	89.69	40.43

The P90 capital cost for the Barambah Creek Dam and Irrigation network is $130 million as shown in the table below.

Table 12.36: Pipeline from Paradise Dam to Coalstoun Lakes—P90 capital costs

Item	Weir ($ million)
Risk adjusted total—dam	89.69
Risk adjusted total—distribution	40.43
Total—risk adjustment	**130.12**

12.6.4.3 Residual values

Jacobs assumed that the dam has a life of a 100 years and irrigation network has a life of 50 years. This assumption is reflected in residual calculations in year 30 of the financial model. The residual value provided is net of all costs and is the remaining benefit of the asset.

Table 12.37: Residual value estimate for Barambah Creek Dam and irrigation network

	Net residual value
Residual value in year 30 ($)	65,557,203
NPV (medium discount rate)	**8,612,061**

12.6.4.4 Revenues

Customer contributions for the purchase of water allocations from the project will be collected to offset the capital cost of the project.

Table 12.38: Barambah Creek Dam and irrigation network assumed upfront customer contributions

	Scenario 1	Scenario 2	Scenario 3
Nominal volume (yield, ML)	22,500	22,500	22,500
Upfront customer contributions per ML ($/ML)	**1,000**	**1,500**	**2,000**
Total upfront customer contribution ($ million)	**22.5**	**33.75**	**45.00**
Percentage of total capex	17%	26%	35%

Proposed grant funding under each scenario is detailed in the table below. If there is still outstanding capital contribution required for the project this will be funded through ongoing charges.

Table 12.39: Barambah Creek Dam and irrigation network funding scenarios

	Scenario 1	Scenario 2	Scenario 3
Upfront water user contribution ($ million)	22.5	33.75	45.00
Queensland and Australian Government funding ($ million)	78.07	39.03	–
Capital funded through ongoing charges ($ million)	29.55	57.33	85.12

The required annual charges are based on the forecast ongoing costs of the project. These costs are attributed to the new allocations (**Table 12.40**). The annual charges have been developed on a full cost recovery basis and are standalone. It has been assumed that there is no cross-subsidy between new and existing customers.

Table 12.40: Barambah Creek Dam and irrigation network—fixed and variable charge

	Scenario 1	Scenario 2	Scenario 3
Part A (fixed charge) ($/ML)	330.52	373.34	416.16
Part B (variable charge) ($/ML)	143.49	143.49	143.49

The total forecast annual revenue for Barambah Creek Dam and irrigation network is shown in **Table 12.41**.

Table 12.41: Barambah Creek Dam and irrigation network—total annual revenue from water charges

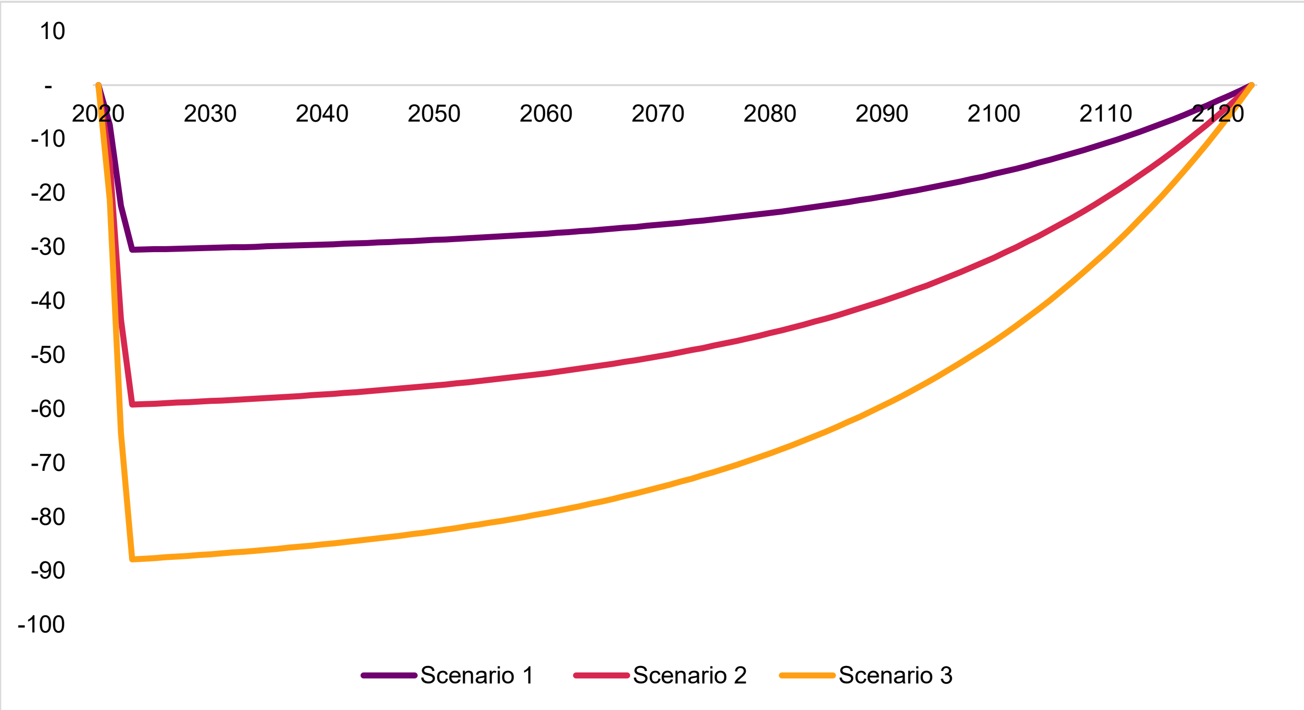
	Scenario 1	Scenario 2	Scenario 3
Part A & B ($ million)	9.35	10.36	11.28

12.6.4.5 Net debt

The implication of calculating cost-reflective charges based on forecast capital, operating and financing costs, and using these charges as the forecast revenue, is that the financial analysis will show a positive net present financial value. A better metric for considering a project's financial viability when revenues equal costs is the amount of debt held by the project.

The net debt of the three scenarios is shown in **Figure 12.12**.

Figure 12.12: Net debt under the three scenarios ($ million)



12.6.5 Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes

12.6.5.1 Raw capital and operating costs

Capital costs for the multiple weirs and irrigation network are assumed to be incurred in year 1. The total construction is forecast to cost $50.58 million.

Table 12.42: Raise Jones Weir—raw capital cost

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Mobilisation	0.14	0.18	0.21
Demobilisation	0.08	0.10	0.11
Diversion and care of river	0.05	0.06	0.07
Access roads	0.02	0.03	0.03
Concrete sill	0.01	0.02	0.02
Fish ladder	0.03	0.04	0.04
Existing apron	0.06	0.07	0.09
Concrete in weir spillway fixed crest	2.09	3.15	4.21
Concrete in weir abutments	0.05	0.07	0.09
concrete in weir outlet works	0.02	0.02	0.03
Concrete in weir apron slabs	0.24	0.30	0.36
Abutments	0.01	0.01	0.01
Weir apron slabs	0.10	0.13	0.15
Spillway	0.07	0.08	0.10
Abutments	0.04	0.05	0.06
Apron	0.07	0.08	0.10

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Farm relocations	0.48	0.59	0.71
Town water	0.03	0.04	0.05
Water stop modifications	0.02	0.02	0.02
Metal work	0.02	0.03	0.03
Modifications to existing outlet	0.03	0.04	0.05
Concrete	0.74	1.20	2.20
Reinforcement	0.09	0.11	0.15
Per stock gates	0.04	0.05	0.15
Cooper crossing	0.68	0.85	1.02
Dykehead crossing	0.29	0.36	0.44
Engineering	0.57	0.72	0.86
Total cost	**6.03**	**8.37**	**11.36**

Table 12.43: Raise Claude Wharton Weir—raw capital costs

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Flap gates—16m x 1.5m high	0.72	0.94	1.09
Built in parts—SS seal plates and ms hinge parts	0.18	0.24	0.28
Installation—gates and BIP	0.45	0.59	0.71
Gate piers—1 No piers, 0.5 m thick	0.86	0.96	1.02
Stoplogs—one set of mild steel stoplogs	0.58	0.76	0.92
Built in parts for stoplogs—SS guides in each weir	0.07	0.10	0.12
Installation of BIP—BIP only	0.07	0.10	0.12
Hydraulic cylinders—280 kN with 1m stroke, ss rod and ms barrel	0.45	0.50	0.53
Hydraulic piping and installation—1800 m ss pipe	0.46	0.50	0.53
HPU—0.9 kW Hydraulic power unit including 600 L oil reservoir	0.09	0.10	0.11
Control system for HPU—PLC control system and programming	0.23	0.25	0.28
Backup generator—12 kVa diesel generator	0.05	0.06	0.07
Electrical installation—electrical installation for above works	0.09	0.10	0.11
Mobilisation and demobilisation	0.22	0.26	0.88
Preliminaries and general	0.65	0.78	0.88
Total cost	**5.16**	**6.24**	**9.37**

Table 12.44: New weir on the Burnett River—raw capital cost

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
General	0.32	0.36	0.56
Weir construction	0.55	0.62	1.20
Outlet works	0.24	0.27	0.47
Control building	0.04	0.04	0.09
Protection	0.13	0.15	0.20
Landscaping	0.01	0.02	0.05
Upstream effects	0.62	0.68	1.03
Fish lock	-	1.20	2.00
Investigation and design	0.25	0.28	0.78
Project and contract management	0.12	0.13	0.20
Site supervision and administration	0.12	0.13	0.24
Land resumption	0.20	0.40	0.60
Approvals	0.25	0.86	1.19
Offsets	-	1.00	3.00
Total cost	**2.85**	**6.13**	**11.61**

Unsupplemented Water Allocations will need to be purchased within the Upper Burnett Supply Scheme to fill the Weirs. Over the past six years, 461 ML have been traded across 6 transactions, at an average traded value of $0.

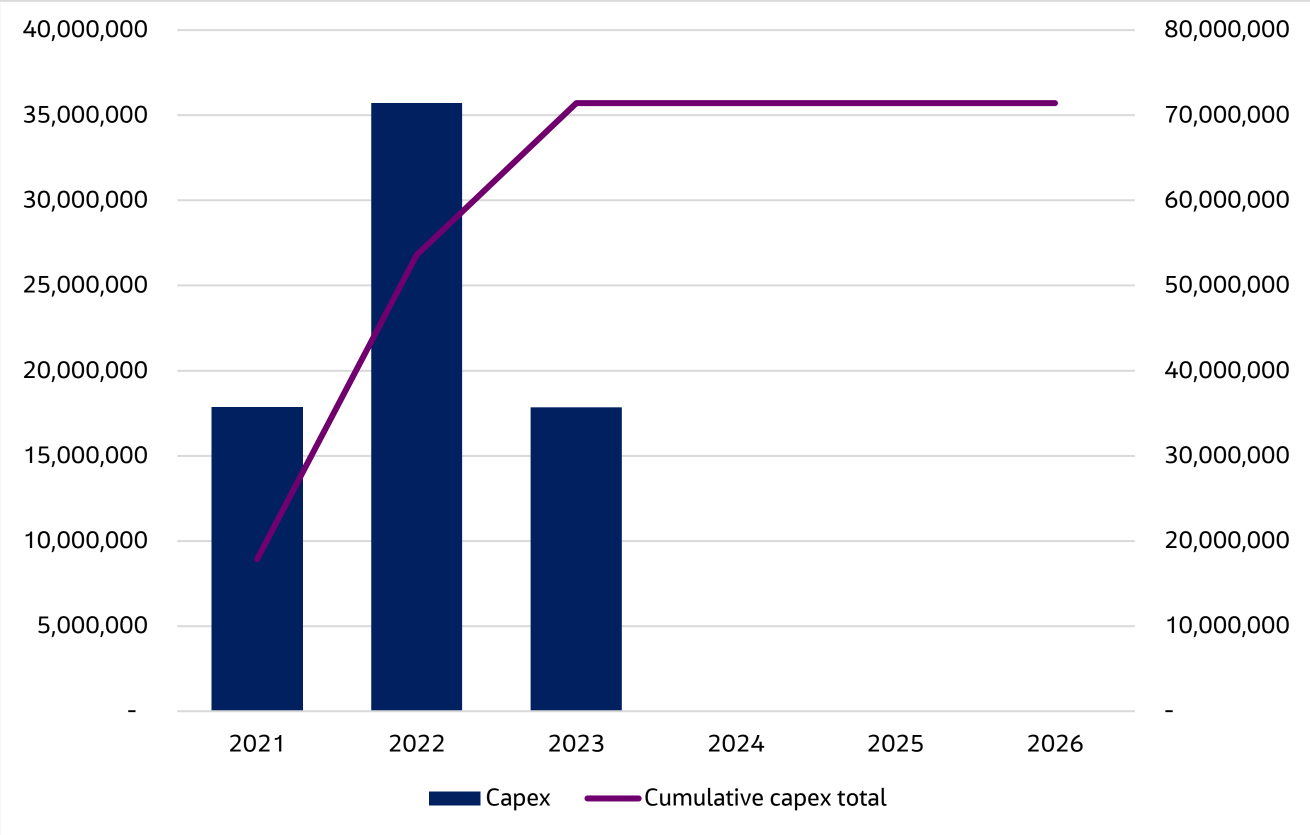
The irrigation network costs have been outlined in the Barambah Creek Dam financial assessment above.

Table 12.45: Raw upfront capital costs

Item	Low cost ($m)	Medium cost ($m)	High cost ($m)
Raise Jones Weir	6.03	8.37	11.36
Raise Claude Wharton Weir	5.16	6.24	9.37
Weir on Burnett River	2.85	6.13	11.61
Irrigation network	22.63	29.84	43.84
Total	**36.67**	**50.58**	**76.18**

The construction profile of the medium capital costs associated with the option is shown in **Figure 12.13**.

Figure 12.13: Medium capital cost profile ($ million)



The ongoing operating costs for the option were developed in conjunction with the capital costs. Operating costs are shown in **Table 12.46**.

Table 12.46: Ongoing operational costs

Item	Low cost ($ per year)	Medium cost ($ per year)	High cost ($ per year)
Operations and maintenance—weirs	439,470	488,300	537,130
Ongoing environmental conditions	109,868	122,075	134,283
Land tax	54,934	61,038	67,141
Council rates	21,974	24,415	26,857
Land management costs	109,868	122,075	134,283
Insurance	43,947	48,830	53,713
Annualised refurbishment costs—weirs	109,868	122,075	134,283
Total fixed and variable operations and maintenance costs—weirs	**889,927**	**988,808**	**1,087,689**
Maintenance costs	430,385	860,770	1,291,155
Overhead and administrative operating costs for whole scheme	80,100	89,000	97,900
Distribution operating costs for the pipeline (excluding overhead)	1,441,039	1,601,154	1,761,270

Item	Low cost ($ per year)	Medium cost ($ per year)	High cost ($ per year)
Total fixed operations and maintenance costs—irrigation network	**1,951,524**	**2,550,925**	**3,150,325**
Pumping costs	2,250,000	2,500,000	2,750,000
Total variable operations and maintenance costs—irrigation network	**2,250,000**	**2,500,000**	**2,750,000**
Total operations and maintenance costs—irrigation network	**4,201,524**	**5,050,925**	**5,900,325**
Total operations and maintenance costs—network and weirs	**5,091,451**	**6,039,733**	**6,988,014**

12.6.5.2 Risk-adjusted capital costs

The intrinsic risk adjustment uses Monte Carlo simulation to develop a probability distribution (0 to 100 per cent) using the low, medium and high capital costs. The P90 cost is then taken from this probability distribution and the medium cost is subtracted from that to calculate the P90 intrinsic cost.

Figure 12.14: Raise Jones Weir—intrinsic risk adjustment

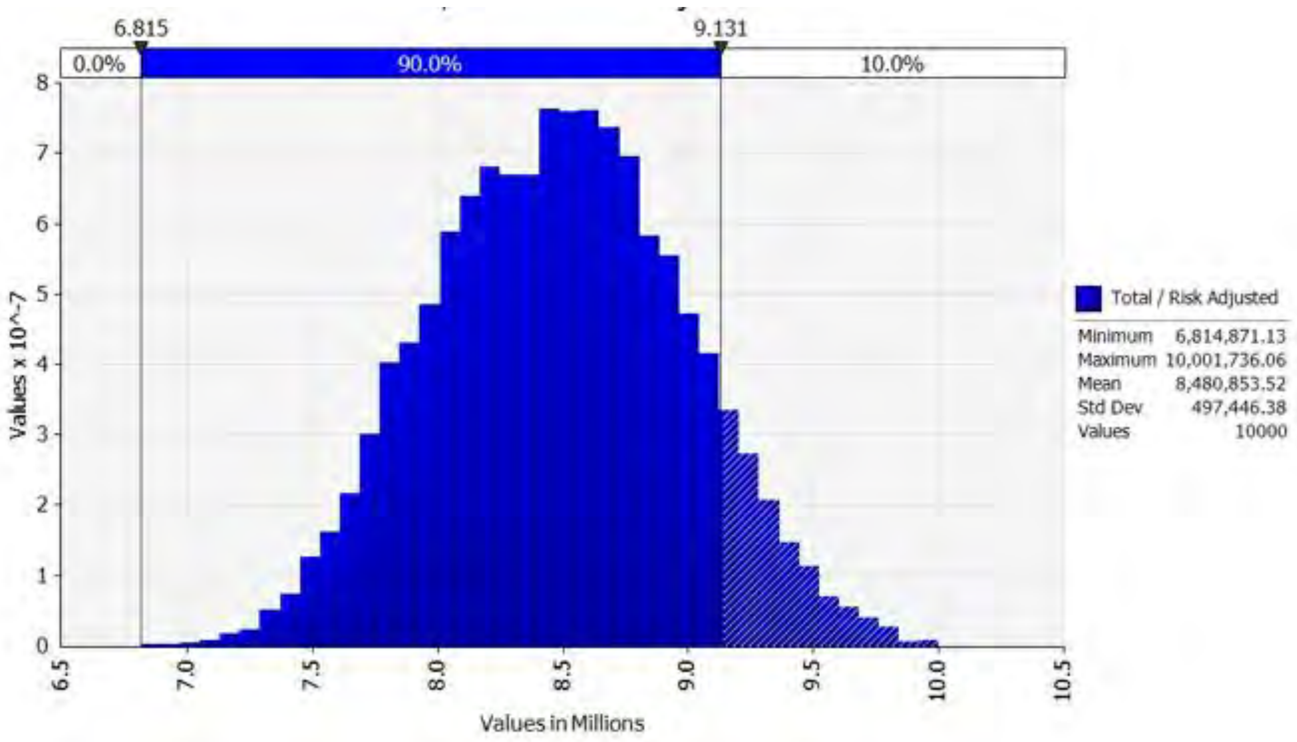


Figure 12.15: Raise Claude Wharton Weir—intrinsic risk adjustment

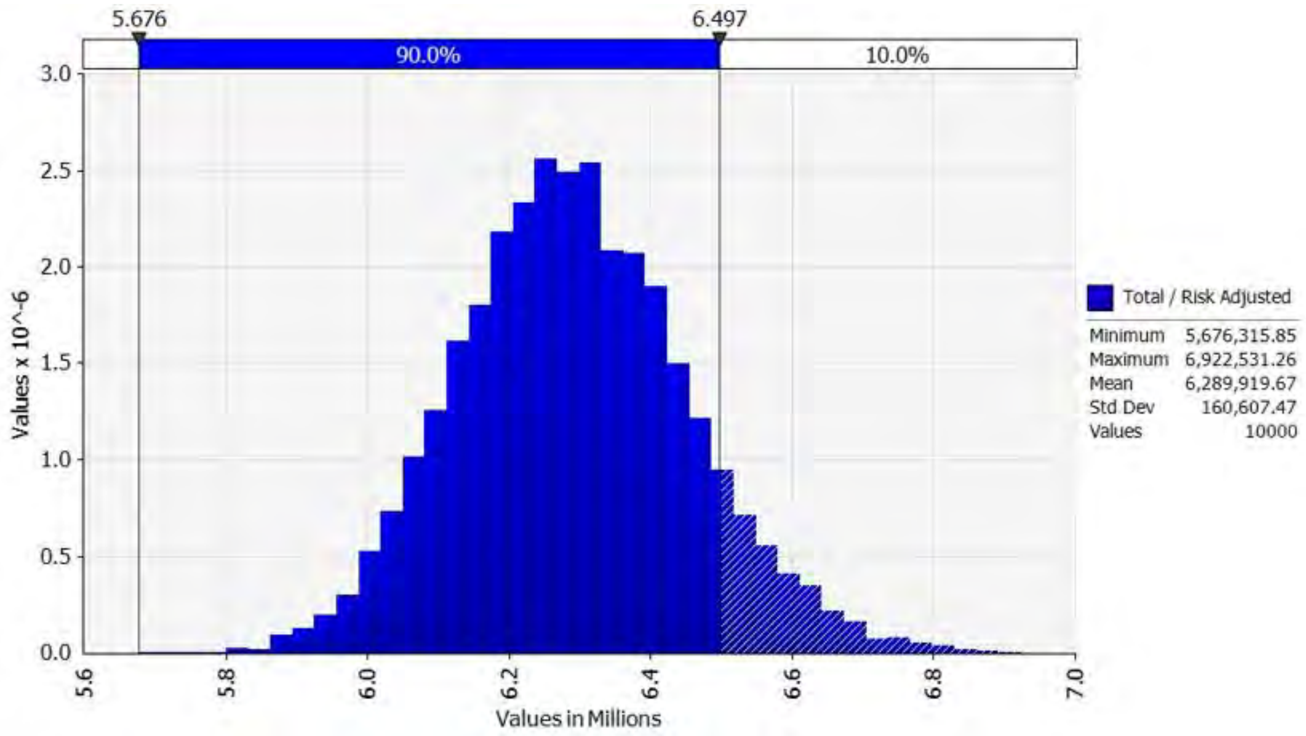


Figure 12.16: New weir on the Burnett River—intrinsic risk adjustment

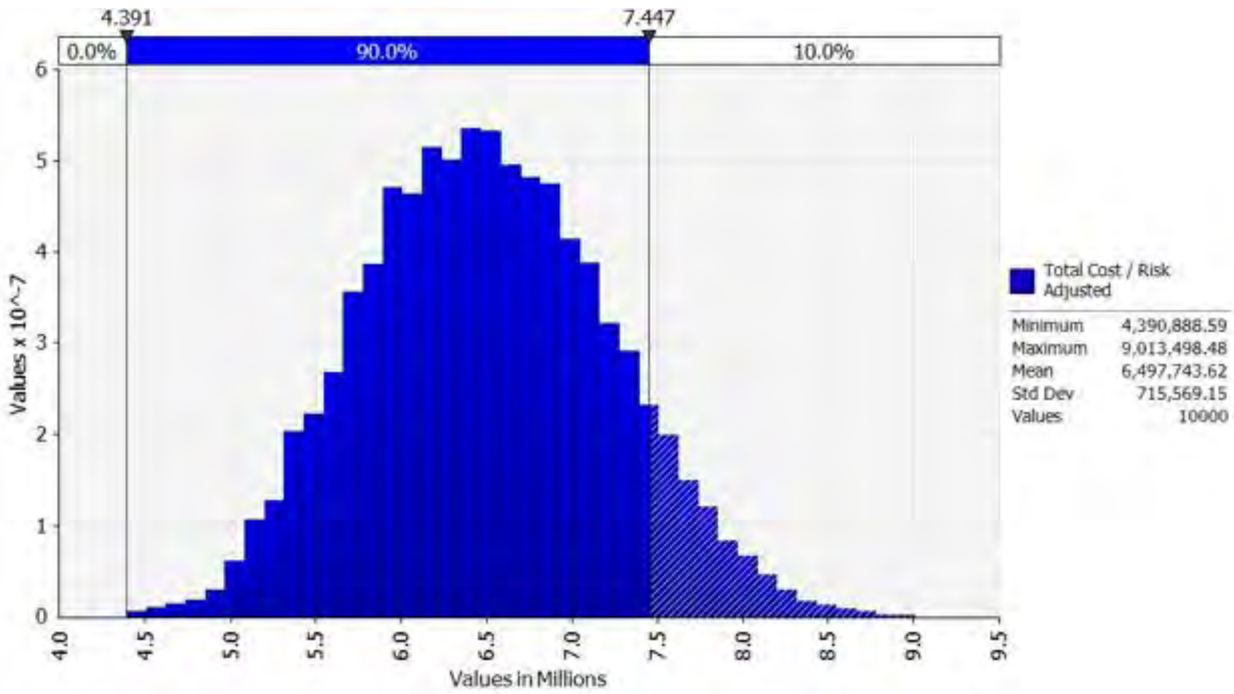
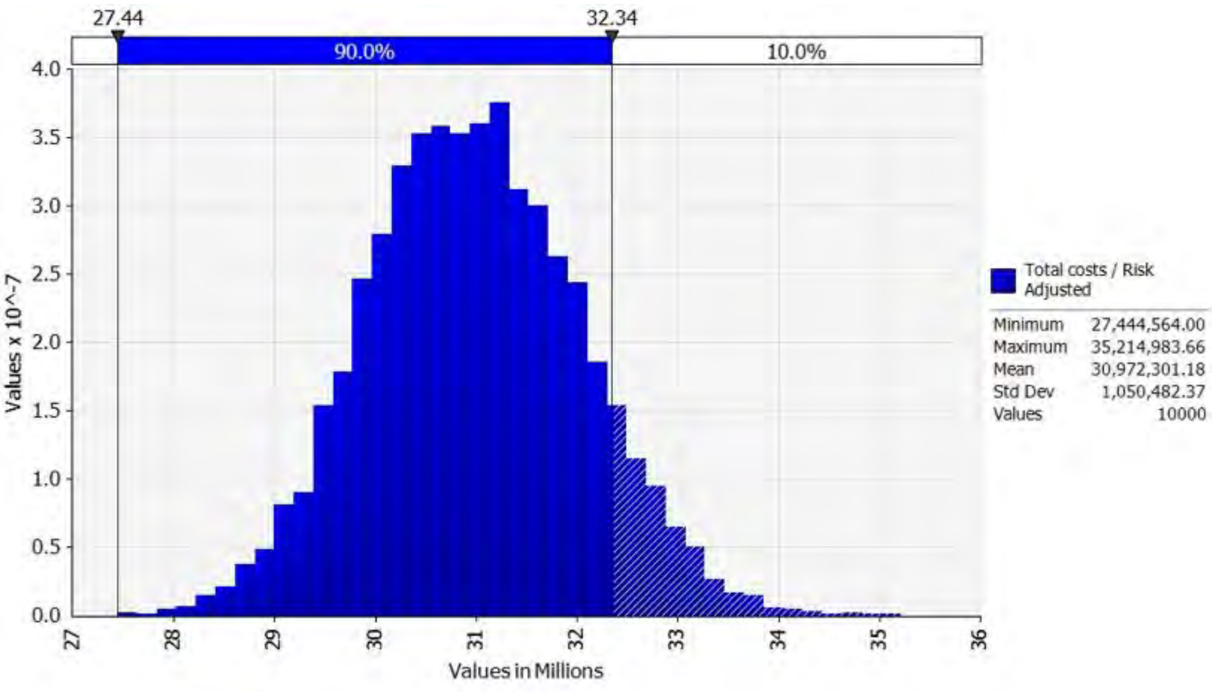


Figure 12.17: Irrigation network—intrinsic risk adjustment



The contingent risk adjustment accounts for risks that are outside the low, medium and high capital cost assessment.

Table 12.47: Raise Jones Weir—top contingent risks

Risk	Probability—post-mitigation (%)	Post-control consequence ($ million)
Design growth	50	1.03
Availability of staff/labour resources or requirement to attract staff/labour to remote location	50	0.51
Cultural heritage significant findings—time delays and costs associated with assessing and removing the finding from the area.	50	0.50
Availability of construction materials including pipe	40	0.50
Potential delay to progress as rain hampers construction activities.	40	0.50

Table 12.48: Raise Claude Wharton Weir—top contingent risks

Risk	Probability—post-mitigation	Post-control consequence ($ million)
Design growth	50%	0.62
Availability of staff/labour resources or requirement to attract staff/labour to remote location	50%	0.31
Availability of construction materials including pipe.	40%	0.25
Cultural heritage significant findings—time delays and costs associated with assessing and removing the finding from the area.	50%	0.25
Wet weather	40%	1.00

Table 12.49: New Weir on the Burnett River—top contingent risks

Risk	Probability—post-mitigation ($%)	Post-control consequence ($ million)
Design growth	50	0.11
Availability of staff/labour resources or requirement to attract staff/labour to remote location	50	0.10
Availability of construction materials including cement and fly ash	40	0.10
Wet weather	40	0.50
Diversion/flood event	30	0.25

Table 12.50: Irrigation network—top contingent risks

Risk	Probability—post-mitigation (%)	Post-control consequence ($ million)
Design growth	50	2.73
Environmental offsets		2.50
Availability of staff/labour resources or requirement to attract staff/labour to remote location	50	1.37
Availability of construction materials including cement and fly ash	40	1.00
Cultural heritage significant findings—time delays and costs associated with assessing and removing the finding from the area.	50	0.25
Wet weather	40	1.00

These contingent risks were included in a Monte Carlo simulation to calculate the likely contingent risk. The intrinsic and contingent risk assessment for the dam and irrigation network is summarised below.

Table 12.51: P90 capital costs

Item	Raise Jones Weir ($ million)	Raise Claude Wharton Weir ($ millions)	New Weir on the Burnett River ($ million)	Irrigation network ($ million)
Total—raw capital cost	8.37	6.24	6.13	29.84
Intrinsic risk allowance	0.76	0.26	1.32	2.50
Contingent risk allowance	4.08	2.37	1.47	8.09
Total—risk adjustment	13.21	8.87	8.92	40.43

The P90 capital cost for the option is $71.43 million, as shown in the table below.

Table 12.52: P90 capital costs

Item	$ million
Risk adjusted total—Raise Jones Weir	13.21
Risk adjusted total—Raise Claude Wharton Weir	8.87
Risk adjusted total— New weir on Burnett river	8.92
Risk adjusted total—Irrigation network	40.43
Total—risk adjustment	**71.43**

12.6.5.3 Residual values

Jacobs assumed that the weirs and associated irrigation network have a life of 100 years. This assumption is reflected in residual calculations in year 30 of the financial model.

Table 12.53: Residual value estimate

	Net residual value
Combined residual value in year 30 ($)	122,897,298
NPV (medium discount rate)	**16,144,664**

12.6.5.4 Revenues

Customer contributions for the purchase of water allocations from the project will be collected to offset the capital cost of the project.

Table 12.54: Assumed upfront customer contributions

	Scenario 1	Scenario 2	Scenario 3
Nominal volume (yield, ML)	25,000	25,000	25,000
Upfront customer contributions per ML ($/ML)	500	1,000	1,500
Total upfront customer contribution ($ million)	**12.5**	**25.00**	**37.50**
Percentage of total capex	18%	35%	53%

Proposed grant funding under each scenario is detailed in the table below. If there is still outstanding capital contribution required for the project, this will be funded through ongoing charges.

Table 12.55: Funding scenarios

	Scenario 1	Scenario 2	Scenario 3
Upfront water user contribution ($ million)	**12.5**	**25.00**	**37.50**
Queensland and Australian Government funding ($ million)	42.86	21.43	–
Capital funded through ongoing charges ($ million)	16.07	25	33.93

The required annual charges are based on the forecast ongoing costs of the project. These costs are attributed to the new allocations, as shown in **Table 12.56**. The annual charges have been developed on a full cost recovery basis and are standalone. It has been assumed that there is no cross-subsidy between new and existing customers.

Table 12.56: Fixed and variable charge

	Scenario 1	Scenario 2	Scenario 3
Part A (fixed charge) ($/ML)	181.87	194.25	206.63
Part B (variable charge) ($/ML)	129.08	129.08	129.08

The total forecast annual revenue for the option is shown in **Table 12.41**.

Table 12.57: Total annual revenue from water charges

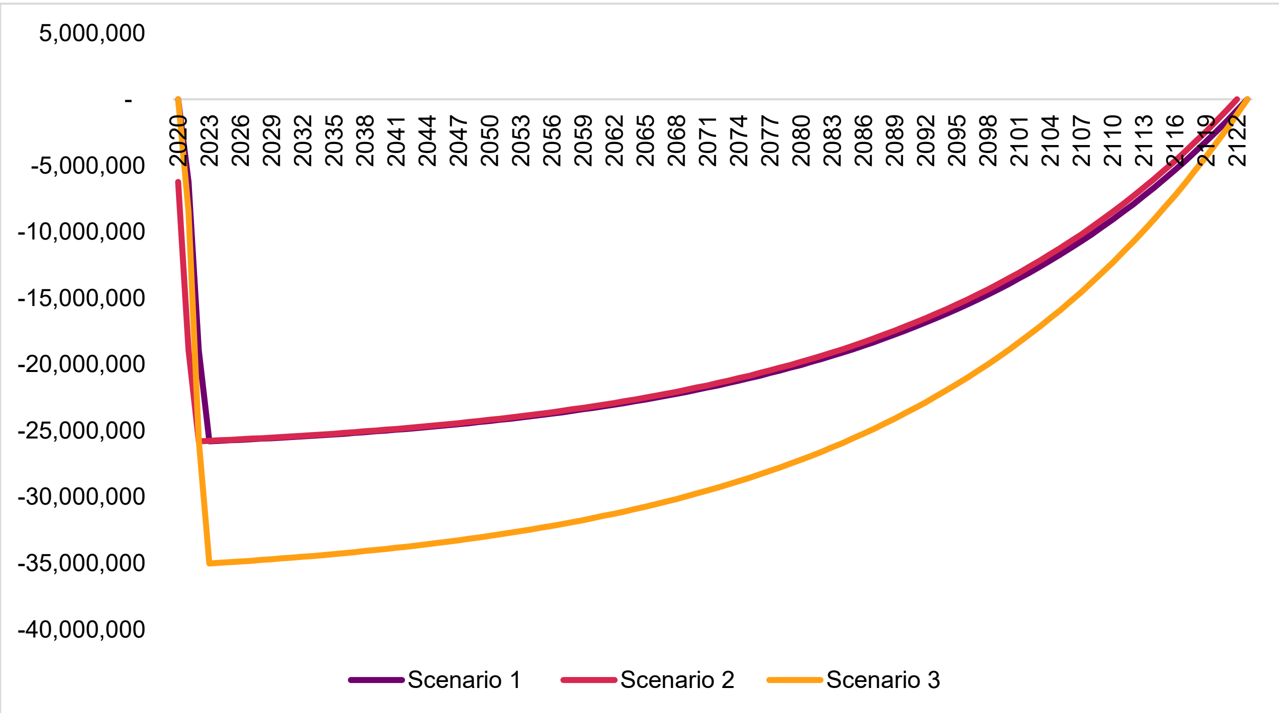
	Scenario 1	Scenario 2	Scenario 3
Part A & B ($ million)	6.3	6.6	6.9

12.6.5.5 Net debt

The implication of calculating cost-reflective charges based on forecast capital, operating and financing costs, and using these charges as the forecast revenue, is that the financial analysis will show a positive net present financial value. A better metric for considering a project's financial viability when revenues equal costs is the amount of debt held by the project.

The net debt of the three scenarios is shown in **Figure 12.18**.

Figure 12.18: Net debt under the three scenarios ($ million)



12.6.6 Construct water recycling plant at Swickers facility in Kingaroy

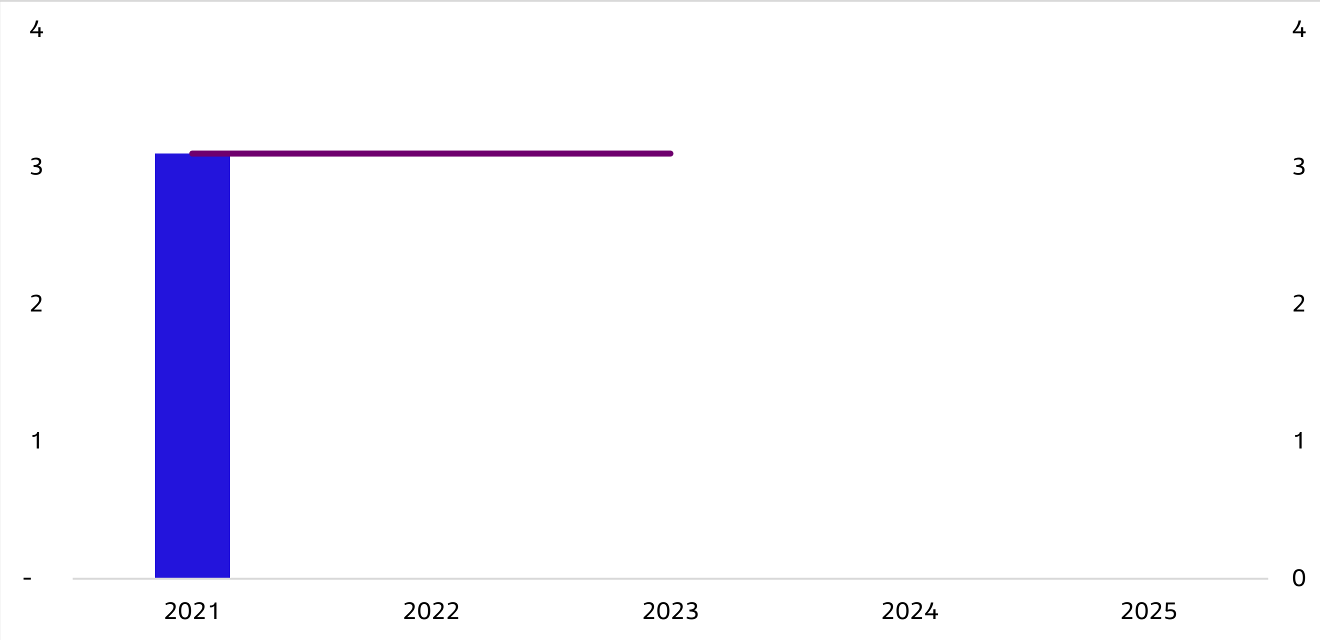
Swickers provided indicative capital costs for the water recycling, shown in **Table 12.58**.

Table 12.58: Water recycling capital costs

Item	Low cost	Medium cost	High cost
Turnkey onsite plant ($ million)	1.84	2.3	2.76
Enabling infrastructure including pipes ($ million)	0.4	0.5	0.6
Total capex ($ million)	2.24	2.8	3.36
Contingency	10%	10%	10%
Total capex including contingency ($ million)	2.48	3.1	3.72

The assumed capital cost profile is shown in **Figure 12.19**.

Figure 12.19: Water recycling plant facility—medium capital cost profile ($ million)



The ongoing operating costs, proposed water use and the levelised cost of water for the option were developed in conjunction with the capital costs in **Table 12.59**.

Table 12.59: Ongoing operational costs

Item	Low cost	Medium cost	High cost
Total ($ million per year)	0.42	0.61	0.82
Proposed water use per year (ML)	624	676	728
Levelised cost of water ($/ML)	1,118	1,097	1,019

This assessment assumes that Swickers is the beneficiary of this option. Other water consumers or government contributions are not considered at this stage; however, subsequent, detailed analysis on the potential urban water security benefits may generate a case for recovering a part of the cost through urban customer water charges or government contributions.

12.6.7 Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)

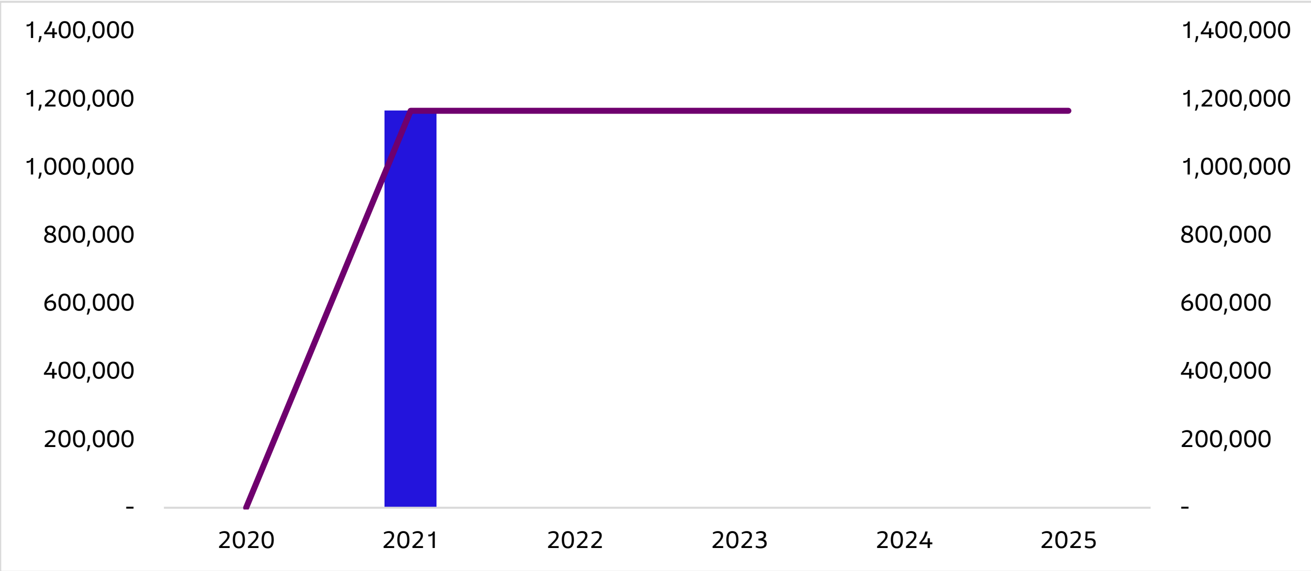
The proposed capital costs for the greater utilisation of the Wivenhoe to Tarong pipeline for Blackbutt irrigators are shown in **Table 12.60**.

Table 12.60: Greater utilisation of the Wivenhoe to Tarong pipeline—capital costs

	Low cost ($)	Medium cost ($)	High cost ($)
Development of implementation plan and adequacy study	500,000	1,000,000	1,500,000
Stakeholder consultation	50,000	60,000	70,000
Subtotal	550,000	1,060,000	1,570,000
Contingency	55,000	106,000	157,000
Total	**605,000**	**1,166,000**	**1,727,000**

The proposed capital cost profile is shown in **Figure 12.20**.

Figure 12.20: Greater utilisation of the Wivenhoe to Tarong pipeline—capital cost profile ($)



The operating costs for the options are primarily captured in the charges that Blackbutt irrigators will pay per megalitre for the water from Seqwater and the use of the pipeline. The assumed price is $1,200/ML each year for the 2,500 ML, given irrigators' willingness-to-pay.

Additional operating costs associated with administering the option are shown in **Table 12.61**.

Table 12.61: Greater utilisation of the Wivenhoe to Tarong pipeline—operating costs

	Low	Medium	High
Operations and maintenance ($)	100,000	200,000	300,000
Total ($)	**100,000**	**200,000**	**300,000**

The low capital means that there is no assessment of the net debt or revenue requirements for the repayment of the capital expenditure.

12.6.8 Purchasing water from Tarong Power Station to improve urban water security in Kingaroy options

The upfront cost of purchasing high priority water allocations in Boondooma Dam from TPS based on the assumed medium purchase prices per ML for the 1,300 ML per year for a 15-year period. The discount (present value) of these charges, along with the reduction in TPS payments to Sunwater, at the financial discount rate is shown in **Table 12.62**.

Table 12.62: Present value of payments by TPS to Seqwater over 30 years

PV ($ million)	Low	Medium	High
Wivenhoe Dam	11.1	27.5	43.9
Manufactured water	15.7	36.6	59.1

Negotiations with TPS may result in a different present value. Two of the options involve the conversion of Gordonbrook Dam to irrigation. The assumed conversion capital costs are shown in **Table 12.63**. The study would need to consider the urban water security needs and consider the options, potential water sales and legal issues.

Table 12.63: Conversion of Gordonbrook Dam to irrigation—capital costs

Description	Low costs ($)	Medium cost ($)	High cost ($)
Study and implementation plan to convert Gordonbrook Dam to irrigation only	1,000,000	2,000,000	3,000,000
Stakeholder and public consultation	50,000	60,000	70,000
Subtotal	1,050,000	2,060,000	3,070,000
Contingency	105,000	206,000	307,000
Total	**1,155,000**	**2,266,000**	**3,377,000**

The expected capital costs (upfront compensation to TPS) are shown in **Table 12.64**.

Table 12.64: Compensation paid to TPS—present value of TPS payments to Seqwater at financial discount rate

PV ($ million)	Low	Medium	High
Wivenhoe Dam	9.9	25.2	40.5
Manufactured water	14.5	34.4	55.8

12.6.8.1 Revenue

The conversion of Gordonbrook Dam to irrigation will create a revenue stream for the South Burnett Regional Council. A preliminary, conservative assessment converted the 1,809 ML of high priority water (the council's current urban allocation) into 1,809 ML of medium priority water allocation for irrigators at an upfront price of $1,500/ML and an ongoing charge of $50/ML.

Table 12.65: Revenue from the conversion of Gordonbrook Dam to irrigation

PV ($M)	Upfront	Yearly	NPV
Allocation (upfront sale)	2.7	–	2.61
Annual revenues	–	0.09	1.56
Total value of irrigation revenue	**2.7**	**0.9**	**4.2**

However, further investigation is needed to determine whether the high priority water allocation could be converted into a materially larger medium priority water allocation. If so, the expected revenue could be much higher.

This revenue stream can be used to offset part of the cost of the high priority allocations from TPS and/or the likely cost to upgrade Gordonbrook Dam to meet ANCOLD standards. Further analysis on the water product reliability, potential demand and upfront contribution should be undertaken as part of a detailed assessment.

13. Affordability analysis

13.1 Key points

- The affordability analysis assesses the magnitude of the new customer charges compared to current charges and potential government contributions, particularly for options that provide water to irrigators. The government contributions reduce the initial capital cost of the options, resulting in a lower fixed customer charge.
- The financial net present value analysis, based on the estimated capacity to pay assessment, shows that there is likely a need for government contributions in four of the five infrastructure options to enable customers to transition, over time, to higher-value crops and afford the full cost recovery prices, particularly for the Coalstoun Lakes options.
- The affordability analysis highlights the need for detailed consultation with potential customers on the likely new water charges for irrigators and urban water customers to confirm the ability for these customers to pay these charges.

13.2 Approach

The affordability analysis present information that allows decision-makers to assess whether each option is affordable over the whole of its life, by considering all sources of current funding, as well as additional funding sources. All infrastructure investments will need to be funded over the life of the infrastructure regardless of the mechanism used to finance the investment.

The first part of this analysis is the use of the capacity to pay assessment information to calculate a financial net present value (FNPV) for the five major infrastructure options. In addition, it is likely that Sunwater will own and operate these infrastructure options. The options are:

- Construct a re-regulating weir on the Boyne River
- Construct a re-regulating weir on the Barambah Creek (Barlil Weir)
- Build a pipeline from Paradise Dam to Coalstoun Lakes
- 65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes
- Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes

The FNPV provides an indication of the potential government contribution that will required to bridge the gap between full cost recovery pricing and the likely capacity to pay of the customers.

The second part of the analysis is to show the potential size of government contributions for the remaining options:

- Construct water recycling plant at Swickers facility in Kingaroy
- Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)
- Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)
- Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)
- Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam).

13.3 Infrastructure options

13.3.1 Current customer charges for irrigators

The current charges (fixed and variable) for the Sunwater-administered water supply schemes are below.

Table 13.1: Current water charges—2019–2020 ($/ML)

Water supply scheme	Part A (fixed charge)	Part B (variable charge)
Boyne River and Tarong	28.58	1.77
Barker Barambah	25.93	4.60
Upper Burnett	30.58	4.08
Three Moon Creek	32.43	4.78
Bundaberg	13.06	1.31

Source: Sunwater fees and charges 2019–2020.

13.3.2 Capacity to pay assessment

The central input into the affordability analysis is the capacity to pay assessment. The summary of the assessment is shown below.

Table 13.2: Summary of findings

Water supply scheme	Findings
Barker Barambah (Barlil Weir)	• Analysis suggests that current net margins are similar to the $850/ML average value of permanent medium priority trades in the Barker Barambah scheme. • This region has the lowest capacity to pay in terms of net margin. Not all enterprises currently grown will be able afford the proposed cost of the shortlisted option but there is already evidence of customers within the scheme moving towards high-value cropping.
Boyne River and Tarong (Boyne River Weir)	• The region has significant investment in permanent plantings and perennial crops, which have a greater ability to pay for water. • The current, low price of medium priority water in permanent market is likely to be reflective of a product that is unreliable and offers customers lower return for their investment. • Consultation with local irrigators revealed there was evidence of a significant level of unmet demand and intentions to expand into high-value horticulture in the region. The primary factor outlined by customers restricting this expansion was reliability rather than new water.
Coalstoun Lakes	• Local consultation outlined the desire for the region to transition into an irrigation area focusing on high-value crops (including irrigated peanuts, green vegetables and macadamias). • The previous investigation conducted by the Coalstoun Lakes Development Group into the willingness to pay for the proposed irrigation scheme estimated the upfront customer contribution to be $1,400/ML (total contribution of $29 million). This estimate broadly aligns with the results from this capacity to pay assessment.
Blackbutt customers	• Positive responses were received in support of short-listed option, as well as a strong uptake in the demand assessment process. • Crop mix and net margins were sourced directly from information received during consultation process. There is strong demand for continued expansion of avocado production • A preliminary demand assessment was conducted with more than 15 irrigators and customers in the region. This process was conducted through in-person discussions and over the telephone. • Jacobs' assessment revealed non-binding expression demand of 2,500 ML with an upfront payment of $850/ML and an annual charge of $1,200 ML. (see table 1.4 for full details)

Based on the analysis summarised above (and detailed in full in Chapter 10), the estimated capacity to pay an upfront contribution and an increase in the fixed ongoing charge is shown below.

Table 13.3: Estimated capacity to pay—total upfront contribution and increase in fixed ongoing charge

Option	Total upfront contribution ($/ML)	Increase in fixed ongoing charge: low ($/ML)	Increase in fixed ongoing charge: medium ($/ML)	New fixed ongoing charge: high ($/ML)
Construct a re-regulating weir on the Boyne River	–	50	75	110
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	1,000	50	100	150
Build a pipeline from Paradise Dam to Coalstoun Lakes	1,400	150	200	300
65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	1,400	150	200	300
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	1,400	150	200	300

13.3.3 Financial net present value

This information was used to generate a set of FNPVs for the five infrastructure options as shown in the table below. The FNPV represents the likely over- or under-recovery of capital and ongoing costs over the life of the project.

Table 13.4: FNPV assessment of infrastructure options over 100 years (present value, $ million, 2020)

Option	Capital costs	PV of total ongoing costs	Upfront contributions	FNPV: low	FNPV: medium	FNPV: high
Construct a re-regulating weir on the Boyne River	25.7	8.6	–	-14.2	-7.9	1.1
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	10.8	3.6	2.9	-5.2	-1.0	3.1
Build a pipeline from Paradise Dam to Coalstoun Lakes	54.8	203.0	33.4	-101.5	-66.5	3.3
65,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	122.2	225.2	32.2	-206.7	-175.2	-112.4
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	67.1	154.8	33.4	-69.6	-35.8	31.8

The FNPV analysis shows negative FNPVs for each of the infrastructure options. The negative FNPVs represent the present value of government funding that may be required to achieve cost recovery based on the estimated capacity to pay. The positive NPVs indicate an over-recovery based on customer stated upfront contributions and fixed charges.

13.4 Impact of government grant funding on full cost recovery prices

A second analysis provides an indication of the likely full cost recovery prices under different government grant funding scenarios:

- Scenario 1: High government funding—60% of capital cost
- Scenario 2: Medium government funding—30% of capital costs
- Scenario 3: No government funding—0% of capital costs

13.4.1 New charges for each infrastructure option under different government funding scenarios

The key affordability measure is the likely annual total charges for irrigation customers. The charges calculated for each scenario is shown below.

The utilisation of the Wivenhoe to TPS pipeline and Swickers water recycling plant are private costs and/or customer charges are covered by the irrigator group. A government contribution has been calculated for these options in the next section. A larger contribution reduces the forecast increase in the fixed charge (Part A).

Table 13.5: New customer charges (current plus option)—Part A (fixed)

	New customer charges (current plus option)—Part A (fixed, $/ML)		
Option	**Scenario 1: High government funding**	**Scenario 2: Medium government funding**	**Scenario 3: No government funding**
Re-regulating weir on the Boyne River	102.61	132.76	162.90
Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	103.94	125.59	147.25
Build a pipeline from Paradise Dam to Coalstoun Lakes	117.92	124.37	130.82
Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	347.41	373.34	416.16
Raise Jones Weir, raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	181.87	194.25	206.63

** It should be noted that Paradise Dam to Coalstoun Lakes pipeline will deliver water to a new area, outside the Bundaberg scheme area. Therefore, the difference in current and new charges may not be an appropriate comparison.*

13.5 Other options

Grant funding scenarios have also been provided for the remaining options. The amount of grant funding associated with each scenario is shown in **Table 13.6**

Table 13.6: Grant funding ($ million)

Option	Scenario 1: High government funding	Scenario 2: Medium government funding	Scenario 3: No government funding
Construct water recycling plant at Swickers facility in Kingaroy	1.85	0.92	–
Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)	0.7	0.3	–
Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	16.49	8.24	–
Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	21.99	10.99	–
Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	15.13	7.56	–

The capital cost not covered by government grants of options to increase the water security of Kingaroy through the purchase of high priority allocations will have to be recovered through urban water customer charges. The amount of the purchase cost that is likely to be needed to be recovered from urban water customers under each scenario is shown below.

Table 13.7: Urban customers capital cost recovery under each scenario ($ million)

Option	Scenario 1: High government funding	Scenario 2: Medium government funding	Scenario 3: No government funding
Tarong Power Station to source more of its water from Wivenhoe Dam (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	10.99	19.23	27.48
Tarong Power Station to source more of its water from manufactured water products (convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	14.66	25.65	36.64
Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	10.08	17.65	25.21

In addition, the operating costs will have to recovered through customer water charges and there will be revenue associated with the sale of water to irrigators from Gordonbrook Dam under two options. Further analysis on costs to be recovered under these options should be undertaken based on discussions with TPS.

13.6 Conclusion

Further analysis is required to determine the likely amount of government funding and the ability for the irrigators to pay the new fixed and variable charges. In addition, further analysis should be undertaken to determine the likely increase in urban water charges under the TPS options.

14. Options analysis

This section summarises the above six sections for each shortlisted option and specifies the next step.

14.1 Summary of options

Table 14.1: Construct re-regulating weir on the Boyne River

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	There is close alignment with state and local government policies (provided a suitable cost recovery or management plan can be developed during the detailed business case).
Effectiveness in addressing the service need and achieving the benefits sought	Medium	Fully addresses unreliability with specific existing agricultural supplemented water allocations. This option facilitates the delivery of: ▪ sustained increases in agricultural production and employment; and ▪ Improved economic (agricultural) resilience for the Boyne River irrigators.
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	Medium	Classified as 'new' under the State Infrastructure Plan Hierarchy. While the construction of the weir is new, it would be built within an existing irrigation scheme and improve the efficiency of existing infrastructure.
Social, environmental and sustainability appraisal		
Social impacts	High	Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries. New build projects can also provide the greatest potential for negative social outcomes. However, any impacts on existing property rights and considered to be minor and manageable.
Environmental impacts	Medium	The Boyne River includes the protected lungfish, whose breeding is impacted by barriers in the river. This issue could likely be managed. No sites of cultural heritage importance have been identified within 5 km of Cooranga.
Sustainability impacts	Medium	Medium governance (strategic planning undertaken)
Benefit–cost ratio	Medium	1.01
Net present value (NPV)	Medium	$0.24 million
Deliverability appraisal		
Risk	High	The identified risks can be managed through the options analysis and detailed business case processes.
Financial NPV and affordability	Medium	Government contribution of approximately $8 million would be required for financial viability, based on a preliminary assessment of irrigators' capacity to pay.
Potential for PPP delivery	Low	No community-based irrigation schemes have been funded in this way in Australia. Instead, significant private funding could be raised from irrigators, paid for through ongoing water charges.
Outcome		
Next steps		Reference project for detailed business case

Table 14.2: Construct re-regulating weir on the Barambah Creek

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This is highly aligned with state and local government policies and objectives, and has previously received approval and support from the Commonwealth Government.
Effectiveness in addressng the service need and achieving the benefits sought	Medium	Fully addresses unreliability with specific existing agricultural supplemented water allocations. This option facilitates the delivery of two benefits for irrigators in the South Burnett: ▪ Sustained increases in agricultural production and employment ▪ Improved economic (agricultural) resilience
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	Medium	Classified as 'new' under the State Infrastructure Plan Hierarchy. While the construction of the weir is new, it would be built within an existing irrigation scheme and improve the efficiency of existing infrastructure.
Social, environmental and sustainability appraisal		
Social impacts	High	Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries. New build projects can also provide the greatest potential for negative social outcomes. However, any impacts on existing property rights and considered to be minor and manageable.
Environmental impacts	High	Jointly with the State of Queensland, the Commonwealth Minister for Environment and Heritage approvals for Barlil Weir.
Sustainability impacts	Medium	Medium governance (strategic planning undertaken)
Benefit–cost ratio	Medium	0.94
Net present value (NPV)	Medium	-$0.8 million
Deliverability appraisal		
Risk	High	The risks of this project have been considered and successfully mitigated previously. Some planning and approval are dated and will require updating
Financial NPV and affordability	High	Government contribution of approximately $1 million would be required for financial viability, based on a preliminary assessment of irrigators' capacity to pay.
Potential for PPP delivery	Low	No community-based irrigation schemes have been funded in this way in Australia. Instead, significant private funding could be raised from irrigators, paid for through an upfront capital contribution.
Outcome		
Next steps		Reference project for detailed business case

Table 14.3: Build a pipeline from Paradise Dam to Coalstoun Lakes

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This option aligns generally with the policy and objectives of the Queensland Government in relation to: ▪ the efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure ▪ supporting infrastructure development that provides a commercial return to bulk water providers.
Effectiveness in addressng the service need and achieving the benefits sought	High	This option addresses the problems of: ▪ highly unreliable existing agricultural water allocations ▪ fertile area without reliable source of water. This option facilitates the delivery of: ▪ sustained increases in agricultural production and employment; ▪ Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	Medium	Classified as 'improve existing' under the State Infrastructure Plan Hierarchy.
Social, environmental and sustainability appraisal		
Social impacts	High	Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries. New build projects can also provide the greatest potential for negative social outcomes. However, any impacts on existing property rights and considered to be minor and manageable.
Environmental impacts	Medium	Pipeline route will need to avoid sensitive areas and/or mitigate environmental impacts.
Sustainability impacts	Medium	Medium governance (strategic planning undertaken)
Benefit–cost ratio	High	1.25
Net present value (NPV)	High	$34 million
Deliverability appraisal		
Risk	Medium	Some risk related to potential route requiring lift which would increase operational costs, and access to water from Paradise Dam.
Financial NPV and affordability	High	A $67 million government grant is needed for financial viability, based on a preliminary assessment of irrigator's capacity to pay.
Potential for PPP delivery	Low	No community-based irrigation schemes have been funded in this way in Australia. Instead, significant private funding could be raised from irrigators, paid for through an upfront capital contribution.
Outcome		
Next steps		Reference project for detailed business case, in combination with the other Coalstoun Lakes options.

Table 14.4: Option 4A: Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	Medium	While the State Government has declared a preference for projects that utilize existing infrastructure, this option could align with the State Government objective of achieving efficient water usage with the lowest practical expenditure. This option could be achieved for significantly lower cost that the alternative dam proposals.
Effectiveness in addressng the service need and achieving the benefits sought	High	This option addresses the problems of: ▪ highly unreliable existing agricultural water allocations ▪ fertile area without reliable source of water. This option facilitates the delivery of: ▪ sustained increases in agricultural production and employment ▪ Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators.
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	Low	This option requires the construction of new water infrastructure.
Social, environmental and sustainability appraisal		
Social impacts	Medium	Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries. New build projects can also provide the greatest potential for negative social outcomes. A large water storage will have some property impacts that cannot be fully mitigated.
Environmental impacts	Medium	There is some evidence that the number of structures already in this water course have impacted flora and fauna, which could be further impacted by another storage.
Sustainability impacts	Medium	Medium governance (strategic planning undertaken)
Benefit–cost ratio	Medium	0.71
Net present value (NPV)	High	-$61 million
Deliverability appraisal		
Risk	Medium	There is some risk in relation to determining the final location for the dam and the resulting uncertainty regarding costs and approvals.
Financial NPV and affordability	Low	A large government contribution would be required of $175 million.
Potential for PPP delivery	Low	No community-based irrigation schemes have been funded in this way in Australia. Instead, significant private funding could be raised from irrigators, paid for through an upfront capital contribution.
Outcome		
Next steps		Reference project for detailed business case, in combination with the other Coalstoun Lakes options.

Table 14.5: Option 4I: Raise Jones Weir, raise Claude Wharton Weir. build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This option includes broadly aligns with government objectives in relation to the efficient use of existing water resources and infrastructure, and seeking to support projects that may provide a financial return for commercial return to bulk water providers. This project is designed to relocated inefficient water to a potential area of high production, which aligns with State Government economic policy and objectives.
Effectiveness in addressing the service need and achieving the benefits sought	High	This option addresses the problems of: ▪ highly unreliable existing agricultural water allocations ▪ fertile area without reliable source of water. This option facilitates the delivery of: ▪ sustained increases in agricultural production and employment; and ▪ improved economic (agricultural) resilience for the Coalstoun Lakes irrigators.
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	Medium	This option is a combination of 'improve existing' to raise two weirs, and a 'new' weir and pipeline network.
Social, environmental and sustainability appraisal		
Social impacts	High	Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries. New build projects can also provide the greatest potential for negative social outcomes. However, any impacts on existing property rights and considered to be minor and manageable; however, the impacts will be over a wide area.
Environmental impacts	Medium	The majority of the instream works (Claude Wharton and Jones weir) relate to existing sites. The new weir (small to allow for a pumping pond) may require more extensive environmental approvals (refer Table 8.8)
Sustainability impacts	Medium	Medium governance (strategic planning undertaken)
Benefit–cost ratio	Medium	1.31
Net present value (NPV)	Medium	$38 million
Deliverability appraisal		
Risk	Medium	This option involves multiple minor to moderate construction projects that each have some associated risk. The proposed new weir requires further engineering and environmental review.
Financial NPV and affordability	Medium	Government contribution of approximately $36 million would be required for financial viability, based on a preliminary assessment of irrigators' capacity to pay.
Potential for PPP delivery	Low	No community-based irrigation schemes have been funded in this way in Australia. Instead, significant private funding could be raised from irrigators, paid for through an upfront capital contribution.
Outcome		
Next steps		Reference project for detailed business case, in combination with the other Coalstoun Lakes options.

Table 14.6: Construct water recycling plant at Swickers facility in Kingaroy

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This option includes broadly aligns with government objectives in relation to the efficient use of existing water resources and infrastructure without the need for expenditure on new water infrastructure. While this option does involve capital expenditure on infrastructure, the focus on improving existing infrastructure instead of major expenditure on a wholly new project aligns with the Governments fiscal efficiency policy focus. This option aligns with Government support for water solutions with a lower environmental impact.
Effectiveness in addressng the service need and achieving the benefits sought	Medium	Improves water supply in Kingaroy, and provides for expanded industrial expansion with additional supply of reliable water. Partially delivers improved community (urban) resilience.
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	High	Classified as ‘improve existing’ under the State Infrastructure Plan Hierarchy.
Social, environmental and sustainability appraisal		
Social impacts	High	Very large positive impacts on employment in an area with high unemployment. Very minor impacts beyond the direct onsite impacts.
Environmental impacts	Medium	This option produces additional water without the need to capture, storage and transport it. Additional electricity costs will be required.
Sustainability impacts	High	High governance (planning undertaken)
Benefit–cost ratio	High	4.5
Net present value (NPV)	High	$37 million
Deliverability appraisal		
Risk	Medium	The risks are highly limited and can be easily mitigated.
Financial NPV	High	This project has a positive FNPV. However, some Government contribution may assist with progressing the project.
Potential for PPP delivery	Low	In this case, the proponent (Swickers) will seek a return on its own commercial investment.
Outcome		
Next steps		To be progressed by the South Burnett Regional Council

Table 14.7: Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigation)

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This option aligns closely with the state government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of the South Burnett. Furthermore, this option is lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation priorities the safety and security of power generating facilities, and this includes that water security is maintained and protected.
Effectiveness in addressng the service need and achieving the benefits sought	High	This option addresses the problems of: ▪ highly unreliable existing agricultural water allocations ▪ fertile area without reliable source of water. This option facilitates the delivery of: ▪ sustained increases in agricultural production and employment ▪ improved economic (agricultural) resilience.
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	High	Classified as better use' under the State Infrastructure Plan Hierarchy.
Social, environmental and sustainability appraisal		
Social impacts	Medium	Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food-processing industries. Impacts on electricity and SEQ water security need to be managed.
Environmental impacts	Medium	Additional pumping electricity needed
Sustainability impacts	Medium	Potential long-term impact on SEQ urban water security
Benefit–cost ratio	High	1.32
Net present value (NPV)	Medium	$12 million
Deliverability appraisal		
Risk	Medium	There is some risk relating to the potential impact on energy security and water security in South East Queensland. These would need to be resolved in order for this option to progress. Pipeline capacity may not be available if TPS is drawing water from Wivenhoe Dam, and the needs of TPS have highest priority. Access to the pipeline needs to be determined in consultation with Stanwell and there is a resulting risk to the reliability for the irrigation users.
Financial NPV		$0 to $0.7 million may be required from Government to progress this option.
Potential for PPP delivery	Low	This option does not require investment in new infrastructure.
Outcome		
Next steps		

Table 14.8: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This option aligns closely with the state government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of the South Burnett (and more generally to the North Burnett). Furthermore, this option is potentially lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation prioritizes the safety and security of power generating facilities, including ensuring that water security is maintained and protected.
Effectiveness in addressng the service need and achieving the benefits sought	High	This option addresses all of the issues in the South Burnett, including urban water security, unreliability for existing allocation holders, and lack of reliable water for fertile areas. This option delivers benefits for agricultural production, urban resilience, agricultural resilience and growth opportunities for agricultural processing industries.
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	High	Classified as 'better use' under the State Infrastructure Plan Hierarchy.
Social, environmental and sustainability appraisal		
Social impacts	High	Additional urban water security for Kingaroy will result in a relaxation of water restrictions. Long-term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries.
Environmental impacts	Medium	Additional pumping electricity needed
Sustainability impacts	Medium	Potential long-term impact on SEQ urban water security
Benefit–cost ratio		2.47
Net present value (NPV)		$16 million[38]
Deliverability appraisal		
Risk	Medium	There is some risk relating to the potential impact on energy security and water security in South East Queensland. These would need to be resolved in order for this option to progress.
Potential for PPP delivery	Low	This option does not require investment in new infrastructure.
Outcome		
Next steps		To be progressed by the South Burnett Regional Council

[38] The NPV calculation includes estimates by the consultant on the additional costs of Stanwell sourcing higher volumes from Wivenhoe Dam.

Table 14.9: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This option aligns closely with the state government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of the South Burnett (and more generally to the North Burnett). Furthermore, this option is potentially lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation prioritizes the safety and security of power generating facilities, including ensuring that water security is maintained and protected.
Effectiveness in addressng the service need and achieving the benefits sought	High	Option addresses all of the issues in the South Burnett, including urban water security, unreliability for existing allocation holders, and lack of reliable water for fertile areas. Option delivers benefits for agricultural production, urban resilience, agricultural resilience and growth opportunities for agricultural processing industries.
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new	High	Classified as 'better use' under the State Infrastructure Plan Hierarchy.
Social, environmental and sustainability appraisal		
Social impacts	High	Additional urban water security for Kingaroy will result in a relation of water restrictions. Long term increases in irrigation water supply can potentially increase employment levels through greater agricultural production and associated food processing industries.
Environmental impacts	Medium	Additional pumping electricity needed
Sustainability impacts	Medium	Potential long-term impact on SEQ urban water security
Benefit–cost ratio	High	2.15
Net present value (NPV)	High	$7 million[39]
Deliverability appraisal		
Risk	Medium	There is some risk relating to the potential impact on energy security and water security in South East Queensland. These would need to be resolved in order for this option to progress.
Financial NPV		
Potential for PPP delivery	Low	This option does not require investment in new infrastructure.
Outcome		
Next steps		To be progressed by the South Burnett Regional Council

[39] The NPV calculation includes estimates by the consultant on the additional costs of Stanwell sourcing higher volumes from Wivenhoe Dam.

Table 14.10: Tarong Power Station to source more of its water from Wivenhoe Dam (Keep Gordonbrook Dam)

Options assessment	Rating	Rationale
Strategic appraisal		
Alignment to objectives (state, community, agency)	High	This option aligns closely with the state government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of the South Burnett (and more generally to the North Burnett). Furthermore, this option is potentially lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation prioritizes the safety and security of power generating facilities, including ensuring that water security is maintained and protected.
Effectiveness in addressng the service need and achieving the benefits sought		This option will fully address the urban water security issue in Kingaroy. This option facilitates the delivery of improved community (urban) resilience
Alignment with State Infrastructure Plan options assessment—reform, better use, improve existing, new		Classified as 'better use' under the State Infrastructure Plan Hierarchy.
Social, environmental and sustainability appraisal		
Social impacts	High	Additional urban water security for Kingaroy will result in a relation of water restrictions.
Environmental impacts	Medium	Additional pumping electricity needed
Sustainability impacts	Medium	Potential long-term impact on SEQ urban water security
Benefit-cost ratio	High	2.13
Net present value (NPV)	High	$6 million[40]
Deliverability appraisal		
Risk	Medium	There is some risk relating to the potential impact on energy security and water security in South East Queensland. These would need to be resolved in order for this option to progress.
Potential for PPP delivery	Low	This option does not require investment in new infrastructure.
Outcome		
Next steps		To be progressed by the South Burnett Regional Council

[40] The NPV calculation includes estimates by the consultant on the additional costs of Stanwell sourcing higher volumes from Wivenhoe Dam.

15. Market considerations

15.1 Key points

- There is capacity and interest within Australian construction companies to deliver the proposed water infrastructure of the preferred options, which are to construct new and augment existing infrastructure—weirs, dams, pipelines, and pump stations.
- Material risks that are associated with construction are the below-ground uncertainties and the management of large flows of water in case of high rainfall events during construction. These risks are typically most cost-effectively managed by the contractor.
- Previous assessments have indicated contractors are positive about undertaking water infrastructure projects—both about wanting to be involved with it and being able to construct it.
- Feedback from local representatives indicated local companies do not have enough capacity or expertise to undertake lead construction roles, but could provide support through equipment hire, provision of materials and subcontracting arrangements.
- The construction market in Queensland was resource-constrained before the impacts of coronavirus pandemic.
- There is some uncertainty about the flow of work in the short to medium term, in particular with private sector projects. This may make capacity available during this period as some private sector projects may not proceed.
- Our conclusion is that the contracting market will be able to deliver the preferred options, subject to further consideration of market conditions as part of a detailed business case, particularly when the impacts of coronavirus pandemic are better understood.

15.2 Objectives

The main objective of considering market conditions was to make an initial assessment of the capability of construction companies to deliver preferred options. The appetite of market participants to undertake a project impacts upon the preferred delivery model and the level of competition within the market at project tendering stage.

15.3 Approach

This assessment was conducted for the suite of preferred options, which vary across a range of construction values and risks. The size, type and location of preferred options are substantially similar; therefore, this assessment has been undertaken to account for all preferred options.

The results of market sounding are influenced by whether contractors believe a project is likely to be funded and developed in a reasonable timeframe. The Building Queensland guidelines state that 'care must be taken to ensure participants' expectations regarding project implementation and options are managed appropriately and with due regard for probity'. To give the impression that a project is more likely to be funded than is the case will distort the contractor market against the best interests of the contractor.

Contractors and other private sector entities have limited resources to investigate and bid for projects. They dedicate these limited budgets towards projects that are more likely to be built and projects for which they believe they can deliver a competitive proposal.

Estimating and bidding for a job is expensive for a contractor, who needs to apply sufficient resources to properly quantify and manage risks. Where risks cannot be adequately quantified with the resources available, the cost estimates increase as the risk cost allocation for each risk increases. The risks associated with building a large dam in an area where tropical rainfall intensities occur are particularly challenging, as the bypass flows during construction and operation must be managed. This, coupled with the below-ground risks of the in-river and saddle dams, create a project that contractors will approach carefully.

There is a limit to the frequency that contracting companies can be engaged on particular projects. Construction companies are generally unwilling to devote time and resources to considering a project unless they believe that it will proceed. Generally, government support for a project is required before significant resources will be expended. As the preferred options are not considered likely to proceed in the short term, testing the depth of the market and assessing the market risk appetite and the availability of interested contractors is of limited value, because these factors vary over time.

Once available evidence shows that preferred option funding is likely, a comprehensive market engagement and communication process would be necessary to ready the market to receive the tenders. Such a process would likely succeed in positively engaging suitable contractors. The process would support the development of the procurement strategy and delivery model and allow the tenderers to assemble bid teams. Communicating well in advance the date that tenders will be released improves the quality of the bid teams and thereby influences the quality of the tender results.

As a result, the approach for this assessment focused on:

- local factors that impact the contracting capacity within the North and South Burnett regions
- the requirements of the preferred options
- recent assessments of capability and interest from the construction market for water infrastructure projects.

15.4 Contracting tiers

More expensive and higher-risk projects would be more suited to be delivered by tier one contractors. These projects may offer scope for the involvement of smaller tier two and three contractors if the project consisted of one or more work packages. Breaking up the work could make the pricing sharper but make a project less attractive to the large players, so care has been exercised. By breaking the project up into smaller packages also increases project management costs as well as an increase in project risk dealing with multiple contractors.

Where preferred options have smaller values and limited risks placed upon the contract, it may be suitable for tier two or three contractors to undertake a lead contracting role.

There is no definitive classification for each tier of company—tiers are specific to a region and/or market—but tiers can generally be identified by some typical features (**Table** 15 1). The tier of a construction company reflects the company's capacity to take on certain projects; its capacity in turn typically depends on its size, resources, experience and financial position.

Table 15 1: Features of tier one, two and three construction companies

Tier one	Tier two	Tier three
Tier one contractors are typically the largest and most experienced and have a substantial financial position. This tier typically is engaged on large commercial projects, such as motorways, railways and hospitals, with contract values ranging from hundreds of millions of dollars to billions of dollars. They have the expertise, resources, and finances to deliver large-scale projects. John Holland, Fulton Hogan and McConnell Dowell are examples of tier one contractors in Australia.	Tier two companies typically secure work that is under the threshold of a tier one company. Tier two companies can take advantage of smaller overheads and administrative functions, and therefore tend to be more competitive on a medium-sized project than a tier one contractor. For large contracts undertaken by a tier one company, tier two and three companies will typically be engaged as subcontractors. Tier two companies usually take on medium projects, up to $40 million in capital costs. Tier two contractors can be more cost-competitive than tier one contractors, as they do not have the additional costs of management, higher margins, corporate offices and overheads. They usually own	Tier three companies usually take on small projects, up to $5 million. They may also support tier one and two companies on a larger project under a subcontractor, where specific expertise and/or additional resources are required. It is considered that local tier three companies could support the successful tier two companies. Tier three contractors can be more cost-competitive than tier one contractors, as they do not have the additional costs of management, higher margins and overheads. They also usually own plant and equipment and have access to experienced machine operators.

Tier one	Tier two	Tier three
	plant and equipment and have access to experienced machine operators.	Tier Three companies are also more likely to be found in the regional areas with reduced establishment costs.

To increase the attractiveness of the project to contractors, the tender design and specifications need to be carefully crafted, with risk generally allocated to the party best able to manage that risk. It is important to minimise negative cash flows (i.e. improve cash flow conditions) faced by the tendering companies (e.g. use upfront and monthly payments), to identify and reduce risk, and to provide all parties with complete information and site access. At the same time, a rigid fixed price approach will be maintained. That will minimise the risk of contractors bidding low with a plan to recoup money through variations and resulting in a project overspend and will therefore ensure value is preserved for the project.

15.5 Market assessment

Several of the preferred options are recommended to be involved of tier one contractors, due to the magnitude of the risks, and the complexity and value of the project. Lower-risk and lower-value projects may be delivered by tier two and three contractors, including those located locally.

Discussions were held with representatives of each council, who understand the depth and skill of the local contracting markets. Feedback from local representatives confirmed that tier one contractors are not present in the region, but several local contractors should be encouraged to participate in the build through equipment hire, providing construction materials and in subcontracting roles. Such companies include Burnett Water Services, Project Water Kingaroy and AMG Electrical Solutions. These companies have had exposure to large-scale irrigation, pumping and associated control system works.

Significant market feedback was received for two recently completed detailed business cases for large water development project—the Cloncurry River Dam Detailed Business Case (Jacobs, 2019) and Gilbert River Dam Detailed Business Case (Jacobs, 2020). Both projects have estimated capital budgets above $400 million and involve the construction of a large dam and delivery network. Both assessments received feedback from five construction companies, including three tier one contractors (the John Holland Group, Fulton Hogan and McConnell Dowell).

These discussions with construction companies are relevant for this project, as they relate to water infrastructure projects in regional and remote locations, albeit of larger capital value than the preferred options. The following comments and observations by the construction companies are also relevant for this project:

- Companies were positioning themselves as significant dam builders with a recent history of construction (e.g. Fulton Hogan had recently completed an 11,000 ML dam near Weipa for Rio Tinto and had built two more smaller dams in far north Queensland; and the John Holland Group has interest in 'more than a dozen' other dams and dam upgrades.).
- Companies were prepared to take on the inherent risks associated with constructing large dams, including below-ground conditions, managing the diversion of existing water courses and sourcing suitable construction material. However, the details of how risk is allocated will be important considerations in pricing risk.
- Regional locations were not seen as a problem.
- A proposed contracting approach of transferring the below-ground risk and the risk of inundation to the contractor did not cause concern with these contractors; they saw this as business as usual, particularly if the geotechnical investigation was rigorous. Companies were comfortable with contracting the dam construction under a design and construct contract and one said that it 'really loves that approach'.
- Companies said that they were prepared to contribute to an early contractor involvement process if the proponent provided payment for the time involved.
- Companies observed that that some companies identify two years in advance which projects they are likely to tender and then target their limited project procurement budgets primarily on those select projects.

- The construction market in Queensland was resource-constrained (note that this assessment was made before the coronavirus pandemic occurred).

In addition, the construction of Paradise Dam occurred relatively recently within the broader region. The 37-metre-high, roller-compacted-concrete dam is located on the Burnett River about 80 km west of Bundaberg. It was commissioned in 2006 at a cost of $240 million. The main contractor for the dam construction was the Burnett Dam Alliance, a consortium comprising the Walter Construction Group, Macmahon Holdings, Hydro Tasmania, SMEC and the Wagner Group. Further works are currently being undertaken on the dam to reduce the spillway by around 5metres. CPB Contractors, a subsidiary of the CIMIC Group that also includes Leighton Asia and Thiess, is undertaking this work.

Typically, the capacity to deliver higher-value and higher risk project would reside with a tier one contractor with a proven track record and capacity to deliver similar projects, risk profile and complexity. Tier one contractors are the largest and most experienced and have a substantial financial position. These contractors typically are engaged on large, commercial projects, such as motorways, railways and hospitals, with contract values ranging from hundreds of millions of dollars to billions of dollars.

In addition, to apply for federal government funding, federal safety accreditation must be held by the head contractor, due to the size of the project spend. This accreditation is typically held by tier one contractors, and some tier two contractors, particularly those involved with federal government-funded road projects. The cost of maintaining accreditation limits the number of contractors with accreditation. For a contractor with federal safety accreditation, the systems and processors must be utilised on all work that the contractor performs, irrespective of a requirement for them to be held on any particular job.

However, there is significant scope to use local tier two and three contractors. For large projects, this can be done by:

- a tier one contractor engaging several smaller tier two and three construction contractors with local experience. Participation of local contractors can be encouraged if the proponent facilitates project briefings and registers interest of potential contractors and subcontractors to support the inclusion of local content
- splitting a large project into several work packages, which would be suitable for direct tier two and three contractor participation. For smaller projects and small work packages of larger projects, tier two and tier three contractors would also be interested in being involved in projects.

15.6 Conclusion

Based on statewide and local evidence, we conclude that the capability exists in the market to deliver the identified preferred options in this assessment.

Once project funding is confirmed, significant consideration should be given to the allocation of project risk and the conditions of a construction contract, to ensure an effective and efficient delivery model is adopted.

The market assessment has also found that there is capability to deliver the preferred options. The construction market in Queensland was resource-constrained before the impacts of the coronavirus pandemic. There is some uncertainty about the flow of work in the short to medium term, in particular with private sector projects. This may make capacity available during this period, as some private sector projects may not proceed. Further consideration of market conditions is required during additional assessment of preferred options.

16. Delivery model analysis

16.1 Key points

- When selecting the preferred delivery model, the proponent of the project role is an important factor.
- Typically, a design and construct (D&C) contracting model is a preferred delivery model for water infrastructure projects. The model allows the various engineers (in geotechnical, design and construction) to collaborate progressively and respond to issues as they arise. There is more value in this delivery approach with more complex and high-risk projects.
- A construct only contracting model may be preferred for simpler complex projects that are delivered by an experienced proponent (e.g. Sunwater).
- Like most water infrastructure projects, a cost-effective delivery model is required for the project to be economically viable. Alliance and early contractor involvement models, while effectively delivering the engineering collaboration required for road projects, are less likely to keep the costs low enough for this project.
- The delivery model for each preferred option should be considered further in additional assessments.

16.2 Delivery model assessment

The choice of an optimal model depends on various factors, including the complexity and scope of the project, the level of innovation required, timeframes, cost certainty, risk, and more (Table 16 1).

Table 16 1: Delivery models

Delivery model	Characteristics
Traditional delivery model options	
Construct only The proponent retains full responsibility for design and documentation (via engaging a design consultant) and tenders for construction contractors. Example: • Keepit Dam Safety Upgrades, NSW	▪ The project scope and works are routine, uncomplicated, and of a small to medium size and duration. ▪ The project content is well defined through a consolidated/peer reviewed design process. ▪ The timeframe for project delivery is not compressed, allowing the design and construction to be conducted sequentially. ▪ Construction innovation is not considered a priority. ▪ The geotechnical and design engineers tend to be somewhat removed from the construction engineers, as their interests are not aligned. ▪ The proponent is willing to retain design risk as it relates to the construction, as well as most other risks. ▪ There can be opportunity for variations due both to design and scope battery limit changes. ▪ Design omissions and most changes are the responsibility of the proponent and tend to be priced highly by the contractor. ▪ The proponent has suitably skilled and experienced resources to manage the project delivery. ▪ The contractor is not incentivised to innovate to reduce costs for unanticipated developments, as these all add to the contractor's margin. Innovation and problem-solving can therefore be inhibited.
Early tenderer involvement (ETI) As a subset of the 'construct only' delivery model, this model involves selecting shortlisted competing contractors to participate in value engineering and refinement of a client's preliminary designs. Examples: ▪ Shannon Creek Dam, Clarence Valley Council	In addition to the points noted under 'construct only': ▪ A relationship (collaborative) contracting environment is desirable. ▪ The scope is well defined. ▪ Involving the contractor early helps to identify the most effective method to procure and manage the construction. ▪ There is scope for value engineering/refinement of existing design documentation.

Delivery model	Characteristics
▪ Mt Crosby East Bank Water Treatment Plant, Centrifuge Upgrade Project, Seqwater	▪ There is market interest and scope for competition. ▪ This approach can lead to some doubts about current, fully market-tested pricing.
Design and construct (D&C) The proponent contracts with a single entity that is responsible for both design and construction of the project. Examples: ▪ Tasmanian Irrigation's Tranches One and Two irrigation schemes, Tasmania ▪ Meander Dam Construction Project, Tasmania ▪ Bootawa Dam Water Treatment Plant, NSW ▪ Folsom Dam Joint Federal Project, USA ▪ Calveras Dam Replacement Project, USA ▪ Olivenhain Dam, USA ▪ Glencorse Water Treatment Works, Scotland	▪ The project scope and works are routine, uncomplicated, and well-defined. ▪ It is desirable to fast-track the project timeframe, by undertaking design and construction activities partially in parallel. ▪ A degree of innovation in the design is desirable. ▪ A high degree of cost certainty at the time of award is desirable. ▪ The proponent has suitably skilled and experienced resources to manage the project delivery. ▪ There is a preference to have a single point of responsibility for design and construction. ▪ There is an opportunity to realise benefits by combining the design and construction and bringing together innovation and experience from the geotechnical, design and construction engineering progressively through the project as issues arise. ▪ There can be opportunity for variations, particularly due to scope battery limit changes. ▪ Building is undertaken at a predetermined price. ▪ The high cost of tendering is a serious concern with this approach. ▪ Pre-tender assessments, including geotechnical and hydrology, significantly decrease the risk and remove significant unknowns for a contractor. This should lead to lower tendered prices.
Early contractor involvement (ECI) As a subset of the D&C delivery model, this model involves engaging a construction contractor prior to commencing a project to work in collaboration with the project sponsor.	In addition to the points noted under D&C: ▪ There is a perceived benefit of involving the contractor early to assist with scoping the project and outcomes. ▪ A relationship (collaborative) contracting environment is desirable. ▪ This approach can make it difficult for the principal to be sure that the price paid is appropriate with the prevailing construction market.
Design, construct, maintain and operate (DCMO) The proponent contracts with a single entity that is responsible for design and construction of the project, as well as the operations and maintenance components. Examples: ▪ Adelaide Desalination Plant, SA ▪ Kurnell Desalination Plant, NSW ▪ Tampa Bay Seawater Desalination Plant, USA	In addition to the points noted under D&C: ▪ There is a desire to have a single point of responsibility for the design, construction, operations and maintenance phases. ▪ There is an opportunity to realise benefits by combining design, construction, operations and maintenance into one package. ▪ Innovation across the whole-of-life of the facility or infrastructure is desirable and achievable. ▪ There is a desire/opportunity to realise efficiencies in the ongoing operations and maintenance components of an asset and associated service/s. ▪ A premium will be paid to transfer longer-term operating risk to the contracting entity, particularly if some of these risks can be better managed by the proponent. ▪ This approach can make it difficult for the principal to be sure that the price paid is appropriate with the prevailing construction market.
Alliance The proponent enters into a transparent 'open book' co-operative contracting arrangement with the private sector, wherein unforeseen risks and benefits are essentially shared. Examples:	▪ The project is complex or high-risk. ▪ The scope is unclear, and the risks are unpredictable. ▪ A high level of innovation is required, particularly in resolving technical challenges or maximising operating efficiencies and performance. ▪ A transparent relationship is possible and desirable. ▪ A flexible schedule is desirable.

Delivery model	Characteristics
▪ Wyaralong Dam, Queensland ▪ Logan River Catchment Project, Queensland ▪ Burnett Water Project, Queensland ▪ Hinze Dam Stage 3 Construction, Queensland ▪ Eildon Weir Improvement Works, Victoria ▪ Thames Water Desalination Plant, UK	▪ A knowledge transfer between parties is highly desirable. ▪ Risks are best managed collectively and collaboratively. ▪ Close involvement of the owner can add value. ▪ There is sufficient capacity and capability to resource the alliance. ▪ This approach can make it difficult for the principal to be sure that the price paid is appropriate with the prevailing construction market.
Managing contractor The proponent engages a head contractor to coordinate, engage and manage the design, procurement, and construction, while retaining the ability to directly influence the design development. It is often delivered under a negotiated capped price (guaranteed construction sum or GCS).	▪ The project is complex or high-risk. ▪ The scope is unclear, and the risks are unpredictable. ▪ There may be significant time constraints, necessitating bundled delivery. ▪ A high level of innovation is required, particularly in resolving technical challenges or maximising operating efficiencies and performance. ▪ A transparent relationship is possible and desirable. ▪ Delivery is essential, but a flexible schedule is desirable. ▪ A knowledge transfer between parties is desirable. ▪ Risks are best managed collectively and collaboratively. ▪ Close involvement of the owner can add value. ▪ There is capacity and capability to resource the process. ▪ This approach can make it difficult for the principal to be sure that the price paid is appropriate within the prevailing construction market. The GCS can drive cost savings beyond the comfort of the proponent and it cannot be preserved where the scope battery limits change.
Partnership delivery model options	
Availability payment public private partnership (PPP) A Special Purpose Vehicle (SPV) receives a guaranteed fixed payment from the proponent in return for delivering a project on behalf of the public sector (i.e. an availability payment). Examples: ▪ Mundaring Weir Water Treatment Plant, WA ▪ Tuaspring Desalination and Integrated Power Plant, Singapore	▪ There is a major and complex capital investment program, requiring effective management of risks associated with construction, operations and maintenance. ▪ The private sector has the expertise to deliver the project and there is good reason to think it will offer value for money. ▪ The public sector can clearly define its needs as service outputs that can be adequately measured and contracted in a way that ensures effective, equitable and accountable delivery of public services in the long term, and risk allocation between public and private sectors can be clearly made and enforced. ▪ The assets and services identified as part of the partnership scheme are capable of being costed on a whole-of-life long-term basis and there is scope for innovation. ▪ The value of the project is sufficiently large to ensure that procurement costs are not disproportionate. ▪ The technology and other aspects of the sector are stable and not susceptible to fast-paced change. Or, if the technology relevant to the project is subject to rapid change, the private sector can allow for an appropriate technology refresh without impacting service requirements and/or introducing significant pricing uncertainty. ▪ Long-term planning horizons apply, with assets used far into the future. ▪ This model may be difficult to reconcile with the 50 per cent contribution from the National Water Infrastructure Development Fund, where the payment is against a milestone for construction of infrastructure only.
Build, own, operate/transfer (BOO/T) A SPV builds, owns and operates an asset for a specified period, during which time the SPV is entitled to collect user charges. Examples:	In addition to the points noted under 'Availability payment PPP': ▪ An element of demand/revenue risk is transferred to the private sector. ▪ Project returns depend in part on the user charges expected to be collected during the operations phase.

Delivery model	Characteristics
▪ Prospect Water Filtration Plant (NSW) ▪ Macarthur Water Filtration Plant (NSW)	▪ The state may be required to make capital contributions during the construction phase to help fund the project. ▪ The state may be required to underwrite a minimum level of demand for the project (usually only sufficient to cover the debt obligations of the SPV). ▪ It is applicable to greenfield or brownfield projects (but most commonly used for brownfield projects in the current environment). ▪ Residual risk may be transferred to the private sector under BOO. ▪ This model may be difficult to reconcile with the 50 per cent contribution from the National Water Infrastructure Development Fund, where the payment is against a milestone for construction of infrastructure only.

Source: Adapted from BQ (2020).

16.2.1 Delivery models

The delivery model assessment was developed in a way that can allocate the below-ground and weather construction risk to the contractor. This is because the contractor is best able to manage these risks and inject cost-effective responses to issues that arise. Meeting Queensland dam safety regulation requirements and ANCOLD guidelines, with the supervision of design and construction by an approved peer review team would be mandatory for preferred options that include constructing a new weir or dams or augmenting existing ones. Payment arrangements would be set with reference to the predetermined milestones set in the project funding agreement with the Australian and/or Queensland governments. It is important that the model facilitates the effective and innovative collaboration between geotechnical, design and construction engineers at all stages of the design and construction delivery as the risk profile for the project progresses and changes. It is also very important that the current civil construction market pricing is applied in this assessment, because the economics of irrigation projects are challenging, and without strong cost management from the project outset, many viable irrigation projects will not proceed to construction.

The following evaluation criteria from the Queensland Project Assessment Framework (PAF) were applied to assess the models of delivery:

1) Contractor appetite, capability and competition

- market appetite (i.e. existence of players with the relevant skills, expertise and capacity).
- extent to which the model achieves competitive tension

2) Risk management

- appropriate allocation of risk to party best placed to manage that risk at the lowest cost
- efficient risk management and/or mitigation
- ability to manage the procurement process and contractual arrangements.

3) Stakeholder and scope management

- ability of the model to ensure that delivery of the project is consistent with stakeholder interest, and stakeholder expectations are effectively managed
- ability of the model to effectively manage scope change requests by stakeholders and minimise impact on cost, time and quality.

4) Quality, whole-of-life design and maintenance

- quality of the design and the constructed facility
- meeting service specifications/requirements
- robustness and functionality of the design

- allowing for future proofing and flexibility
- extent to which the model promotes a whole-of-life management solution, including the incentive to optimise life cycle, general maintenance and interrelated service provision.

5) Cost minimisation

- ability of the model to reduce capital costs and, where appropriate, operational costs
- extent to which the model achieves cost optimisation through competitive tension.

The delivery models were rated on a scale of 1 to 10 for 'likelihood of success', with 10 representing the highest likelihood of success (Table 16 2) when measured against the criteria.

Table 16 2: Assessment of delivery models against evaluation criteria

Delivery model	Evaluation criteria					Likelihood of success	Comments
	1	2	3	4	5		
Construct only	9	6	6	8	5	Likely	Although tender prices are likely to be encouraging, the final price will be adversely affected by variations on design and scope changes. This approach will also lack the innovation in design and the agility to cost effectively respond to arising construction issues, because the contractor has little incentive to keep pricing down and to find the most cost-effective options.
Early tenderer involvement (ETI)	7	6	6	8	5	Likely	Payment would need to be made to facilitate the ETI before any milestones have been met.
Design and construct (D&C)	9	9	6	7	9	Very likely	This option is very good at building to a predetermined price if good tendering, contract formation and administration are used diligently. There is an opportunity to realise benefits by combining the design and construction and bringing together innovation and experience from geotechnical, design and construction engineering progressively through the project as issues arise. This makes for an agile and innovative team that can respond effectively to challenges as they arise right through the project, with resultant good risk management.
Early contractor involvement (ECI)	9	6	6	7	5	Likely	ECI will bring some innovation and construction experience to the table, but this is likely to be at the expense of an open competitive market tender process on the final design. This can be offset to a degree by an open process to select the contractors for an ECI process.
Design, construct, maintain and operate (DCMO)	5	9	2	8	5	Likely	The margin required for another independent entity to maintain and operate would be high and not warranted, given that more value is created by the maintenance and operation being undertaken by a body consisting predominantly of irrigator representation, as has been successfully implemented across Queensland. It is unlikely that a constructor would naturally have the necessary skills, experience and appetite to maintain and operate without partnering with another entity. However, there may be complexity for project located on regulated watercourses under the control of a bulk water supplier.
Alliance	9	9	7	7	1	Very unlikely	The alliance would require large outlays to set it up, thus adding greatly to the administrative burden of the project. This project would be small to carry the overheads associated with an alliance. The effect on cost rules out an alliance for this project despite it scoring well on the other criteria,

Delivery model	Evaluation criteria					Likelihood of success	Comments
	1	2	3	4	5		
Managing contractor	7	3	7	5	3	Possible	The option could be used as a variation to ECI, with the same strengths and weaknesses. A tier one contractor is similar to using a managing contractor. However, a managing contractor does not normal carry much risk.
Competitive alliance	5	9	7	7	0	Very unlikely	As for the alliance delivery model, but with even higher initial administrative costs upfront.
Availability payment public private partnership (PPP)	5	8	2	6	1	Very unlikely	The economic success of new irrigation projects depends on the pricing of the new water being sufficiently attractive to entice businesses to take on the considerable risk of establishing new agricultural enterprises in a new area. However, to take on the risk associated with an availability payment through a PPP, the private sector would have to price the water too high to attract sufficient investment in the water. No community-based irrigation schemes have been funded in this way in Australia. If this were feasible, there would be no need for the National Water Infrastructure Development Fund and other government funding (PPP is further discussed in section 16.3).
Build, own, operate/transfer (BOO/T)	5	8	2	6	3	Very unlikely	This option has many similarities with the PPP immediately above, but with the addition of the transfer. The weaknesses of this approach are as above.

16.3 Public private partnership

The value for money drivers in the National PPP Guidelines are:

1) complex risk profile and opportunity for risk transfer
2) whole-of-life costing
3) innovation
4) measurable outputs
5) asset utilisation
6) better integration of design, construction and operational requirements
7) a competitive process.

The National PPP Guidelines also state that ‘the government is typically seeking the whole-of-life innovation and efficiencies that the private sector can deliver in the design, construction and operation phases of the project’. However, irrigators will likely gain most if they directly manage their own scheme, which has been built with the money raised by the purchase of their water entitlements and provided by Australian and/or Queensland government funding. It places them progressively in a well-informed position and incentivises them to add value, leaving little room for the private sector to contribute to the drivers listed above. PPPs are not well suited to service a limited number of knowledgeable customers. The likelihood of dissatisfaction and conflict is high.

16.4 Recommendation

Should a preferred option proceed to construction, it is recommended that a design and construct (D&C) contracting model be adopted. If there is a cap on the funding in line with the economic return for the project, it may be necessary to declare this to the prospective tenderers before tendering starts. A prerequisite of this option is that the proponent has access to suitably skilled and experienced resources to manage the project delivery, to ensure they are contractually and technically well informed. In addition, an experienced facilitator should be engaged to run a competitive tender process, oversee the contract formation and set up the contract administration. This approach has worked well for Tasmanian Irrigation in the development of 15 irrigation schemes over the previous decade.

A D&C contracting model allows a progressive and innovative collaboration between the geotechnical, design and construction engineers to respond to issues as they arise right through design and construction delivery. It has been shown that this collaboration can yield substantial productivity gains, which in this model accrue to the contractor. This promotes a highly innovative and productive collaboration between geotechnical, design and construction engineers, with the best people available throughout the project delivery.

There may be opportunities for smaller-value and lower-risk projects to be delivered under a construct only method. This may be the preferred approach for a project delivered by Sunwater due to Sunwater's internal design capacity and project delivery experience.

Minimising the cost of tendering by providing comprehensive information and a preliminary design will be very important.

There are material risks with the construction of the project, in particular the risks associated with the below-ground uncertainties and the management of large flows of water associated with high rainfall events. These risks are most cost-effectively managed by the contractor and will be allocated accordingly.

It is not surprising that some of tier one contractors advocate for early contractor involvement or an alliance, because these approaches substantially reduce the cost risk to the contractors for both pre-construction and for project delivery. However, they also somewhat remove the project from the reigning civil construction market forces and are likely to result in a higher project cost, which the project may not be able to carry. However, there may be projects where an early contractor involvement approach with contractors with significant on-ground experience may lead to an overall project saving and minimum variations during delivery.

Further consideration of the delivery model for each preferred option is required in additional assessments. This would include whether to divide larger project into smaller work packages. If the argument used by some tier one contractors that the size afforded by combining the work package is necessary to get the efficiencies needed to work in this regional location, this will be evident in the savings offered for the award of all packages to a single entity. Awarding multiple packages to a single contractor effectively manages the risks inherent at the boundaries between work packages and is therefore desirable if the cost is affordable.

Awarding multiple packages to a single contractor provides that contractor with the flexibility to switch resources between a greater number of work fronts and thereby leverage efficiency gains. There is likely to be overlap of equipment and the skilled personnel required for each of the work packages; therefore, if an area of work is delayed, the resources can be redeployed to other areas. The contract is also more attractive due to its larger value. However, awarding multiple packages to a single contractor frequently comes at a cost that is higher than the savings associated with splitting the work, which creates a more competitive environment, because the work is accessible to a broader number of contractors. Splitting the work also allows a contractor to tender to their strengths. Developing clear and well-defined boundaries between work packages strengthens the case for tendering the project in multiple packages.

17. Conclusion

This options analysis conducted a detailed, robust review of the viable options available to address the problems and opportunities in the North Burnett and South Burnett regional council areas.

The longlist of 28 options were examined and assessed against a uniformed and approved set of criteria that measured the value, viability and support for each option.

The multi-criteria analysis produced a shortlist of options suitable for further detailed analysis to determine which options are suitable for investment and referral for further examination. Three of the options that did not make the shortlist were considered suitable to be pursued by the Queensland Government separate to this process and have been included in Recommendation 3 in the next chapter.

The shortlisted options were subjected to further examination and tested against multiple criteria that revealed their value and viability as a potential solution to the addressable problems and opportunities. The analysis of the shortlisted options identified:

- reference projects in Coalstoun Lakes that are suitable for further assessment in a detailed business case (options 4A, 4B and 4I)
- two reference projects that can be progressed further towards a potential detailed business case when the economic environment is suitable (options 1 and 5)
- five non-build options that can be pursued directly without the need for a detailed business case and form the basis for the South Burnett Integrated Water Initiative (options 8, 9A, 9B, 10B and 15).

Each of the shortlisted options are addressed in the recommendations for next steps in Chapter 17.

18. Recommendations

The options analysis makes the following four recommendations:

Recommendation 1—Further assessments for North and South Burnett Regional Council areas

It is recommended that further assessments detailed in Appendix I should be undertaken to refine understanding of the following two projects:

e) Construct a re-regulating weir on the Boyne River.

f) Construct a re-regulating weir on the Barambah Creek (Barlil Weir).

The assessments identified should be undertaken in collaboration with appropriate stakeholders to narrow project risks prior to deciding whether it is appropriate to progress to a detailed business case for either project.

Recommendation 2—Detailed business case for Coalstoun Lakes

It is recommended that a separate detailed business case should be undertaken for Coalstoun Lakes consistent with the additional NWIDF agreement. The nature of the reference project should be informed by and be aligned with the outcomes of the studies on the future of Paradise Dam and the current Burnett Basin Water Plan. As the outcome of these studies will not be known until 2021, it is recommended that the detailed business case consider at least two reference projects—one project that is reliant on water from Paradise Dam and one that is independent of Paradise Dam.

Recommendation 3—Referral of efficiency measures to the Queensland Government for direct review

It is recommended that the Queensland Government investigate, in collaboration with Sunwater:

a) optimised in-scheme unsupplemented access rules

b) refinements and efficiency improvements to rules relating to private water harvesting

c) regulatory and operational refinements to support agricultural supply chain improvements.

Recommendation 4: South Burnett Integrated Water Initiative

It is recommended that South Burnett Regional Council conduct a further investigation, and take direct action, in relation to:

a) procuring a permanent transfer of high priority water from the Tarong Power Station to secure the urban water supply for Kingaroy

b) securing a combination of private and public investment for the construction of a water recycling plant at the Swickers facility in Kingaroy

c) assessing the viability and process of converting Gordonbrook Dam from urban to irrigation use

d) securing additional water for irrigators in Blackbutt from Wivenhoe Dam to be transported through the Wivenhoe pipeline.

Council should formulate a 25-year economic roadmap that addresses the above a) to d) and provides a strategic direction for how the region will prepare for and manage strategic water opportunities.

It is not recommended that the projects in Recommendation 4 be included as part of a detailed business case. While some of these projects would require limited further investigations—such as the viability and structure of the purchasing and transporting of water for the Blackbutt irrigators—those investigations are primarily commercial in nature and therefore the in-depth analysis required by a detailed business case would have limited value. Including these recommendations in a detailed business process would unnecessarily delay the pursuit and achievement of commercial outcomes that could resolve the identified problems and provide the desired benefits.

19. Next steps

This recommended next steps for each of the options included in the recommendations in Chapter 17 are outlined below.

19.1 Reference projects

Appendix I sets out the available material to support progressing the reference projects included in Recommendation 1 and Recommendation 2, including design drawings for proposed infrastructure (where available) and a checklist of project-critical issues that require further investigation as part of a detailed business case.

Recommendation 2 is premised on the selection of two reference projects for Coalstoun Lakes from a group of three high-value potential projects. As described in Appendix I, the first task for the detailed business case for Coalstoun Lakes should be to work with the proponent and Project Working Group to determine which two reference projects will proceed through the whole of the detailed business case.

19.2 Projects for referral

The options in Recommendations 3 and 4 are to be referred to the Department of Natural Resources, Mines and Energy and South Burnett Regional Council respectively for further investigation, planning and implementation (where appropriate). The options for referral are summarised below.

Table 19.1: Summary of referrals

Option	Nature of option	Organisation (receiving the referral)
Greater utilisation of the Wivenhoe pipeline for irrigation use (Blackbutt irrigators)	Better use	South Burnett Regional Council
Construct water recycling plant at Swickers facility in Kingaroy	New build	South Burnett Regional Council
Procuring a permanent transfer of high priority water from the Tarong Power Stations to secure the urban water supply for Kingaroy	Better use	South Burnett Regional Council
Assessing the viability and process of converting Gordonbrook Dam from urban to irrigation use	Better use	South Burnett Regional Council
Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	New build	South Burnett Regional Council
Optimise in-scheme unsupplemented access rules	Reform	Queensland Government
Agricultural supply chain improvements	Reform	Queensland Government
Private water harvesting	New build	Queensland Government

19.2.1 South Burnett Integrated Water Initiative

It is recommended that South Burnett Regional Council undertake an economic planning exercise to develop a 25-year economic roadmap that provides a strategic direction for how the region will prepare for and manage the closure of the Tarong Power Station (see section 11.9.2). The 25-year economic roadmap should utilise the economic analysis undertaken in this options analysis to identify and plan the optimal structure and timing for future water projects and investigations in the region.[41]

As part of the roadmap, it is recommended that South Burnett Regional Council create the South Burnett Integrated Water Initiative—a set of strategic urban, industrial and agricultural water projects that can be actioned progressively to address the short- and medium-term water needs of the region and prepare for the long-term risks and opportunities resulting from the impending closure of the Tarong Power Station. These investigations should take place in the context of applicable legislative instruments and principles, including those relating demand management and best use of existing infrastructure.[42]

Based on the analysis on this options analysis, the South Burnett Integrated Water Initiative would include:

1) Progressing the assessment, and if suitable, constructing a re-regulating weir on Barambah Creek (Barlil Weir) (medium term).
2) Accessing and utilising the Wivenhoe pipeline more for irrigation use (short and medium term).
3) Constructing a water recycling plant at Swickers facility in Kingaroy (short term).
4) Procuring a permanent transfer of high priority water from the Tarong Power Stations to secure the urban water supply for Kingaroy (short and medium term).
5) Assessing the viability and process of converting Gordonbrook Dam from urban to irrigation use (medium and long term).
6) Flood harvesting from Barambah Creek into Bjelke-Petersen Dam (medium and long term).

The following provides an initial implementation plan for each of the projects in the South Burnett Integrated Water Initiative (except for a re-regulating weir on the Boyne River, which is examined further as a prospective reference project in Appendix I).

Greater utilisation of the Wivenhoe pipeline for irrigation use (Blackbutt irrigators)	
Description	This project proposes increasing the usage of the Wivenhoe pipeline to access more water from Wivenhoe Dam for use by irrigators in Blackbutt in South Burnett. This project relates to option 15 considered in this study.
Organisation receiving the referral	South Burnett Regional Council
Recommended actions	The following steps may be undertaken by the South Burnett Regional Council: • Conduct a further investigation with potential irrigation customers in Blackbutt to identify the strength of demand at various price and reliability points and additional private infrastructure required by individual irrigators to access water. • Commence commercial enquiries with Stanwell to identify the viability of accessing the Wivenhoe pipeline, and the scope of further investigations to determine the technical capability of the pipeline.

[41] Further discussion of the economic roadmap is set out at section 11.9
[42] Discussion on existing legislative instruments is set out at section 3.5.

	• Work with Stanwell to develop commercial terms for a negotiation in relation to purchasing access to the Wivenhoe pipeline, including limitations to access relating to scheduling, volume, technical requirements and risk management. • Commence commercial enquires with Seqwater in relation to the purchasing of water from Wivenhoe Dam, including (but not limited to) available volumes, pricing, water quality (relating to manufactured water). • Commence enquiries with water allocation holders located between Wivenhoe Dam and Blackbutt that may be motivated to permanently transfer medium priority water allocations. • Identify available public funding sources available to augment financial contribution from the Blackbutt irrigators. • Establish (if suitable) the Blackbutt entity to manage the purchasing of water for the Blackbutt irrigators. • Conduct parallel commercial negotiations with Seqwater, allocation holders and Stanwell to identify a reasonable and affordable price for purchase of water and transport of water. • (If possible) agree on commercial terms with Seqwater and/or allocation holders, and Stanwell, and enter into long-term commercial agreements.
Strategic considerations and risks	The following strategic considerations and risks should be addressed and managed: • Possible limitations on accessing the Wivenhoe pipeline relating to technical capacity, water access scheduling for the power stations, and commercial considerations for Stanwell. • Possible limitations on the sale of water by Seqwater to the Blackbutt irrigators. • Lack of interest by medium priority allocation holders to permanently transfer water allocations to the Blackbutt irrigators. • This option may potentially have synergies with the potential purchase of high priority water allocations from Stanwell required to secure urban water in Kingaroy.
Timeframe for actions	Subject to the administrative requirements of the South Burnett Regional Council, the actions identified in this table should be able to commence immediately.

Construct water recycling plant at Swickers facility in Kingaroy	
Description	This project proposes to upgrade and expand water treatment system at the Swickers processing and packaging facility in Kingaroy for the onsite recycling and reuse of water for use in the Swickers operations. This project relates to option 8 considered in this study.
Organisation receiving the referral	South Burnett Regional Council
Recommended actions	The following steps may be undertaken by the South Burnett Regional Council: • Confirm the commercial and technical terms of the proposed treatment plant with Swickers and provide any suggested refinements or improvements.

	• Work with Swickers to identify available Queensland Government funding to support the investment in the water treatment facility on the basis that it will facilitate business and employment growth. • Work with Swickers to lodge suitable funding applications. • Develop an advocacy plan to support the case for funding by the Queensland Government.
Strategic considerations and risks	The following strategic consideration and risk should be addressed and managed: • Lack of available funding from the Queensland Government, which could necessitate the option to be partially or fully funded by Swickers.
Timeframe for actions	Subject to the administrative requirements of the South Burnett Regional Council, the actions identified in this table should be able to commence immediately.

Procuring a permanent transfer of high priority water from the Tarong Power Stations to secure the urban water supply for Kingaroy	
Description	This project proposes that South Burnett Regional Council purchase (by way of permanent transfer) a volume of high priority water allocations from Stanwell to secure the urban water supply for Kingaroy. This project relates to options 9A, 9B and 10A in this study.
Organisation receiving the referral	South Burnett Regional Council
Recommended actions	The following steps may be undertaken by the South Burnett Regional Council: • Further investigate in relation to the volume of additional high priority water allocations it requires from Boondooma Dam (based on the findings in this study). • Determine the volume of additional high priority water allocations it requires, including any escalation in the required volume and the value of the water to the council and region. • Commence commercial enquires with Stanwell in relation to purchasing the required volume of high priority water allocations from Stanwell, including price, limitations on availability and issues relating future volume escalations. • Conduct commercial negotiations with Stanwell to identify a reasonable and affordable price for purchase (permanent transfer) of high priority water allocations. • (If possible) agree on commercial terms with Stanwell and enter into long-term commercial agreements.
Strategic considerations and risks	The following strategic considerations and risks should be addressed and managed: • Possible limitations on the sale of water by Stanwell to the council. • Significant differences between the commercial positions (including prices) between the council and Stanwell.

	• This option may potentially have synergies with the securing of water for Blackbutt irrigators to be transported through the Wivenhoe pipeline (owned by Stanwell).
Timeframe for actions	Subject to the administrative requirements of the South Burnett Regional Council, the actions identified in this table should be able to commence immediately.

Assessing the viability and process of converting Gordonbrook Dam from urban to irrigation use	
Description	This project proposes investigating and pursue available mechanisms to terminate the use of Gordonbrook Dam for urban water, and either upgrade the water management, convert the dam to irrigation use or dispose of the dam. This project relates to option 7 considered in his study.
Organisation receiving the referral	South Burnett Regional Council
Recommended actions	The following steps may be undertaken by the South Burnett Regional Council: • Initiate a technical assessment of Gordonbrook Dam to investigate and determine the best future use of the dam, including potentially replacing the pumps and upgrading water treatment capabilities; environmental measures to control discharge into the water storage; converting to irrigation; selling the dam; or decommissioning the dam. • Identify associated issues that require further investigation, including demand from irrigators and a potential price point, and options in relation to the dam safety upgrade. • Subject to the determination of the council, develop a management plan to implement the selected option. • (If relevant) investigate funding opportunities for assistance with the cost of the selected option.
Strategic considerations and risks	The following strategic considerations and risks should be addressed and managed: • Kingaroy currently utilises water from Gordonbrook Dam for urban and industrial water supply—an alternative source should be available to supplement that supply (if applicable). • The dam safety upgrade may be required regardless of which option is selected (except decommissioning). • The cost of each option is potentially high, and the opportunities to recover the cost from water users are limited. • This project will have dependencies, and possible synergies, with the potential purchase of high priority water allocations from Stanwell required to secure urban water in Kingaroy.
Timeframe for actions	This project is a medium-term opportunity and should be commenced after a determination is made on potentially securing more high priority water allocations for urban water security.

Flood harvesting from Barambah Creek into Bjelke-Petersen Dam

Description	This option proposes to develop and implement a system and process for pumping flood waters—at times of significant inflows—from Barambah Creek, into Barker Creek to be stored in Bjelke-Petersen Dam. This project relates to option 6 considered in this study.
Organisation receiving the referral	South Burnett Regional Council
Recommended actions	The following steps may be undertaken by the South Burnett Regional Council: • Further investigate with potential irrigation customers downstream of Bjelke-Petersen Dam to identify the strength of demand at various price and reliability points and additional private infrastructure required by individual irrigators to access water. • Conduct further investigations into technical requirements, design, environmental impacts and cost of a channel and pump system (or alternative system identified). • Investigate the availability of funding for detailed business case for the potential project and seek to secure that funding if available.
Strategic considerations and risks	The following strategic considerations and risks should be addressed and managed: • This project is potentially relatively high-cost while delivering intermittent and unreliable performance. The investigations should be candid about the viability and value of this project. • Alternative mechanisms for securing additional water for irrigators downstream of Bjelke-Petersen Dam should also be considered. • If this project only offers improved reliability (no water allocations are available or able to be created), then the cost for existing water users may be far too high to be practical.
Timeframe for actions	This project is a medium- to long-term opportunity and should commence after the conclusion of the detailed business case for the proposed Barlil Weir as well as any activities relating to the detailed business case.

19.2.2 Options being referred to the Queensland Government

Optimise in-scheme unsupplemented access rules	
Description	This project proposes operational improvements to the administration of water harvesting entitlements. This would involve optimising in-scheme unsupplemented access rules in schemes across the North and South Burnett, to enable the use of projected downstream water levels when making water harvesting announcements (in relation to both the commencement and cessation of water harvesting events). This proposal will allow greater utilisation of water harvesting opportunities by existing unsupplemented water allocations and support expansion of irrigated agriculture. This project relates to option 14 considered in this study.
Organisation receiving the referral	Department of Natural Resources, Mines and Energy
Possible actions	The following steps may be undertaken by the department: • Investigate the potential reforms and refinement to the access rules. • Consult with Sunwater in relation to its practices in the management and delivery of harvesting announcements, and potential improvements. • Consult with irrigators and other water users around the potential solutions and improvements that could optimise the efficiency of the system.
Strategic considerations and risks	The benefits of this reform project will potentially be greater certainty and opportunity for commercial planning and greater flexibility for irrigators in the North and South Burnett around water harvesting events. The benefits will not be realised unless, and until, the changes are implemented, which could result in water harvesting opportunities being missed or not optimised to their fullest possible extent.
Timeframe for actions	Subject to other priorities for the department, the steps outlined above could be commenced in the short term, although the reform process could take considerable time due to the necessary balancing of government priorities.

Agricultural supply chain improvements	
Description	The project proposes developing a supply value chain for the North and South Burnett and addressing supply chain gaps and constraints. Systematic and targeted improvements to the supply value chain has the potential contribute substantially to the economic growth of the region. The North and South Burnett have significant potential for commercial growth and investment attraction (outlined in section 11.8.2). This project relates to option 17 considered in this study.
Organisation receiving the referral	Department of Natural Resources, Mines and Energy
Possible actions	The following steps may be undertaken by the department:

	• Directly consult with the Department of State Development, Tourism and Innovation, which has relevant experience and knowledge in these areas. • Conduct further investigations to understand the impediments to supply chain efficiency in the North and South Burnett region. • Conduct further industry consultations and investigations to identify available mechanisms, including administrative actions, to address the supply chain deficiencies. • Investigate industries in the North and South Burnett regions that have particular strategic opportunities for growth with improvements to supply chain processes and opportunities, including piggeries, pig meat processing (including Swickers) and grain producers.
Strategic considerations and risks	The Department of State Development, Tourism and Innovation has significant experience and expertise in this area and has built a considerable understanding with local industries and businesses across the region. It is recommended that this department be central to the planning and assessment in relation to this reform project, to maximise the prospects of success.
Timeframe for actions	Subject to other priorities for the department, the steps outlined above could be actioned in the short term.

Private water harvesting	
Description	The option proposes harvesting wet-season floodwaters for off-stream storage and later use to irrigate riparian and near-riparian lands. It could be expected that this type of development would be replicated in multiple locations across lands that have previously been identified, noting static lift and distance from watercourse. This project relates to option 16 considered in this study.
Organisation receiving the referral	Department of Natural Resources, Mines and Energy
Possible actions	The following steps may be undertaken by the department: • Investigate on the viability and value of harvesting wet-season floodwaters in the Burnett region. • Identify and assess existing off-stream storages for suitability for storing harvested flood waters.
Strategic considerations and risks	None
Timeframe for actions	Subject to other priorities for the department, the steps outlined above could be actioned in the short term.

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Appendix A

Options Analysis

Appendix A. Summary of previous studies

The following table provides a detailed index of all documents reviewed as part of the literature review.

Table 19-2: Detailed list of documents reviewed – general studies and proposals

1	Discussion Paper	Regional Water Position Paper	2018	WBBROC	High-level detailed reference information on the operation of water demand, the market and role of water in the WBB economy. See further detailed description in below.
2	Map	Paradise Dam Water Pipeline	2016	NBRC Assets Department	Map of pipeline from Paradise Dam to Biggenden (20.78km).
3	Report	Soils and Agricultural Suitability of the South Burnett Agricultural Lands	2001	DNRME	Report on the South Burnett Agricultural Survey, which measured cropping suitability (53% suitable for dryland cropping; 73% for dryland sown pastures; 48% for tree and vine crops). 80% of the survey area has been cultivated at some stage, with erosion and salinity issues impacting significant portions.
4	Plan	North Burnett Advocacy Action Plan	2019	North Burnett Regional Council	Confirms support for federal funding of the feasibility study to assess options for new water infrastructure in the North and South Burnett Regions.
5	News Article	Great Ideas…Just Add Water	2018	South Burnett Regional Council	Reports on the meeting of South Burnett water users and the ideas put forward by meeting attendees. References the importance of the feasibility study for the region. Ideas include TPS taking some supply from Wivenhoe Dam, water storage upstream of Barambah Station; Barlil Weir.
6	Advocacy Paper	Building the future trade potential of the Wide Bay Burnett		WBBROC	This paper identifies the trade potential of WBBR and identifies the infrastructure priorities to exploit that potential. The paper focuses on transport infrastructure (port, rail, road) and gives limited priority water infrastructure (identified $23m investment in water storage and supply).
7	Research Paper	Water for Economic Development DSDMIP	2018	Marsden Jacobs 2017	Overview of the availability and demand for water in WBB for urban, industrial and agricultural sectors. See further detailed description below.
8	Submission	Sunwater Irrigation Pricing Review Submissions		WBBROC	The WBBROC submission raises multiple questions in relation to the formulation of pricing and suggests that pricing should reflect the value to the customer and not be subject to broad increases that impact irrigators equally with high priority water users. See further detailed description below.

9	Submission	Submission to the Rural Irrigation Price Review 2020-2024	2018	NBRC	NBRC largely agrees with the WBBROC and LGAQ submissions to the review (see Document #8) and provides some further commentary that focuses on increased clarity in relation to North Burnett.
10	Presentation	Kingaroy RWSSA Hydrological Assessment – Water Supply Planning	2019	DNRME	The demands for Kingaroy are modelled with the assumption that water will be diverted from both Gordonbrook and Boondooma Dams. Water restrictions are modelled and demonstrate that to achieve modelled reductions that drastic management measures would be required. Multiple scenarios are considered to model the water impact of water restrictions. Findings that an additional 1,300 ML/a would dramatically reduce fail frequency of water supplies.
11	Report	Soils of the Riparian Lands of the Burnett River	1996	DMNR	The soil assessment identifies that a high proportion of the land close to the Burnett River is suitable for irrigated cropping, and that there are extensive areas suitable for irrigation some distance from the Burnett River. See further detailed description below.
12	Strategy Paper	Economic Development and Innovation Strategy		NBRC	Review of the economic and development opportunities and strengths of the region. Limited commentary on the role of water supply and security.
13	Feasibility Study	Bundaberg Channel Upgrade Feasibility Study	2018	Sunwater	This feasibility study examines potential irrigation expansion areas, including identification of potential customers and concept level engineering studies to determine the optimal methods of water conveyance to these areas, including estimated costs. An assessment between existing water prices and Paradise Dam water is undertaken to develop an appropriate approach to water pricing in the future. See further detailed description below.
14	Report	Queensland Regional Profile: South and North Burnett	2019	QLD Government	This report breaks down data for South and North Burnett in the areas of demography, society, economy, industry and development.
15	Policy	Queensland Bulk Water Opportunities Statement	2018	DNRME	This is the bulk water security strategy and direction statement for Queensland. This strategic infrastructure document provides a framework through which the Queensland Government can support and contribute to sustainable regional economic development through better use of existing bulk water infrastructure, and planning and investment in new infrastructure.
16	Report	Regional Water Supply Security Assessment - Bundaberg	2016	BRC QLD Government	This report discusses the heavy reliance of the Bundaberg region on reliable and secure water resources for economic development. The region has a significant water allocation, with the vast majority of water supply capacity designated as medium priority for use by irrigators. There is a large volume of uncommitted water allocations, with the majority of that volume designated as medium priority. See further detailed description below.

17	Minutes	Stakeholder Meeting – Water Policy	2018	DNRME	Detailed minutes of stakeholder meeting that outlines the specific experiences of local irrigators. Consideration of how water management regulations could be changed to accommodate water requirements and be more considerate of irrigator needs in the region. Discussion of the ways to best service TPS and provide for the irrigator requirements when mandatory cut-off levels are approaching. Set down an action list for further investigations.
18	Map	Upper Burnett Sunwater Zones	-	Sunwater	Sets out the Sunwater Zones across the Upper Burnett.
19	Proposal	Water Proofing Wide Bay Burnett	2017	WBBROC	This proposal recommends significant infrastructure investment to increase storage capacity, create more efficient water transfers with new pipeline distribution and restructure the water pricing mechanisms. See further detailed description below.
20	Synopsis	WBBROC Regional Water Strategy Water Synopsis	2017	WBBROC	This synopsis provides a reference for publicly available sources on WBB water security discussions. The synopsis reviews the current position of water security and reliability in WBB and identifies the costs and lost opportunity of the current under-utilisation of water reserves in the region. See further detailed description below.
21a	Data Sheet	Water Use on Australian Farms 2017-18	2018	ABS	-
21b	Data Sheet	Water Use on Australian Farms 2016-17	2017	ABS	-
21c	Data Sheet	Water Use on Australian Farms 2015-16	2018	ABS	-
21d	Data Sheet	Water Use on Australian Farms 2014-15	2015	ABS	-
22a	Data Sheet	Value of Agricultural Commodities Produced 2017-18	2018	ABS	-
22b	Data Sheet	Value of Agricultural Commodities Produced 2016-17	2017	ABS	-
22c	Data Sheet	Value of Agricultural Commodities Produced 2015-16	2016	ABS	-
22d	Data Sheet	Value of Agricultural Commodities Produced 2014-15	2015	ABS	-

25	Proposal	Water Transfer and Hydro Storage Study	2018	Coalstoun Lakes Development Group Inc Eaglehawk Consulting	Study proposes a project for the utilisation of surplus water and electrical power generation. See further detailed description below.
26	Discussion Paper	Getting Water for Peanuts	2018	Eaglehawk Consulting	Water transfer project with pipeline and pump infrastructure to better utilise allocation to service existing and new irrigation areas. See further detailed description below.
27	Proposal	Review for Lower Barambah Coalstoun Lakes Irrigation Scheme	2015	North Burnett Regional Council GHD	Desktop review of previous studies in the Lower Barambah/Coalstoun Lakes Irrigation Scheme, and study of the viability of suitable water infrastructure. Report reviews the SKM (1996) study and PPK (1998) study. See further detailed description below.
28	Proposal	Barambah Creek Proposal	2018	Coalstoun Lakes Development Group Inc	Informal proposal for the development of a demand distribution system for Barambah Creek and Coalstoun Lakes. The proponent is confident in high and reliable take up of water allocations. See further detailed description below.
29	Supporting Document	Barambah Creek Scheme Schematic	2018	-	Schematic documents in support of Coalstoun Lakes Irrigation Scheme.
30	Report	Agricultural Land Resource Assessment of Coalstoun Lakes	2000	DNRME	This assessment was required to assess the potential for irrigation development to ensure sustainable agricultural development. The assessment identifies significant areas suitable for expanded agricultural production. Broadacre cropping is the dominant agricultural production in Coalstoun Lakes. See further detailed description below.
31	Proposal	Gayndah Regional Irrigation Development (GRID) Project – Detailed Business Case	2018	Isis Central Sugar Mill Co Ltd with support from NWIDF	Infrastructure works and water transfer from upstream on the Burnett River to make 24,000ML (approx.) available for the development of 5,000ha for sugarcane production and 1,200 for irrigated rotation cropping. See further detailed description below.
33	Letter	Water Resources Letter May 1980	1980	-	Letter form the Boyne River Water Advisory Board requesting clarity on the priority for water for irrigators; soil survey of surrounding lands; water requirements for irrigation from the report; and plans for stage two. Response from the Minister confirmed that a percentage of water would be reserved for irrigation although urban and other uses would have a higher priority; advised that stage two would not proceed for a significant period.
34	Letter	Sunwater Letter 23 March 2017	2017	Boyne River	Letter from Sunwater to Boyne River Irrigator Advisory Committee summarising the water infrastructure options for the Boyne catchment area. See further detailed description below.
34a	Presentation	Boondooma presentation – Cooranga Weir Modelling	2018	Boyne River	Presentation outlining the hydrological performance of the proposed Cooranga Weir
35	Letter	Sunwater Letter 5 June 2017	Boyne River	Boyne River	Confirmed that Cooranga Weir is unattractive due to geotechnical and environmental issues. Sunwater set out a proposal for preliminary IQQM hydraulic modelling for Boondooma Dam raising. See further detailed description below.

37	Meeting Notes Part 1 (links to 38)	DNRME, Sunwater, Boyne Irrigator Meeting – 16 August 2018	2018	DNRME	Reported on survey results on water supply and impacts on TPS. The survey was made up by DNRME and conducted by BIEDO on behalf of DNRME. The presentation argues that there is not currently sufficient justification to source TPS' substantive water requirements from Wivenhoe Dam, and that the impacts would outweigh the demand for MP water for irrigators. See further detailed description below.
38	Meeting Notes Part 2 (links to 37)	DNRME, Sunwater, Boyne Irrigator Meeting – 16 August 2018	2018	DNRME, Sunwater, Boyne River irrigators	Reported that there is support from irrigators for the Cooranga Weir scenario, and that there are substantive benefits. However, the impact on p/ML cost would exceed the market willingness to pay. See further detailed description below.
40	Minutes	Cabinet Meeting Minutes – 1 June 1978	1978	QLD State Government	Decision to construct 210,000ML dam on Boyne River for power station supply.
41	Minutes	Cabinet Meeting Minutes – 27 June 1978	1978	QLD State Government	Amended the minutes from 1 June 1978 so that the capital costs of the project are apportioned as: Boyne River Dam (QEGB - 75%; IWSC – 25%); and Pumping Station and Pipeline (100% - QEGB).
42	Report	Irrigation from the Boyne River	2019	RECE BIEDO	The study assesses the broad social and economic benefits of increased water availability in BRIA in the context of the proposed Cooranga Weir. The study determined that increasing irrigation water reliability from the current 73% to a future 88% would have a major economic impact on BRIA and the whole North Burnett Regional Council area. See further detailed description below.
43	Data Sheet	Boyne River Irrigators Meeting – 16 August 2018 (Attachment 1)	2018	BRI	Details of Simulated Boondooma Dam and Cooranga Weir Level Analysis
44	Map	Boyne River Irrigators Meeting – 16 August 2018 (Attachment 2)	2018	BRI	Map of Boyne River and Tarong WSS
45	Graph	Boyne River Irrigators Meeting – 16 August 2018 (Attachment 3)	2018	BRI	Boondooma Dam Releases compared to Cooranga Flow
46	Network Service Plan	Barker Barambah Bulk Water Service Contract	2018	Sunwater	The NSP outlines a short-term refurbishment and longer-term projects for the improvement of the Barker Barambah area by Sunwater. The primary infrastructure in this NSP region is Bjelke - Petersen Dam. The significant works for the five-year forward period are focused on Silverleaf Weir and assessments and works on Bjelke- Petersen Dam.
47	Network Service Plan	Boyne River and Tarong Bulk Water Service Contract	2018	Sunwater	The NSP outlines a short-term refurbishment and longer-term projects for the improvement of the Boyne River and Tarong region by Sunwater. The significant works for the five-year forward period are focused on assessments and works on Boondooma Dam.

48	Network Service Plan	Three Moon Creek Bulk Water Service Contract	2018	Sunwater	The NSP outlines a short-term refurbishment and longer-term projects for the improvement of the Three Moon Creek area by Sunwater. The primary infrastructure in this NSP region is Cania Dam. The significant works for the five-year forward period are focused on assessments on Cania Dam and works on various weirs. See further detailed description below.
49	Annual Report	Permanent Water Trading Annual Report 2011-12 (Supplement)	2012		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year.
50	Annual Report	Permanent Water Trading Annual Report 2012-13 (Supplement)	2013		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year.
51	Annual Report	Permanent Water Trading Annual Report 2013-14 (Supplement)	2014		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year.
52	Annual Report	Permanent Water Trading Annual Report 2014-15 (Supplement)	2015		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year.
53	Annual Report	Permanent Water Trading Annual Report 2015-16 (Supplement)	2016		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year.
54	Annual Report	Permanent Water Trading Annual Report 2016-17 (Supplement)	2017		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year.
55	Annual Report	Permanent Water Trading Annual Report 2017-18 (Supplement)	2018		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year.
56	Annual Report	Permanent Water Trading Annual Report 2018-19 (Supplement)	2019		Reporting on transfer of ownership in water allocations over the period in the Burnett Basin Water Plan, and specifically North and South Burnett, for the financial year. .
57	Report	Sustainable Water Alternatives for the Southern Burnett	2004	SWASB	Review of the relevant reports and studies on the water alternatives in the Kingaroy, Nanango, Rosalie and Crows Nest LGAs, and recommendations for implementing water strategies.
58	Report	Kingaroy Water Supply: Augmentation of Raw Water Supply	1995	Kingaroy Shire Council John Wilson & Partners	The report was commissioned to investigate new water sources for Kingaroy and expanded treatment plant capacity. The report identified and analysed multiple options and recommended further action.

59	Report	Kingaroy Water Supply Planning Report – Development of Borefield	1998	Kingaroy Shire Council John Wilson & Partners	Investigation of the development of a borefield south of Kingaroy to supplement existing supply from Gordonbrook Dam and delay the second raising of Gordonbrook Dam.
60	Report	Nanango Water Supply: Augmentation of Barker Creek Groundwater Supply	1994	Nanango Shire Council John Wilson & Partners	Report on the program of bore hole investigations to identify viable options for additional supply of bore water in the Nanango Shire Council area.

The following section provides a detailed summary of selected documents as part of the literature review.

A.1 Regional Water Position Paper (2018 WBBROC)

A.1.1 Summary

High-level detailed reference information on the current state of water demand, the operation of the water market and role of water in the economy (especially in WBBR).

A.1.2 Key Features

- WBB has around 1,723GL of storage capacity in 30 regulated impoundments with a total stored volume averaging 56% of full capacity over the last 14 years ranging from 10% during the millennium drought to 100% after the 2013 flood event. There is an estimated additional 120GL of on-farm surface storage.
- Total available capacity of all sources is therefore around 2,317GL with 1,000GL held as strategic reserve (Figure 19-1)
- The irrigation sector consumes over 82% of regulated water and most of the unregulated water. The largest irrigation use of water is the sugar industry which uses over half of all agricultural water or 44% of total consumption in the region (Figure 19-2).
- The future outlook for projected annual demand against a reducing catchment yield would result in the surplus supply reducing to zero by 2050 and strategic reserves to 8 months (from the current 46 months). These estimates will be further impacted by planned expansion water demand from the irrigation sector.
- Position paper recommends further reviews of regulatory mechanisms, water trading rules, recycled water options and bulk water pricing.

Figure 19-1: Representation of the volumes of various water classes in WBB (extracted from paper)

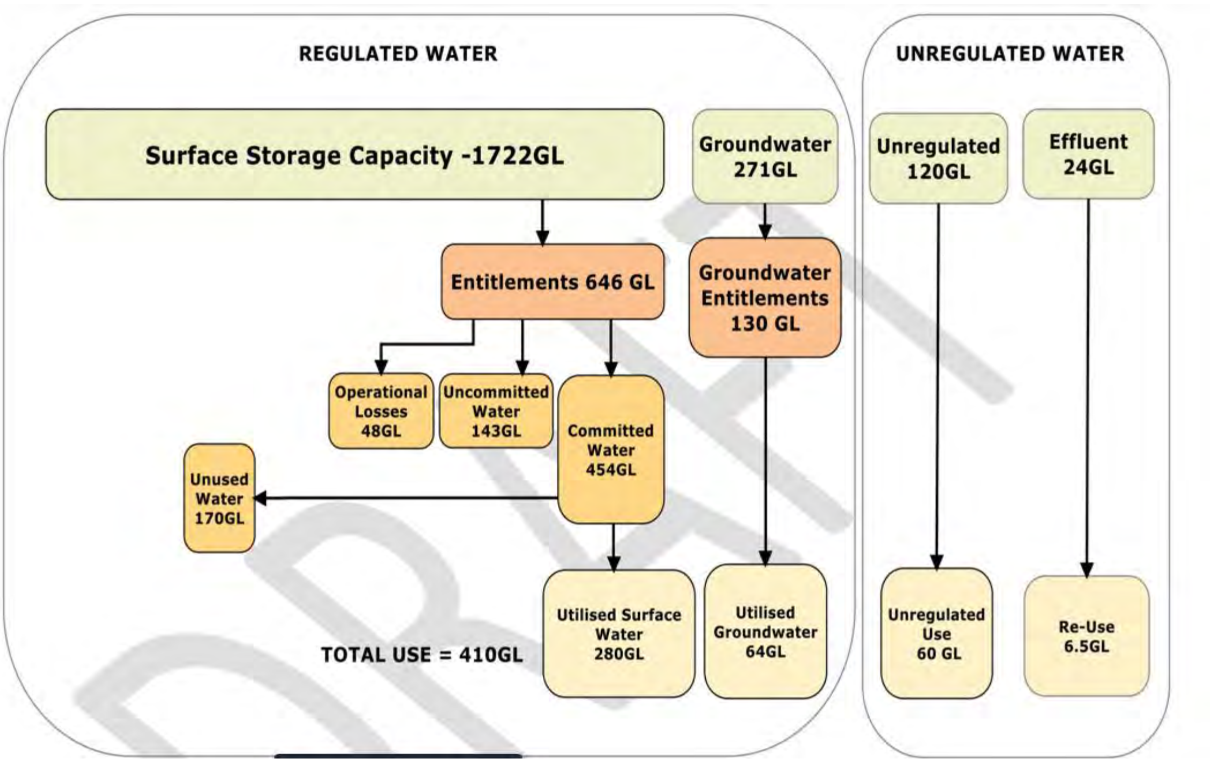
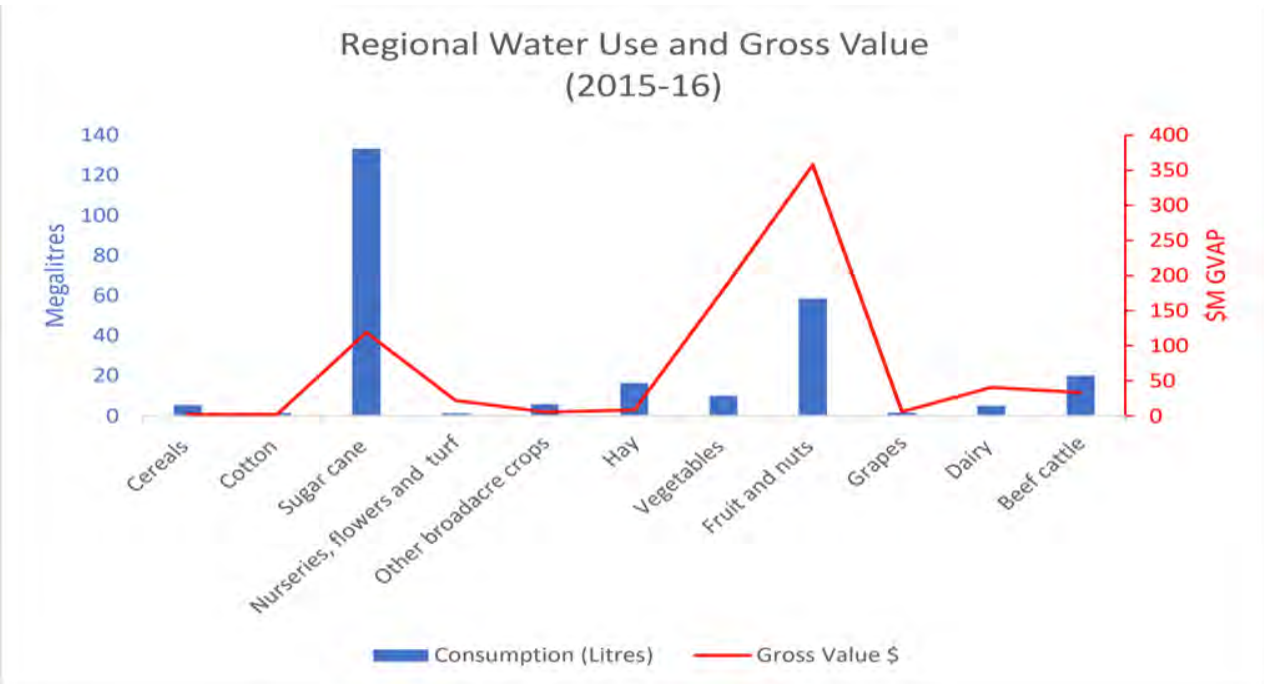


Figure 19-2: Irrigation Water Use in WBB and Gross Value (extracted from paper)



A.2 7. Water for Economic Development DSDMIP (Marsden Jacobs 2017)

A.2.1 Summary

Overview of the availability and demand for water in WBB for urban, industrial and agricultural sectors.

A.2.2 Key Features

- WBB has substantial water resources that are under-utilised. There is increasing water demand for agriculture and high value crops, although water resources are often not cost-effectively available in areas of existing or potential demand.
- Urban demand is largely secured, although some smaller centres will require longer term planning for secure water resources.
- The authors of the report are unwilling to give assurances or confidence to their forward demand estimates due to the fluid nature of customer requirements for water resources.
- Decline in agriculture-based employment, and a slowing population growth rate that is below the Queensland average.
- Top agricultural outputs: cattle and calves; sugar cane; pigs; mandarins; macadamias; avocadoes and various vegetables.
- General commentary on the water access, strategy and regulatory considerations, and some suggestions on how to streamline and simplify water management and access in WBB.
- The water trading market is immature, unreliable and impacted by limited and (allegedly) inaccurate reporting and public information. It is believed that this is resulting in large parcels of water are being locked up in underutilised small holdings.
- Summarised the unused and uncommitted surface water allocations and unallocated strategic reserve. The causes of the low utilisation of allocations is caused by reliability and security concerns; concerns regarding the commodity markets; and poor timing. Paper summarises current sources of demand.

A.3 8 Sunwater Irrigation Pricing Review Submissions by WBBROC

A.3.1 Summary

The WBBROC submission raises multiple questions in relation to the formulation of pricing and suggests that pricing should reflect the value to the customer and not be subject to broad increases that impact irrigators equally with high priority water users.

A.3.2 Key Features

- WBBROC seeks assurances that bulk water price paths are reflective of state and national benchmarks.
- WBBROC argues against nominal price increases and advocates for pricing to reflect the value to the customer, and Sunwater should be prevented from applying monopoly rents on customers.
- Raised concerns regarding the impact of the reduction in the Paradise Dam capacity or yield on water availability and reliability.
- Suggested that the capital costs for the proposed Dam Safety Upgrade should be recovered from users on a value-weighted basis, with high priority classes providing the higher contribution.

A.4 11 Soils of the Riparian Lands of the Burnett River

A.4.1 Summary

The assessment of the soils identified that a high proportion of land close to the river is suitable for irrigated cropping, and that there are extensive areas suitable for irrigation some distance from the Burnett River.

A.4.2 Key Features

- During 1991 to 1992, soils were examined up to 5 km north and south from the general course of the Burnett River between Mundubbera and Gayndah.
- The survey covered 38,890 ha. Geological formations include recent alluvia near streams, relict alluvia, sedimentary rocks, basalt and granite.
- A total of 48 soils were identified, which can be categorised as one of seven major soil groups. The lands are assessed in terms of land suitability for growing asparagus, avocados, chickpea, citrus, cruciferae, cucurbits,

grapes, lucerne, mango, mungbean, navybean, improved pastures, peanut, pecan, potato, safflower, soybean, stone fruits, summer grains, sunflower, vegetables and winter grains.

- A high proportion of land close to the river is suitable for irrigated cropping. Extensive areas suitable for irrigation occur distant from the river, while some are also elevated, being on plateaux.
- This study area has the potential to develop salinity and waterlogging problems under irrigation. Even clearing has altered the hydrologic balance and resulted in the development of seeps or salinity in small areas.

A.5 13 Bundaberg Channel Upgrade Feasibility Study (Sunwater 2018)

A.5.1 Summary

This feasibility study examines potential irrigation expansion areas, including identification of potential customers accompanied by concept level engineering studies to determine the optimal methods of water conveyance to these areas, including estimated costs. An assessment between existing water prices and Paradise Dam water is undertaken to develop an appropriate approach to water pricing in the future.

A.5.2 Key Features

- Existing water allocations in the BWSS have been considerably underused in recent years.
- Little demand for Paradise Dam and Kirar Weir high priority water the exists.[43]
- Substantial demand for Paradise Dam and Kirar Weir medium-priority water allocations exists but requires lower pricing and additional infrastructure to deliver water.
- Consequential impacts of the sale of “new” water allocations on the holders of current allocations are manageable.
- The water market in the area could improve with more transparent sales data.
- Study considered multiple prospective infrastructure projects: North of the Elliot River (highest prospective demand); South of the Elliot River highest prospective demand); Wallaville highest prospective demand); Promisedland; Farnsfield; Turpentine Road; and Gayndah. The location of these projects is shown in Figure 19-3 and the basic financial modelling for each project in shown in Figure 19-4.
- The Study proposes a reduction in the shelf price of medium priority water ($550/ML) to drive demand and meet the market price expectations. Fixed and variable charges would remain unchanged and high priority water would not be discounted.
- Prospective demand drivers are sugar; tree crops (macadamias, avocados, mangoes and citrus); other crops (berries, peanuts and selected vegetables); mining (subject to substantive delays and uncertainty).

[43] The Upper Burnett Water Supply Scheme Operations Manual 2020 provides that a holder of high priority water rights in the area of Kirar Weir (Zone OC) may enter into a seasonal water assignment to transfer high priority water to selected other zones provided the take volume is less than (or equal to) 350ML and greater than (or equal to) 200ML.

Figure 19-3: Locality Plan of Prospective Projects (extracted from paper)

Figure 19-4: Financial Modelling (extracted from paper)

	Capital Cost ($ ',000)	Water able to be sold (ML)	Unit Capital Cost ($ per ML)	Grant Required ($ ',000)
North of the Elliot River	20,160	7,200	2,800	15,235
South of the Elliot River	23,750	6,150	3,862	18,237
Wallaville	13,850	8,600	1,610	7,965
Promisedland	16,690	1,000	16,690	9,700
Farnsfield	44,950	3,700	12,148	18,448
Turpentine Road	9,500	5,000	1,900	5,825
Gayndah	116,380	24000	4,849	n/a
Isis Main Channel Upgrade	10,388	n/a	n/a	9,705
Total	**245,280**	**55,650**	n/a	**75,410**

A.6 16 Regional Water Supply Security Assessment – Bundaberg (2016 BRC & QLD Government)

A.6.1 Summary

The Bundaberg region is heavily reliant on reliable and secure water resources for economic development. The region has a significant water allocation, with the vast majority of water supply capacity designated as medium priority for use by irrigators. There is a large volume of uncommitted water allocations, with the majority of that volume designated as medium priority.

A.6.2 Key Features

- The report provides a review of the current state of water availability in the Bundaberg region, and identifies the key needs and opportunities. Safe, secure and reliable water supplies are critical for sustaining economic growth in the area, as well as for the well-being of the community.
- The BWSS has a total water supply capacity of 44,372 ML/a of HP allocations and 335,957 ML/a MP allocations.

- Approximately 110,000 ML of the MP water allocation and 17,000 ML of the HP water allocation is not committed.
- The majority of the water is used by agricultural businesses across the Lower Burnett area, with Council's supplies from the BWSS representing only a small component of the scheme's available supplies.
- The water supply capability of the BWSS is supported by water stored in Paradise Dam (capacity of 300,000 ML) on the Burnett River and Fred Haigh Dam (capacity of 562,000 ML) on the Kolan River.
- Figure 19-5 demonstrates the assumed use of BWSS water allocations at various modelled scenarios.

Figure 19-5: Assumed use of water allocations (extracted from paper)

		Assumed use of BWSS water allocations (ML/a)				
		Council (all HP)		Others + uncommitted		
	Scenario	Bundaberg network*	Other communities	HP	MP	Combined total
1	Current use	3060	1156	17 463	224 309	245 988
2	Current use + 25% of unused allocation**	4220	1256	21 875	252 221	279 572
3	Current use + 50% of unused allocation**	5380	1356	26 288	280 133	313 157
4	Current use + 75% of unused allocation**	6540	1456	30 701	308 045	346 742
5	Full use	7702	1556	35 114	335 957	380 329

A.7 19 Water Proofing Wide Bay Burnett (2017 WBBROC)

A.7.1 Summary

This proposal recommends significant infrastructure investment to increase storage capacity, create more efficient water transfers with new pipeline distribution and restructure the water pricing mechanisms.

A.7.2 Key Features

- Increasing storage by raising the height of Borumba and Boondooma Dams (increasing storage from 915GL to 2,650GL).
- Development of new pipelines to facilitate water transfer between basins, restructure water pricing mechanisms.
- Offset bulk water costs with 20MW of hydro-electric power.
- Total cost of 1.573b with an estimated payback period of 13 years.

A.7.3 Benefits

- Sustained annual employment growth of 2.7% to 2027.
- Directly create 500 construction jobs.
- Export stored surplus water between basis and direct it to highest value areas.
- No new dams are required.

A.8 20. WBBROC Regional Water Strategy Water Synopsis (2017)

A.8.1 Summary

The synopsis provides a reference for publicly available sources on WBB water security discussions. The Synopsis reviews the current position of water security and reliability in WBB and identifies the costs and lost opportunity of the current under-utilisation of water reserves in the region.

A.8.2 Key Features

- WBBROC estimates that WBB consumed 380 gigalitres in 2015 and this will increase by 135GL/a by 2036 at current rates of consumption, water use efficiency and utilisation.

- 140GL of un-committed water is available to meet current and future demand and opportunities, subject to necessary infrastructure development and regulatory and behavioural changes.
- Regional utilisation of available supply is 47%. Estimated that increasing consumption by 135GL could increase GRP from $2.6b to $3.3b. The opportunity cost of under-utilising surplus water is estimated between $80m and $120m annually.

The proper allocation and distribution of the regions water resources is important.

A.9 25. Water Transfer and Hydro Storage Study (Coalstoun Lakes Development Group Inc and Eaglehawk Consulting 2018)

A.9.1 Summary

Study proposes a project for the utilisation of surplus water and electrical power storage, allowing access to 72GL for inland Burnet and building a complimentary revenue stream from power generation.

A.9.2 Key Proposal Features

- Vertical integration project that utilises water to generate electricity, and then uses that electricity to pump the water to higher areas of high demand and send the surplus electricity to the power grid. The project will utilise PHES for energy storage.
- Capital investment into water infrastructure (pipelines, pump-stations, balance reservoirs, distribution networks) and energy infrastructure (head and tail ponds, penstock, transmission infrastructure incorporated into a PHES facility).
- Infrastructure includes 170km pipeline that connects Paradise Dam to the Sunwater pipeline supplying the Tarong Power Stations from Boondooma Dam. This allows the water from Paradise Dam to augment the Boondooma supply and build those storage levels at Boondooma for security and power generation.

A.9.3 Benefits

- Development of 15,500 ha for agriculture in an area well connected with food processing facilities and domestic and export infrastructure.
- 1,350 direct permanent jobs plus up to 4,725 indirect jobs.
- Anticipated high EBITDA rate of return (19-39%) on PHES based on PHES capital unit rates, with a guaranteed 9% rate of return and full capital recovery over 30 years on $833m public investment (in addition to commercial returns).
- GRP of $790m (6% of regional economy) and combined taxation receipts of $618m.

A.9.4 Supporting information

- The return on irrigation water use in the WBB is 12 to 13 times the state average for all agriculture water use.
- A significant proportion of the regions 1,700GL of storage capacity is currently available as under-utilised water entitlement and at a nominal market value of $133 million, comprises about half of the State's un-used regulated reserves.
- Proposal seeks to align the Powering Queensland Plan (strategy for power generation and management that includes pumped storage generation capacity) and the Queensland Bulk Water Opportunity Statement.

A.10 26. Getting Water for Peanuts (Unstated)

A.10.1 Summary

Proposal seeks to exploit the unused allocations in the WBBR, particularly in Lower Burnett. There are currently 100GLin MP allocations available from Paradise Dam at an allocation price of $937/ML (plus ongoing bulk water charges of $45/ML).

A.10.2 Key Proposal Features

- Development of 100km pipeline between Paradise Dam and Lake Boondooma (Figure 19-6 and Figure 19-4) to transfer surplus water to Lake Boondooma and the Gayndah Region via the existing Boyne River Irrigation Scheme and to the South Burnett via the existing Tarong-Boondooma Pipeline.
- Multiple pump stations would be required and 2.2MW of power is necessary to manage the elevation difference.
- Routing pipeline through Coalstoun Lakes to irrigate a new 4,000ha irrigation area.
- Stored water (post transfer) can be held for distribution, facilitating the creating of 20kha of new irrigation areas and increase reliability for existing users.
- Resetting water allocations so that Tarong Power Station water requirements (30,000ML/year) are supplied from Wivenhoe. This would allow the Boondooma-Tarong pipeline to supply irrigation water to the target area around Kingaroy with available allocations from Boondooma, providing the Boyne Irrigation Scheme with a more reliable supply and allows a regulatory review of the 77GL strategic HP reserve held in Boondooma for Tarong.
- Connecting the Wivenhoe, Boondooma and Paradise storages through formalising (making operational) the common terminations at Tarong.

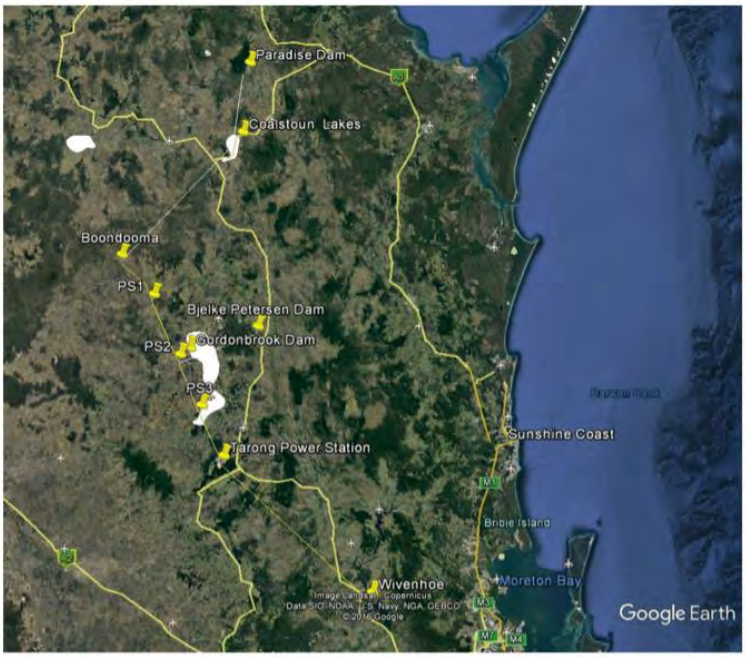
A.10.3 Benefits

- Proposal would create 2,700 new jobs (direct and indirect)
- Capital investment of $425m with annual return of $490m, based on using the Murray Darling Basin agricultural economic multiplier of 3.5.

A.10.4 Supporting information

- The Isis Sugar Ltd proposal to expand sugarcane production by 500,000 tonnes in Gayndah/ Coalstoun Lakes would require 24GL.There is a competitive proposal to send 24GL (approx.) to Mary Basin for Maryborough Sugar Ltd.
- Urban and industrial usage is peripheral, with the additional water providing greater security.
- Boondooma has had a steady decline in available volume and has a strategic cut-off of 77,000ML (no irrigation water below this level).
- Significant areas of existing irrigation area (67,000 ha) would receive greater access to HP water, and new areas (60,000 ha) would receive allocations. Based on 50% utilisation of the new areas, the requirement is for 80GL of the existing entitlement of 120GL.

Figure 19-6: Route of Proposed pipeline from Paradise Dam to Lake Boondooma with route shown in white (extracted from paper)



A.11 27. Review for Lower Barambah / Coalstoun Lakes Irrigation Scheme (North Burnett Regional Council & GHD)

A.11.1 Summary

Desktop review of previous studies in the Lower Barambah/Coalstoun Lakes Irrigation Scheme, and study of the viability of suitable water infrastructure. Report reviewed the SKM (1996) study and PPK (1998) study.

A.11.2 Key Features

- SKM (1996) study identified two options: Irrigation of the Coalstoun Lakes and Ban Ban Springs areas through a pipeline reticulation system pumped from new storage. The second option added irrigation of the Biggenden area with upgrades to pump stations, pipelines and storage capacity.
- PPK (1998) study investigated the SKM options plus larger versions of each of those two proposals.
- The estimated costs of the four options are outline in Figure 19-7. GHD has updated the PPK cost estimates for 2015 and a cost estimate for alternative glass reinforced pipes.
- The size of the irrigation area and water allocation for each of the four options are outlined in Figure 19-8.
- The new storage considered for these four options was originally a 210,000ML dam, although the GHD report generally discussed alternative, more cost effective, options including off-stream storage and water harvesting; a smaller dam or weir; transfer of unallocated water entitlement from Paradise Dam; and water trading.

Figure 19-7: Estimated costs of options (extracted from paper)

Table 1 Summary - Irrigation system cost estimates

Scheme Options	Previous Cost Estimates (PPK, 1998)	Updated Cost Estimates (GHD, 2015)	
		Based on PPK pipe selection	Based on alternative pipe selection
Updated Irrigation Area including Biggenden	$80.0 M	$278.9 M	$135.9 M
Updated Irrigation Area excluding Biggenden	$72.5 M	$226.0 M	$123.5 M
CLBWDG Irrigation Area including Biggenden	$81.2 M	$279.1 M	$134.9 M
CLBWDG Irrigation Area excluding Biggenden	$68.8 M	$215.2 M	$114.6 M

Figure 19-8: Dimensions and requirements for options (extracted from paper)

Table 7 PPK sizing of irrigation scheme infrastructure

Description	Updated Irrigation Area including Biggenden			Updated Irrigation Area excluding Biggenden			CLBWDG Identified Irrigation Area including Biggenden			CLBWDG Identified Irrigation Area excluding Biggenden		
Design Criteria												
Irrigation Area	9,730 ha			8,200 ha			8,686 ha			8,200 ha		
Water Allocation	52,100 ML/a			42,690 ML/a			52,100 ML/a			49,200 ML/a		
Pump Stations	**Flowrate (L/s)**	**Head (m TDH)**	**Power (kW)**	**Flowrate (L/s)**	**Head (m TDH)**	**Power (kW)**	**Flowrate (L/s)**	**Head (m TDH)**	**Power (kW)**	**Flowrate (L/s)**	**Head (m TDH)**	**Power (kW)**
P1 (120 m AHD)	6,340	24	1,884	5,835	24	1,721	7,291	25	2,200	6,021	24	1,781
P2 (140 m AHD)	6,340	71	5,484	5,835	69	4,909	7,291	75	6,666	6,021	96	5,116
P3 (200 m (AHD)	4,464	86	4,681	3,268	89	3,568	5,129	87	5,481	3,373	90	3,705
P4 (265 m AHD)	1,142	75	1,049	1,562	75	1,435	703	75	646	896	75	823
Reservoirs												
R1 (200 m AHD)	162 ML			222 ML			187 ML			229 ML		
R2 (280 m AHD)	108 ML			147 ML			203 ML			214 ML		
R3 (340 m AHD)	99 ML			135 ML			61 ML			77 ML		
Pipelines												
Rising Mains	24.1 km total length Sized from DN750 to DN1800 3-km tunnel to Biggenden Outfall			20.5 km total length Sized from DN825 to DN1750			24.1 km total length Sized from DN675 to DN1800 3-km tunnel to Biggenden Outfall			20.5 km total length Sized from DN675 to DN1750		
Laterals	65.3 km of total length Sized from DN100 to DN750			65.3 km of total length Sized from DN100 to DN750			52.4 km of total length Sized from DN100 to DN750			52.4 km of total length Sized from DN100 to DN825		

A.12 28. Barambah Creek Proposal (Coalstoun Lakes Development Group Inc)

A.12.1 Summary

Informal proposal for the development of a dam and distribution system for Barambah Creek and Coalstoun Lakes. The proponent is confident in high and reliable take up of water allocations.

A.12.2 Key Proposal Features

- 3,500ha of new irrigation land
- 24,000ML (21,000 for Coalstoun Lakes; 3,000ML for downstream users)

- 100,000ML dam at Barambah Creek ($98m)
- Distribution system for Coalstoun Lakes ($38.86m)
- Coalstoun Lakes to purchase allocation for $1,400/ML (a $29m proponent contribution)

A.12.3 Benefits

- Expected 75% immediate take up by existing farming community. Expected 90% take up in 5 years.
- Fertile and highly productive soils, and with a reliable water source could convert the area into an extremely productive cropping district with minimal environmental impact.
- Proposal estimates that with the irrigation scheme production will increase from $4m to $55m.

A.12.4 Supporting Information

- Elevation issues with the project mean that there will be high pumping costs.
- This proposal relies on the GHD Review (see Document #27).

A.13 30. Agricultural Land Resource Assessment of Coalstoun Lakes (DNRME)

A.13.1 Summary

This assessment was required to assess the potential for irrigation development to ensure sustainable agricultural development. The assessment identified significant areas suitable for expanded agricultural production. Broadacre cropping is the dominant agricultural production in Coalstoun Lakes.

A.13.2 Key Features

- 15 different soils have been identified and their distribution mapped. The dominant soils are black and grey cracking clays (Vertosols) and non-cracking red clay soils (Ferrosols), red and brown structured gradational soils (Dermosols) and sodic texture contrast soils (Sodosols).
- Over 50% of the area mapped (3995 ha) are Ferrosols developed on basalt. These soils are suited to a wide range of agricultural and horticultural crops. In the remaining area, 25% of the area are soils developed on alluvium and colluvium (1996 ha), soils formed on Biggenden Beds (775 ha) or on a range of geologies with slopes greater than 8%
- A total of 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navy bean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,288 ha for stonefruit, 4,781 ha for peanuts, 4,595 ha for maize and 6,591 ha for pasture.
- The possibility of future salinisation in some areas will affect future irrigation management within the Coalstoun Lakes area.
- Future irrigation systems will need to be designed so as the amount of water being applied does not exceed crop uptake needs, and monitoring be undertaken to ensure irrigation management is sustainable.
- The average annual rainfall for the area is 772.9 mm. Approximately 70% of the total rainfall occurs in the summer months of October to March.

A.14 31. Gaydah Regional Irrigation Development (GRID) Project – Detailed Business Case (Isis Central Sugar Mill Co Ltd with support from NWIDF)

A.14.1 Summary

Infrastructure works and water transfer from upstream on the Burnett River to make 24,000ML (approx.) available for the development of 5,000ha for sugarcane production and 1,200 for irrigated rotation cropping in the area north of Gayndah.

A.14.2 Key Proposal Features

- Transfer downstream of unused water allocations from further upstream on the Burnett River (10,469ML from upstream relating to reinstating the medium priority water allocations associated with the decommissioned fabri-dam at Claude Wharton Weir).
- Accessing the existing Strategic Water Infrastructure Reserve assigned to the Upper Burnett system as a new water harvesting product
- Reinstating the previous 1.5 m raising of the Claude Wharton Weir full supply level by installing crest gates
- Installation of a major pump station adjacent to the Burnett River at AMTD 184 km (approx.) and pumped main delivering water to a 10,000 ML (approx.) off-stream storage
- Installation of approximately 42 km of pipeline and associated infrastructure to supply water to irrigated cropping in the form of a water distribution network that will supply multiple farm off-takes across the network.
- Network consists of: Wetheron (irrigated area east of Burnett River); Reid's Creek East (between Reid's Creek and Burnett River); Reid's Creek West (west of Reid's Creek)
- Making available approximately 24,000 ML for irrigated crop production
- Development of over 5,000 ha of annual irrigated sugarcane production
- Development of over 1,200 ha of irrigated rotation cropping (including 50% fallow)

A.14.3 Benefits

- Generate over 100 direct full time equivalent (FTE) jobs plus indirect employment
- Production of an additional 70,000 tonnes (approximately) of sugar annually for export through the Port of Bundaberg
- Potential generation of over 17,000 MWh of renewable energy per year from the existing co-generation facility

A.14.4 Supporting Information

- Overall capital cost of $281m (including rail and land cost). Project requires non-recoverable government funding of $170m (approx.)
- Project relies on the re-establishment of the old Gayndah rail corridor to provide the efficient transport of sugarcane to the mill, which is being independently progressed by ICSM (though costings included in proposal overall cost).

A.15 34. Sunwater Letter, 23 March 2017 (Boyne River)

A.15.1 Summary

Summary of the position of Sunwater in relation to two infrastructure projects for the Boyne catchment: Boondooma Dam Raising; and Construction of Cooranga Weir. Sunwater are critical of the financial and regulatory feasibility of the Boondooma Dam Raising option. Sunwater are also critical of the Construction of Cooranga Weir option based on value and the time periods require to obtain necessary approvals.

A.15.2 Key Proposal Features

- Boondooma Dam Raising – raising wall by 12 metres using fixed crest structure without gates to increase capacity by 396,000 megalitres.
- Construction of Cooranga Weir – between 2,200 and 5,350 ML depending on the site selected.

A.15.3 Benefits

- Boondooma Dam Raising – Data is not presently available to determine the additional water allocation volume that would result from the raising. Anticipated that the benefits would be increased reliability and allocations.
- Construction of Cooranga Weir – increased reliability.

A.15.4 Supporting Information

Boondooma Dam Raising – A full EIS would likely be required, in addition various state-level regulatory reviews and approvals taking a minimum of 6 years, with 10+ years of environmental monitoring required post construction. Estimated cost of $110m, including approvals.

Construction of Cooranga Weir – two locations have been considered previously; the location at 34.45km ATMD was found to be structurally unsuitable; require a full EIS, $25m required, including approvals; if used to increase water security then it would result in $200/ML cost increase; development timeframe of 4-5 years.

Significant changes would be required to the Burnett Basin Water Plan to support the creation of unallocated water provisions for either project.

A.16 35. Sunwater Letter to Boyne River Irrigator Advisory Committee, 5 June 2017

A.16.1 Summary

Confirmed that Cooranga Weir is unattractive due to geotechnical and environmental issues. Sunwater set out a proposal for preliminary IQQM hydraulic modelling for Boondooma Dam raising. Sunwater then addressed some additional issues raised by the BRIAC.

A.16.2 Key Features

- Sunwater confirms that it is not responsible for micro-weirs and suggests that irrigators connect with DNRM.
- Sunwater stated that they have no knowledge of any plan for TPS to reduce its power usage.
- Sunwater suggested some approaches for maximising the efficiency and effectiveness of pumping and water use in Boyne River scheme.

A.17 37. DNRME – Sunwater – Boyne Irrigator Meeting – 16 August 2018, Part 1

A.17.1 Summary

The presentation argues that there is not currently sufficient justification to source TPS' substantive water requirements from Wivenhoe Dam, and that the impacts would outweigh the demand for MP water for irrigators.

A.17.2 Key Features

- Survey respondents indicated alternative supply and others with contingency plans.
- If accessing Boondooma Dam water the shortfalls would be 760ML 1 Sep – 31 Dec and 1,020 1 Jan – 30 Jun.
- Details on historical background of the dam funding and apportionment of capital cost and charges.
- Detailed account of the history of the cut-off rule including the communications between the Boyne River Advisory Board and the Minister and confirmation that the 70,000ML MP (irrigators) cut off rule remains despite multiple regulatory changes since 1987. Sunwater manages the delivery of HP (power station and town water supply) and MP.

- Practical measure put in place to facilitate better release decision making and efficient delivery of water to irrigators.
- The water usage at Tarong Power Station (TPS) can equate to 50ML/day subject to conditions, although improving efficiency of cooling towers would be a major infrastructure investment.
- TPS water strategy has included water efficiency measures and alternative sources, including supplementing water allocation from Boondooma Dam with water from Wivenhoe to delay cut offs (this cost $6m in FY18); and regularly operating the Wivenhoe Pipeline to target off peak electricity tariffs.
- There are limitations on water strategy at TPS (Wivenhoe Pipeline capacity is not sufficient to source daily requirement; salinity considerations (impacting releases); water is Stanwell's second largest generation cost.
- Concerns regarding increased access to Wivenhoe Dam for TPS (survey suggests significant additional volumes are not currently required; SEQ grid could be impacted; current and prospective agricultural, urban and industrial (including Stanwell) customers could be impacted).

A.18 38. DNRME – Sunwater – Boyne Irrigator Meeting – 16 August 2018, Part 2

A.18.1 Summary

Reported that there are substantive benefits to the Cooranga Weir scenario, although the impact on p/ML cost would exceed the market willingness to pay.

A.18.2 Key Features

- Most irrigators are concerned about reliability and are interested in Cooranga Weir.
- Willingness to pay more for reliability varied among survey participants ($28-$100).
- Comparison between arrangements under current rules and the Cooranga Weir scenario (5,266ML weir; not limited by 70,000 MP cut-off; Boondooma Dam supplies Weir when water level is low).
- Benefits on Cooranga Weir scenario (reduced reliance on Boondooma Dam for MP demand; increased monthly performance of HP (+3%) and MP (+11%); decreased performance of water harvesters; decreased flows to Upper Burnett; decreased MP performance in Upper Burnett).
- Importantly, under the scenarios considered there are still significant periods where volume in Boondooma Dam is below 70,000ML and Cooranga Weir is empty.
- Cost is estimated at $25m and as the weir will provide reliability benefit to users, the cost would be added to price at an increase of approx. $200ML/a, which exceeds willingness from survey respondents.

A.19 42. Irrigation from the Boyne River (RECE & BIEDO 2019)

A.19.1 Summary

The study assesses the broad social and economic benefits of increased water availability in BRIA in the context of the proposed Cooranga Weir. The study determined that increasing irrigation water reliability from the current 73% to a future 88% would have a major economic impact on BRIA and the whole North Burnett Regional Council area.

A.19.2 Key Features

- BRIA includes 30 irrigators growing a diverse range of crops. BRIA is reliant on water stored in Boondooma Dam, which provides an allocation of 29,270ML of high priority water to TPS and 9,142ML of medium priority to irrigators.
- Water reliability is a continual issue on the basis that the allocated water is insufficient to meet demand and in dry years there is minimal available water for irrigation. On average water availability meets 73% of allocations.
- BRIA has a large area of suitable soils where irrigation could expand with increased was.

- Poor water reliability has a major impact on production, on-farm decision making, cash-flow and debt management, and on the long-term future of growers.
- Improved water reliability would have positive impacts: improved efficiency; production improvements and increases to the production area; value to the regional economy.
- Increasing irrigation water reliability from the current 73% to a future 88% would have a major economic impact on BRIA and the whole North Burnett Regional Council area. The increased agricultural multiplier is 2.32.

A.20 46. Network Service Plan – Barker Barambah Bulk Water Service Contract

A.20.1 Summary

The primary infrastructure in this NSP region is Bjelke- Petersen Dam. The significant works for the five-year forward period is focused on Silverleaf Weir and assessments and works on Bjelke- Petersen Dam.

A.20.2 Key Features

- Water entitlement and actual usage is summarised for user types, with the biggest entitlement and usage in the region being irrigators (MP) and urban (HP).
- The NSP provides a detailed breakdown of the revenue, costs and expenditure for bulk management in region.
- Expenditure on Operations for the region is 54.32% above QCA’s recommended expenditure for the period.
- Expenditure on Preventative Maintenance is 21.04% above QCA’s recommended expenditure for the period.
- Expenditure on Corrective Maintenance is 28.74% above QCA’s recommended expenditure for the period.
- Non-routine expenditure (not covered by the annuity) for the period 2017-18 to 2023-24 is summarised, with the highest forecast expenditure on refurbishment of Silverleaf Weir and assessments and works on Bjelke-Petersen Dam.

A.21 47. Network Service Plan - Boyne River Tarong Bulk Water Service Contract

A.21.1 Summary

The primary infrastructure in this NSP region is Boondooma Dam. The significant works for the five-year forward period is focused on assessments and works on Boondooma Dam.

A.21.2 Key Features

- Water entitlement and actual usage is summarised for user types, with the biggest entitlement and usage in the region being industrial customers (HP) and irrigators (MP).
- The NSP provides a detailed breakdown of the revenue, costs and expenditure for bulk management in region.
- Expenditure on Operations for the region is 159.25% above QCA’s recommended expenditure for the period.
- Expenditure on Preventative Maintenance is 21.11% below QCA’s recommended expenditure for the period.
- Expenditure on Corrective Maintenance is 47.46% below QCA’s recommended expenditure for the period.
- Non-routine expenditure (not covered by the annuity) for the period 2017-18 to 2023-24 is summarised, with the highest forecast expenditure on assessments and works on Boondooma Dam.

A.22 48. Network Service Plan – Three Moon Creek Bulk Water Service Contract

A.22.1 Summary

The primary infrastructure in this NSP region is Cania Dam. The significant works for the five-year forward period are focused on assessments on Cania Dam and works on various weirs.

A.22.2 Key Features

- Water entitlement and actual usage is summarised for user types, with the biggest entitlement and usage in the region being irrigators (MP) and urban (HP).
- The NSP provides a detailed breakdown of the revenue, costs and expenditure for bulk management in region.
- Expenditure on Operations for the region is 88.44% above QCA's recommended expenditure for the period.
- Expenditure on Preventative Maintenance is in line with QCA's recommended expenditure for the period.
- Expenditure on Corrective Maintenance is 272.94% below QCA's recommended expenditure for the period.
- Non-routine expenditure (not covered by the annuity) for the period 2017-18 to 2023-24 is summarised, with the highest forecast expenditure on assessments on Cania Dam and works on various weirs.

A.23 49-56. Water for Economic Development DSDMIP (Water Trading)

A.23.1 Summary

While there is a relatively consistent number of water transfers and total water volume transferred (with the notable exception of 2012/13) in North and South Burnett, the actual volume transferred is low compared to the Bundaberg Water Supply Scheme or other water plan areas.

Figure 19-9: Data set and visualisations (constructed from data in Documents #49-56)

Year	Transfers	Total Volume (ML)		
2011/12	22	1,891		
2012/13	10	29,838		
2013/14	21	2,711		
2014/15	38	1,990		
2015/16	38	1,786		
2016/17	19	2,670		
2017/18	29	1,737		
2018/19	23	1,293		2,941

A.24 57. Sustainable Water Alternatives for the Southern Burnett

A.24.1 Summary

Review of the relevant reports and studies on the water alternatives in the Kingaroy, Nanango, Rosalie and Crows Nest LGAs, and recommendations for implementing water strategies.

A.24.2 Key Features

- The paper considers and analyses 18 proposals/strategies for the management of water resources in Southern Burnett, including the formation of a specific group with the power to purchase and distribute water allocations; new approaches to water trading; the conversion between high and medium water allocations; and the construction of new infrastructure.

- The proposals/strategies are ranked using multiple methodology, including estimated cost, a weighted scoring system that considers multiple factors, and local knowledge and expertise. The options are outlined in the Figure 18.10 and key information is provided in relation to available water volumes, reliability, location, costs and beneficiaries.
- The paper provides a detailed description of how to proceed with the ongoing review and assessment of the selected option(s), and the management of, and advocacy for, water interests in the region.

Figure 19-10: Alternative Options in Southern Burnett

TABLE A.1 Alternatives

Ref. Number	Improvement Opportunity	Volume Available (ML/yr)	Reliability	Source	Potential offtake location	Time to Implement	Estimated Capital Cost per ML	Estimated Operational Cost per ML	Potential Benefactors	Comments	Actions
3.1.A(i)	Unassigned supplemented water Silverleaf weir	700	85-90%	Silverleaf Weir on Barambah Creek	From backup of Bjelke Peterson Dam to Stonelands	6-12 months	$1,000	$50	Kingaroy, Nanango Murgon Shires	**Costs for water purchase and supply to pump offtakes only**	Negotiate with Sunwater.
3.1.A(ii)	Unassigned supplemented water Tarong Pipeline	91	> 95%	Tarong Pipeline	Tarong Pipeline	6-12 months	> $1,000	> $100	Kingaroy Shire	**Costs for water purchase and supply to pump offtakes only**	Negotiate with Sunwater.
3.1.A(iii)	Unassigned supplemented water Barlil weir	4250	85-90%	Barlil Weir on Barambah Creek	From backup of Bjelke Peterson Dam to Stonelands	2 years	> $1000	$50	Kingaroy, Nanango Murgon Shires	**Costs for water purchase and supply to pump offtakes only**	Lobby Government for allocation to be set aside for Local Government
3.1.A(iv)	Unassigned supplemented water Paradise Dam									Not considered	
3.1.A(v)	Unassigned supplemented water Wivenhoe pipeline	2500	> 95%	Wivenhoe pipeline	Wivenhoe pipeline	2 years	> $1000	> $300	Kingaroy, Nanango Murgon, Rosalie, Shires and Tarong Energy	**Costs for water purchase and supply to pump offtakes only**	Negotiations necessary with Brisbane Water and Tarong Energy
3.1.B(i)	Supplemented water allocations, Owned by Irrigators	30000	85-90%	Barker Barambah Water Supply Scheme	From backup of Bjelke Peterson Dam to Stonelands	6-12 months	$500-$1000	$50	Kingaroy, Nanango and Murgon Shires and Tarong Energy	**Costs for water purchase and supply to pump offtakes only**	Allocate funds to purchase water title. Establish suitable agreements for leasing water to third parties
3.1.B(ii)	Supplemented water allocations Owned by Shires	1800								Unlikely that Shires would sell water. Not considered further	
3.1.C	Unsupplemented Water	34200	70-90%	Barker Barambah Stuart and Boyne Rivers	Barker Barambah Stuart and Boyne Rivers	6-12 months	$100		All group users, depending upon location	This is a combination of unsupplemented water and water harvesting. **Costs for water purchase and supply to pump offtakes only**	Investigation into individual or joint facilities for extraction points. Allocate funds to purchase water title

Ref. Number	Improvement Opportunity	Volume Available (ML/yr)	Reliability	Source	Potential offtake location	Time to Implement	Estimated Capital Cost per ML	Estimated Operational Cost per ML	Potential Benefactors	Comments	Actions
3.2.A	Groundwater Subartesian water	For protection of current extraction		Groundwater Alluvials		6-12 months			Shires using groundwater extraction	Primarily for protection of current users	ROP submission to request groundwater inclusion in the WRP/ROPs
3.2.B	Groundwater Artesian water	Unknown				2-5 years					Commission research of mineral logs to determine potential.
3.3.A	Wastewater/Effluent Reuse Councils	500	>95%	Various point sources		6 months	< $500	< $50	Kingaroy, Nanango Murgon Shires		Design contracts for end users of this resource with 3-5 year renewal period
3.3.B	Wastewater/Effluent Reuse Tarong	Variable		Tarong PowerStation	Tarong outlet to Bjelke Petersen Dam	2 years			Kingaroy, Nanango Murgon, Shires and Tarong Energy	Currently used by irrigators D/S from Tarong	Design contracts for end users of this resource with 3-5 year renewal period
3.3.C	Wastewater/Effluent Reuse External Sources	50000	>95%	Sunshine Coast	To be constructed pipeline	10 years	>$4000	$200	All group users, depending upon location		Ensure the proposal is on the agenda of the SEQRWSS

Ref. Number	Improvement Opportunity	Volume Available (ML/yr)	Reliability	Source	Potential offtake location	Time to Implement	Estimated Capital Cost per ML	Estimated Operational Cost per ML	Potential Benefactors	Comments	Actions
3.4	Desalination	Unknown				5 years	>$5000	>$250	All group users, depending upon location	Technology improving and costs decreasing. Identification of a feedstock is essential.	Ensure the proposal is on the agenda of the SEQRWSS
3.5	Redundant weirs	To be negotiated	70-90%	Proston and Nanango weirs		1-2 years			Kingaroy and Nanango Shires, Tarong Energy	Could be used to store purchased or granted water allocations	Design yields require investigation. Discuss options with DNRM&E
3.6.A	New Water Infrastructure Brisbane Valley infrastructure	30000	85-95%	Emu or Cooyar Creeks	Duplicated Wivenhoe pipeline	10 years	$2000-$3000	>$300	All group users, depending upon location	Dependant upon WRPs and demand	Ensure the proposal is on the agenda of the SEQRWSS
3.6.B	New Water Infrastructure Barker/Barambah/Stuart infrastructure	1500	>95%	Gordonbrook Dam	Gordonbrook Dam	5 years	$5,500		Kingaroy Shire	Necessary to purchase the allocation to obtain the water for the dam	Factor into cost comparisons the fact that the distribution system is in place
3.6.C	New Water Infrastructure Wivenhoe pipeline upgrades	15000	>90%	Wivenhoe	Duplicated Wivenhoe pipeline	2-5years	>$3000	>$300	All group users, depending upon location	Requires allocation thru the Moreton WRP	Ensure the proposal is on the agenda of the SEQRWSS

A.25 58. Kingaroy Water Supply: Augmentation of Raw Water Supply

A.25.1 Summary

The report was commissioned to investigate new water sources for Kingaroy and expanded treatment plant capacity. The report identified and analysed multiple options and recommended further action.

A.25.2 Key Features

- The report considered five primary options for the augmentation of the Kingaroy water source: raise Gordonbrook Dam; connect the Boondooma-Tarong Pipeline; bore water supplies; construct a new dam; and construct a pipeline from the Bjelke-Peterson Dam.

- Each of the options is analysed and assessed as a mechanism for providing greater water volume and reliability for Kingaroy. The report concludes that the raising of Gordonbrook Dam by 4.1m would be the most economical way to provide additional raw water, although other investigations should be conducted.
- The Report recommends that further investigations be conducted into bore water supplies at specific locations, although it is noted that bore water supply alone is unlikely to satisfy the forward demand projections.
- The Report recommends further investigation and comparison of the options outlined in the report, and community consultation to identify the quality of water desired with consideration to softening of the Gordonbrook Dam supply.

A.26 59. Kingaroy Water Supply Planning Report – Development of Borefield

A.26.1 Summary

Investigation of the development of a borefield south of Kingaroy to supplement existing supply from Gordonbrook Dam and delay the second raising of Gordonbrook Dam.

A.26.2 Key Features

- This Report was commissioned by KSC following the preparation of Kingaroy Water Supply: Augmentation of Raw Water Supply (see Document #58) to investigate to recommended borefield options.
- The report concluded that the substantial cost of the development of the borefield ($2.5m in 1995) would be justified by the 11-year deferment of the raising of Gordonbrook Dam.
- The report recommended that experienced consultants assess and identify the viability of suitable bores in the area.

A.27 60. Nanango Water Supply: Augmentation of Barker Creek Groundwater Supply

A.27.1 Summary

Report on the program of bore hole investigations to identify viable options for additional supply of bore water in the Nanango Shire Council area.

A.27.2 Key Features

- Assessment of the performance and viability of twelve bore holes drilled into the Barker Creek alluvium.
- None of the twelve bore holes indicated viability of potential supply equivalent to the yield from the existing bore holes drilled in 1982.
- Production hole 13 was drilled and provides a viable option for bore water supply, subject to treatment in a manganese greensand filer.
- Report recommends upgrading the existing bore holes and the most effective and economically viable option.

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Water supply requirements in the North and South Burnett

Appendix B

Options Analysis

Appendix B. High level assessment

Option Number	Name	Location	Feasibility measure: Strategic	Feasibility measure: Regulatory	Feasibility measure: Public Interest	Feasibility measure: Risk
North Burnett						
1	Construct a re-regulating weir on the Boyne River	Boyne River (34.45; 33.8; 33.65 AMTD)	High	High	High	Medium
2A	Raise Jones Weir	Jones Weir, Burnett River (240 AMTD), near Mundubbera	Medium	High	Medium	Medium
2B	Raise Jones Weir and build a pipeline to area of urban or irrigation demand	Jones Weir, Burnett River (240 AMTD), near Mundubbera	Medium	High	Medium	Medium
3A	Raise Claude Wharton Weir	Clause Wharton Weir, Burnett River, near Gayndah	Medium	High	Medium	Medium
3B	Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	Clause Wharton Weir, Burnett River, near Gayndah	Medium	High	High	High
4A	Up to 65,000ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	Barambah Creek (32.0, 39.3, 41.6, 43.0 AMTD)	High	Medium	High	High
4B	Build a pipeline from Paradise Dam to Coalstoun Lakes	Paradise Dam to Coalstoun Lakes	High	Medium	High	Medium
4C	Up to 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	Barambah Creek (32.0, 39.3, 41.6, 43.0 AMTD)	Medium	Medium	Medium	Medium
4D	Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	Barambah Creek (39.3 AMTD)	Low	Medium	Medium	Medium
4E	Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	Barambah Creek (41.6 AMTD)	Low	Medium	Medium	Medium
4F	Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	Barambah Creek (43.0 AMTD)	Low	Medium	Medium	Medium
4G	Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	Paradise Dam to Boondooma Dam	Low	Medium	Medium	Low
4H	Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes	Paradise Dam to Tarong-Boondooma Pipeline	Low	Low	Medium	Low
4I	Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes	Multiple locations on the Burnett River	High	High	High	High

South Burnett						
5	Construct a re-regulating weir on the Barambah Creek (Barlil Weir)	Barambah Creek (135.2 AMTD), near Murgon	High	High	High	Medium
6	Flood harvesting from Barambah Creek into Bjelke-Petersen Dam	Bjelke-Petersen Dam on Barambah Creek	Low	Medium	Medium	Medium
7	Convert Gordonbrook Dam to irrigation use	Gordonbrook Dam	Low	Medium	Low	Low
8	Construct water recycling plant at Swickers facility in Kingaroy	Kingaroy	High	High	High	High
9	Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	Tarong Power Station	Medium	Medium	Medium	Low
9B	Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	Tarong Power Station	High	Medium	Medium	Low
10	Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	Tarong Power Station	Medium	Medium	Medium	Low
10B	Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	Tarong Power Station	High	Medium	Medium	Low
Both North and South Burnett						
11	Remove the 70,000 ML cut-off rule in Boondooma dam	Boondooma Dam	Low	Low	Low	Low
12	Raise Boondooma Dam	Boondooma Dam	Low	Medium	Low	Low
14	Optimise in-scheme unsupplemented access rules	-	High	High	Medium	High
15	Greater utilisation of the Wivenhoe pipeline (for Blackbutt irrigation)	Boyne River & Tarong Water Supply Scheme	Medium	Medium	Medium	Medium
16	Water harvesting	Multiple locations	High	High	Medium	High
17	Agricultural supply chain improvements	-	High	High	Medium	High

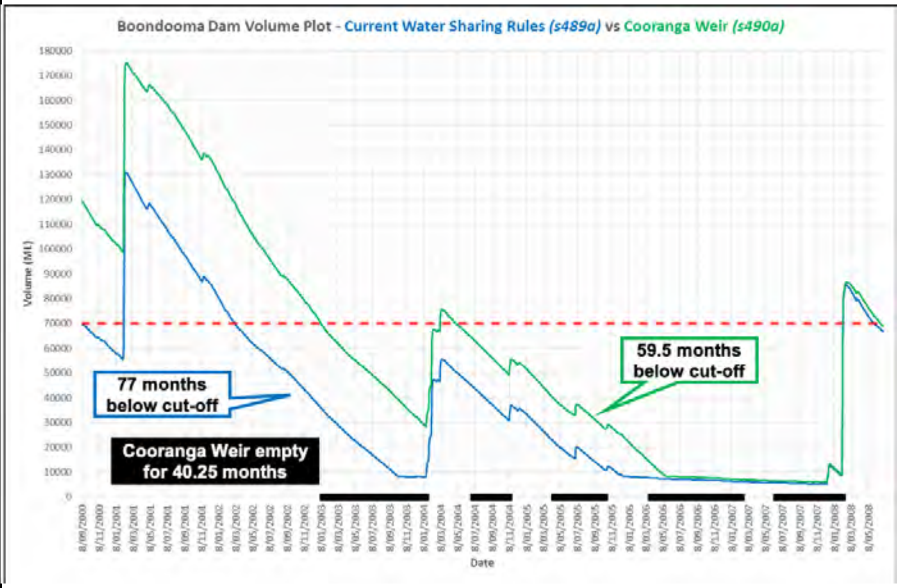
B.1 High-level overview: North Burnett

B.1.1 Option 1: Construct a re-regulating weir on the Boyne River

Option 1 – Construct a re-regulating weir on the Boyne River	
Background to this option	
Description	This option proposes building a re-regulating weir of approximately 5,266 ML capacity on the Boyne River downstream of Boondooma Dam. The purpose of this weir would be to increase the reliability of existing MP water allocations in the Boyne River Irrigation Area ("the BRIA"). Multiple possible locations have been suggested for the weir on the Boyne River. These include at 33.8, 33.95 and 34.45 AMTD. Geotechnical investigations were conducted at river location 34.45 AMTD and found that the bedrock was quite permeable and the left bank unsuitable. Insufficient geotechnical investigations have been conducted at the other possible locations to assess their viability at this stage. The BRIA irrigators hold a range of MP allocations under the Boyne River & Tarong Water Scheme and rely on water stored in Boondooma Dam for those allocations. Water availability in the Boyne River & Tarong Water Scheme has been assessed at 73%. Due to recent years of low water levels, large high priority water allocations and the medium priority cut-off, the water reliability for the BRIA irrigators has been low. The construction of a re-regulating weir downstream on Boyne River is intended to generate an 11% increase in monthly performance for medium priority allocations in the BRIA. Analysis conducted by Sunwater indicated that the construction of this weir could decrease reliance and stress on Boondooma Dam for MP allocations, reduce occurrence and duration MP allocation cut-offs from Boondooma Dam and result in increased Boondooma Dam spills. *Sources: Planning Report for Cooranga Weir, 1998; Irrigation from the Boyne River: The Value of Improved Water Security, 2019; State Water Projects Planning Report, 1998; Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017; DNRME Presentation on Boyne River, August 2018; Report on Preliminary Investigations of Irrigation Supply to Lower Auburn/Boyne Area, 1975; Initial Advice Statement Dunollie Weir Boyne River, 1996*
Costs of this option	The estimated cost of building the re-regulating weir would be \$25 million, including approximately \$5 million for environmental approvals. Further cost modelling will be required if this project progresses to a Detailed Business Case, including an assessment of the prospects of recovering the cost of the project from the beneficiaries through water sales. *Sources: Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017*
Hydrological benefits and how they will be realised	It takes 5 to 10 days for water released from Boondooma Dam to reach the BRIA irrigators, and the geographic conditions, including the porous sandy riverbed, result in a distribution loss of 18% of irrigation allocation. The construction of a re-regulating weir downstream of Boondooma Dam would reduce distribution loss by locating water storage closer to the BRIA irrigators and capturing additional inflows downstream of Boondooma Dam. The effect would be to reduce the volume and frequency of releases to downstream irrigators from Boondooma Dam, reduce the time for releases to reach Boyne River irrigators to 2-3 days and increase the efficiency of the Boyne River & Tarong Water Scheme. Non-BRIA MP Allocation holders in the Boyne River & Tarong Water Scheme would benefit from reduce demand from BRIA irrigators for MP allocations from Boondooma Dam. DNRME modelling found that the monthly performance of high priority would increase by 3% and medium priority by 11%. This suggests that further optimisation of this option may enable a configuration that achieves a higher than 11% increase in MP reliability if the current HP reliability were to be maintained (rather than improved by 3%). This would require further modelling. Sunwater modelling found that the construction of the weir would significantly reduce the frequency and length of periods where Boondooma Dam is below the MP allocation cut-off. For example, Image 1 shows that in the period of 2000 to 2008, a weir on the Boyne River would lead to 17.5 fewer weeks below the cut-off.

Option 1 – Construct a re-regulating weir on the Boyne River

Image 1 - Impact of Boyne River Weir – 2000 to 2008



Sources: Irrigation from the Boyne River: The Value of Improved Water Security, 2019; State Water Projects Planning Report, 1998; Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017. Planning Report for Cooranga Weir, 1998; Irrigation from the Boyne River: The Value of Improved Water Security, 2019; DNRME Presentation on Boyne River, August 2018

Customer benefits and how they will be realised

The BRIA is located on the Boyne River downstream of Boondooma Dam in the Boyne River & Tarong Water Supply Scheme. The BRIA contains approximately 30 irrigators growing a diverse range of agricultural products, including high value horticultural field crops, for local and international markets. The construction of the re-regulating weir on the Boyne River will benefit the BRIA irrigators by improving the reliability of existing MP water allocations by 11%, and increasing water availability from 73% to 88%. These would be realised through the reduction of distribution losses, storing water supply closer to the BRIA irrigators and capturing flows downstream of Boondooma Dam in the new weir.

Sources: Irrigation from the Boyne River: The Value of Improved Water Security, 2019; State Water Projects Planning Report, 1998.

The problem(s) this option seeks to address

This option seeks to address the problem of large areas of fertile land that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a quantity of reliable water. The proposed weir would increase the reliability for a large area of agricultural land and reduce inefficiencies in the distribution of water to allocation holders in the BRIA.

Sources: Irrigation from the Boyne River: The Value of Improved Water Security, 2019; State Water Projects Planning Report, 1998; Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017.

Strategic Considerations

SIP Classification

While the construction of the weir is new, it would be built within an existing irrigation scheme and improve the efficiency of existing infrastructure. Classified as 'Improve existing' under the State Infrastructure Plan Hierarchy

Alignment with Government policy and objectives

This option is a relatively low-cost infrastructure option that would provide tangible benefits. This project is broadly suitable within the current fiscal environment. This option aligns generally with the policy and objectives of the Queensland Government in relation to the efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option is relatively low cost compared to alternative infrastructure proposals for the area.

Source: Queensland bulk water opportunities statement

Feasibility assessment

This option has been assessed as having a high feasibility against the strategic considerations.

Option 1 – Construct a re-regulating weir on the Boyne River	
against strategic considerations	
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option has limited legislative issues and is unlikely to require direct amendment to legislation, although there may be some necessary amendments to legislative instruments (Operations Manual and Water Management Protocol) in respect of any new water allocations. Subject to the final design and increased storage provided by the construction of the weir, this option will be consistent with the Burnett Water Plan, as amended as applicable to consider environmental flows and water allocation security objective outcomes.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders impacted by the construction of the weir: **a) Adjacent landholders** Adjacent landholders would likely experience an increase in land values and commercial activity in and around their land. Previous consideration of the construction of a weir on the Boyne River identified concerns from adjacent landholders, including: • Access to grazing and watering points for cattle • Freedom of movement of cattle across river • Realignment of fencing • Bogging of cattle • Silting of river • Positioning of motor and pump Further, some select landholders may experience adverse impacts from the construction and maintenance of the weir, such as easements and access through their property. Further consultation and engagement with adjacent landholders would be necessary in further investigations of this option. **b) Sunwater** Sunwater manage the Boyne River and Tarong Scheme and would be responsible for the coordination of any changes in water allocation and supply that may result from the construction of the weir. Sunwater have expressed reservations about the construction of the weir based on the cost, environmental and time considerations outlined in this review. Further consultation with Sunwater will be necessary if this option progresses further. **c) Boyne River Irrigators** The Boyne River Irrigators have expressed strong support for this option and have indicated a willingness to pay for additional reliability. However, further work is required to determine whether the cost of the project can be recovered from the irrigators through water sales and if non-recoverable public funding would be required
Environmental impact	The Boyne River ecological environment will inevitably be impacted by the construction of the re-regulating weir. At this stage there has not been a comprehensive assessment of the environmental impacts of a weir on the area and various species in and around the Boyne River. Despite this, Sunwater have identified that the Queensland lungfish is present in the Boyne River and is found at the base of Boondooma Dam. Sunwater suggests that the proposed site at river location 34.45 AMTD would be the upper limit of the lungfish distribution. A similar issue may exist in relation to the lungfish at other prospective sites. It is possible that the potential impact on the lungfish, or other potential environmental impact, may trigger the requirement for an environmental assessment under the Environmental Protection Act 1994 (Qld). The environmental assessment could potentially require the completion of an Environmental Impact Statement. The estimated timeframe for the completion of the environmental assessment, if one is required, is up to two years subject to the level of assessment required. *Sources: Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017; Environmental Protection Act 1994 (Qld).*

Option 1 – Construct a re-regulating weir on the Boyne River	
Timeframe considerations	The timeframe for the planning, approvals and construction of the weir has been estimated at 4 years (low), 4.5 years (medium) and 6 years (high). The anticipated requirement for comprehensive environmental approvals, including potentially a compliant Environmental Impact Statement, is a key factor in the timeframe for the completion of this option. The existing estimated timeframes would need to be reassessed following the completion of comprehensive geotechnical and hydrological assessment at the prospective weir sites. *Sources: Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017; Environmental Protection Act 1994 (Qld).*
Social and economic considerations	Modelling conducted on the economic impact of the construction of a re-regulating weir on the Boyne River found that the resulting increased water reliability would have a major regional economic benefit. The benefits to the irrigation industry would be increased investment, yield, quality and revenue. The benefits to sectors that service the irrigation industry would be increased revenue, stability and investment. According to preliminary modelling, the potential impact of the weir and increased water reliability on the whole North Burnett Region are: • Agricultural output – 2.32 multiplier. • Income – 0.54 multiplier. • Employment – 0.01 multiplier. The increase in water reliability has the potential to facilitate business investment and growth leading to more stable commercial conditions, although the modelling does not suggest a substantive increase in employment. There is an expectation that land values would increase around the Boyne River and across BRIA. Source: *Irrigation from the Boyne River: The Value of Improved Water Security, 2019*
Access to water	This option would not require any additional water from unallocated water reserves. This option would need to be assessed for compliance with the Water Plan's EFOs and WASOs. *Sources: Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Boyne River and Tarong Water Scheme Asset Management Plan 2019-2024; Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017*
Proximity to demand	The construction of the weir on the Boyne River would directly address the demand for increased water reliability by irrigators located in BRIA. The viability and value of this option is supported by the proximity of the proposed weir to productive irrigation lands. BRIA has a large area of suitable soils where irrigation could expand with increased access to water. The soils in the area are a mix of basalt, red soils, and river loams with areas of non-horticultural land located in between. Previous studies have identified that the Boyne River soil can support any tree crop. *Sources: Planning Report for Cooranga Weir, 1998; Irrigation from the Boyne River: The Value of Improved Water Security, 2019.*
Assessment against public interest consideration	This option has been assessed as having high feasibility against the public interest considerations.
Risk Considerations	
Risks	*Failure to recover costs* The beneficiaries of this option are unlikely to be willing to pay the full cost associated with the option as required by national and agreed policy settings, which may mean that a non-refundable grant would be needed to fund the construction cost. *Engineering risk in relation potential site* The existing studies have excluded the previously surveyed sites as unviable for the construction of the re-regulating weir. Until a suitable site is identified, surveyed and found to be viable the engineering risk will remain high, and the risk of increased construction costs is also high. *Aboriginal and Torres Strait Islander cultural heritage*

Option 1 – Construct a re-regulating weir on the Boyne River	
	Further investigations and consultations are required to identify the state of any cultural heritage matters relating to this option. *Reduction in water harvesting performance* Sunwater have expressed concerns regarding the construction of the weir including that it would result in decreased water harvesting performance and decreased flows in the Upper Burnett. *Sources: Letter from Sunwater Limited to Boyne River Advisory Committee, 23 March 2017; Environmental Protection Act 1994 (Qld).*
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.2 Option 2A: Raise Jones Weir

Option 2A: – Raise Jones Weir	
Background to this option	
Description	This option proposes raising Jones Weir by 1.4m in order to increase storage capacity and improve reliability for irrigators in the area and potentially for urban users. Jones Weir is located on the Burnett River at approximately 240km AMTD, immediately adjacent to the township of Mundubbera. The weir is one of the oldest concrete weirs commission in Queensland and was constructed in 1951. Jones Weir is a mass concrete structure on a rock formation, as shown in Image 1. **Image 1 – Jones Weir**  This project was designated as an Infrastructure Facility of Significance in 2002. This project was originally proposed in the 1990s and received Commonwealth Government approval in November 2001, including environmental approval from both Queensland and Commonwealth Governments. This proposal was previously under the direction of Burnett Water Pty

Option 2A: – Raise Jones Weir	
	Ltd, who have undertaken preliminary work including some designs, land acquisition and consultations in relation to cultural heritage impacts. *Sources: Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; State Development and Public Works Organisation Act 1971; Initial Advice Statement: Jones Weir Stage II, 1998*
Costs of this option	The capital cost of this option was estimated at $5.9 million in 2001.Updated costing prepared as part of the Paradise Dam Options Assessment indicate that the cost could be approximately $25 million. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1)*
Hydrological benefits and how they will be realised	This option would result in approximately 10,000 ML of additional medium priority water allocations.
Customer benefits and how they will be realised	Although the customers that might directly benefit from this option are irrigators in the Munduberra area the increase in system yield created by this option means that additional water allocations may be available elsewhere within the Upper Burnett Water Supply Scheme. The benefit for these customers would most likely be in the form of additional medium priority water allocations although some improvement in reliability might also be possible. *Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998*
The problem(s) this option seeks to address	This option seeks to address the problem of the agricultural sector needs a more reliable water source in order to grow. This option will address this problem by providing reliable water directly to irrigators in the Upper Burnett Water Supply Scheme (such as the Munduberra area) for expanded agricultural production. The low reliability experienced by those irrigators has limited growth, investment and undermined stability in the local agricultural industry. *Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998; North Burnett farmers push Queensland government to solve looming water crisis, 2018*
Strategic Considerations	
SIP Classification	Classified as 'Improve Existing' under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option is a relatively low-cost option that would improve existing infrastructure is a cost-effective manner that is well positioned within the current fiscal environment. This option aligns generally with the policy and objectives of the Queensland Government in relation to: (a) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. While some expenditure would be required for this weir raising, it is relatively low compared to alternative infrastructure proposals for the area. (b) Supporting infrastructure development that provides a commercial return to bulk water providers provided commitments can be obtained from users. This option has previously received support and approval from State and Commonwealth Governments, and it has been assessed as being cost effective as part of the Build Queensland review of future options for Paradise Dam. *Sources: Paradise Dam Improvement Project: service needs, demand estimates and options assessment (NC Economics), 2020; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998*
Feasibility assessment against	This option has been assessed as having medium feasibility against the strategic considerations.

Option 2A: – Raise Jones Weir	
strategic considerations	
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option has limited legislative issues and is unlikely to require direct amendment to legislation, although there may be some necessary amendments to legislative instruments (water management protocol and operations manual) in respect of water sharing and trading rules for the new water allocations for example. Subject to the final design and increased storage provided by the raising of Jones Weir, this project will be consistent with the Burnett Water Plan, as amended as applicable to consider environmental flows and water allocation security objective outcomes. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders that will be impacted by this option are: **(a) Sunwater** Sunwater are likely to be responsible for the management of the new water allocations and the sale of water under this option. Further consultation with Sunwater will be required, although Sunwater have detailed knowledge of previous assessments of this option. **(b) Irrigators in the Upper Burnett Water Supply Scheme** The irrigators in the Upper Burnett Water Supply including around Munduberra will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides increased water reliability the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megalitre costs will be necessary. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*
Environmental impact	This raising of Jones Weir has been subject to environmental review and has been approved by the Commonwealth Government, subject to the satisfaction of conditions designed to mitigate any likely determine impacts of the expanded infrastructure. The Department of Natural Resources commissioned a Review of Environmental Factors in 1998. This review identified the environmental impacts of this option and proposed mitigation actions for the planning and construction. An Environmental Management Plan was prepared for this option, which covered predevelopment, construction and operational phases. The Queensland Government provided certification that the proposal had been assessed to the greatest extent possible. Commonwealth Government approval under the EPBC Act was granted in 2001. . *Sources: Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*
Timeframe considerations	In the previous assessments conducted on the raising of Jones Weir in 2001 it was estimated that construction would take 6 to 8 months. These estimates will need to be updated and revised to consider alternative construction methods now available. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*

Option 2A: – Raise Jones Weir	
Social and economic considerations	Increased water reliability for irrigators would potentially provide a significant boost for the local agricultural industry. The increased reliability would potentially facilitate increased investment, greater crop diversity and increases in land and business values. The agricultural community in Munduberra has experienced significant impacts of cyclones and droughts, and has contracted as a result. The Jones Weir raising was designated as an infrastructure facility having significance, particularly economically or socially, by the Commonwealth Government in 2001. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*
Access to water	This option would require water to be allocated from the unallocated water reserve in the Upper Burnett.
Proximity to demand	While this option would potentially the availability of water for medium priority holders in the Munduberra area, this has not been identified as an area of highest demand during regional consultations. The demand, and willingness to pay for increased supply and reliability, was more pronounced in other parts of North Burnett, particularly in Coalstoun Lakes. In media interviews in 2018 one local irrigator indicated that water offered by the Government at $300 ML was too expensive (the normal price was $28 ML). Further demand assessment would need to be required to determine if cost recovery would be possible for this option. The irrigators in the Munduberra area presently grow a diverse range of crops, including mangoes, avocadoes, mandarins and cattle to grapes, pecans and blueberries. The Gayndah- Munduberra area is a high production area for citrus production. It has been estimated that there are 3,550 hectares of suitable, and 6,930 of marginally suitable, soils for citrus production within 5km of the Burnett River between Gayndah and Munduberra. *Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998; North Burnett farmers push Queensland government to solve looming water crisis, 2018; Soils of the Riparian Lands of the Burnett River between Mundubbera and Gayndah, Queensland: Suitability for Irrigated Agriculture, 1996.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Insufficient demand for any increased water supply* There is a risk that any additional water available from the expanded weir will not be purchased and that there will not be sufficient demand in the area. This could impact on the prospects of the dam being able to recover the costs from water users. *More expensive than alternative options* While the weir raising may be a relatively low cost compared to some larger infrastructure options, the cost of this infrastructure project is potentially greater than the alternative of increasing reliability for medium priority allocations from Boondooma Dam. *Environmental and cultural heritage* While approvals and investigations have been obtained in relation to both of these risks, that was 20 years ago and it will be necessary to update these investigations and determine if there are any risks that may impact the viability and success of this option. *Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998; North Burnett farmers push Queensland government to solve looming water crisis, 2018; Soils of the Riparian Lands of the Burnett River between Mundubbera and Gayndah, Queensland: Suitability for Irrigated Agriculture, 1996.*

Option 2A: – Raise Jones Weir	
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis.

B.1.3 Option 2B: Raise Jones Weir and build a pipeline to area of urban or irrigation demand

Option 2B: Raise Jones Weir and build a pipeline to area of urban or irrigation demand	
Background to this option	
Description	This option proposes raising Jones Weir by 1.4m and then transporting the water through a pipeline to an area where soil suitability is high. A pipeline reduces transmission losses and allows water to be delivered to suitable areas that are not adjacent to a river. Jones Weir is located on the Burnett River at approximately 240km ATMD, immediately adjacent to the township of Mundubbera. The weir is one of the oldest concrete weirs commission in Queensland and was constructed in 1951. The purpose of the project is to supply new water to an area with highly fertile soil. Jones Weir is a mass concrete structure on a rock formation, as sown in Image 1. **Image 1 – Jones Weir**  The raising of Jones Weir (although not the pipeline) was designated as an Infrastructure Facility of Significance in 2002. This project was originally proposed in the 1990s and received Commonwealth Government approval in November 2001, including environmental approval from both Queensland and Commonwealth Governments. This proposal was previously under the direction of Burnett Water Pty Ltd, who have undertaken preliminary work including some designs, land acquisition and consultations in relation to cultural heritage impacts. *Sources: Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; State Development and Public Works Organisation Act 1971; Initial Advice Statement: Jones Weir Stage II, 1998*
Costs of this option	The capital cost of raising the weir was estimated at $5.9 million in 2001. Updated costing prepared as part of the Paradise Dam Options Assessment indicate that the cost could be approximately $25 million. There is

	no current cost estimate in relation to irrigation pipelines from the weir to customers. New and updated costing would be required to determine a current and comprehensive cost estimate for this project. *Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1)*
Hydrological benefits and how they will be realised	This option would result in approximately 10,000 ML of additional medium priority water allocations.
Customer benefits and how they will be realised	The customers that would benefit from this option are irrigators in an area with highly fertile soils that could receive additional water through a new pipeline. The use of a pipeline for transmission would increase the efficiency of the water transfers by reducing the transmission losses from river distribution. Areas that could be considered to receive new water through a pipeline transmission include Gayndah and Coalstoun Lakes. Gayndah has good quality soils and demand for increased water supply. Coalstoun Lakes has highly fertile soils, including significant parcels of class 1 soil, and high demand from local irrigators for increased water supply. *Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998*
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a quantity of reliable water. If the Coalstoun Lakes area was to receive new water under this option, it has large parcels of high-quality soil, including significant parts with class 1 and 2 soil. *Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*
Strategic Considerations	
SIP Classification	Classified as 'Improve Existing' under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option is a lower cost option that would improve existing infrastructure in a cost-effective manner that is well positioned within the current fiscal environment. This option aligns generally with the policy and objectives of the Queensland Government in relation to supporting infrastructure development that provides a commercial return to bulk water providers provided commitments can be obtained from users. While transporting the water via a new pipeline to Coalstoun Lakes would require substantive upfront capital expenditure, it would increase the likelihood to recovering the costs due to the high demand for water in that area. The raising of the weir has previously received support and approval from State and Commonwealth Governments, and it has been assessed as being cost effective as part of the Building Queensland review of future options for Paradise Dam. *Sources: Paradise Dam Improvement Project: service needs, demand estimates and options assessment (NC Economics), 2020; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option has limited legislative issues and is unlikely to require direct amendment to legislation, although there may be some necessary amendments to legislative instruments in respect of any new water allocations. Subject to the final design and increased storage provided by the raising of Jones Weir, this project will be

	consistent with the Burnett Water Plan, as amended as applicable to consider environmental flows and water allocation security objective outcomes. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders that will be impacted by this option are: **(a) Sunwater** Sunwater are likely to responsible for the management of the new water allocations and the sale of water under this option. Further consultation with Sunwater will be required, although Sunwater have detailed knowledge of previous assessments of this option. **(b) Irrigators in Munduberra** The decision to direct water away from the Jones Weir via a pipeline instead of allocating it to irrigators downstream of the weir on the Burnett River, such as the irrigators in the Munduberra area, may raise objections. Further assessment should be undertaken to determine and confirm the most efficient and effective location for any new water. **(c) Irrigators in Coalstoun Lakes** The irrigators in and around Coalstoun Lakes will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megalitre costs will be necessary. The lower cost of this option would presumably result in a lower water cost for irrigators, although that will need to be formally reviewed. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*
Environmental impact	This raising of the weir has been subject to environmental review and has been approved by the Commonwealth Government, subject to the satisfaction of conditions designed to mitigate any likely determine impacts of the expanded infrastructure. The Department of Natural Resources commissioned a Review of Environmental Factors in 1998. This review identified the environmental impacts of this option and proposed mitigation actions for the planning and construction. An Environmental Management Plan was prepared for this option, which covered predevelopment, construction and operational phases. The Queensland Government provided certification that the proposal had been assessed to the greatest extent possible. Commonwealth Government approval under the EPBC Act was granted in 2001. Further and additional assessment will be required to determine the environmental impact of the pipeline, including any necessary updates to the existing assessment for the raising of Jones Weir *Sources: Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*
Timeframe considerations	In the previous assessments conducted on this option in 2001 it was estimated that construction would take 6 to 8 months. These estimates are likely to be very short of the actual timeframe and will need to be

	updated and revised to consider alternative construction methods now available. The pipeline would require additional time for planning, approvals, design and construction. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of similar options have been undertaken, although further assessment would be required in any detailed business case. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*
Access to water	This option would require water to be allocated from the unallocated water reserve in the Upper Burnett.
Proximity to demand	This option seeks to deliver new water sources directly to existing demand in the highly fertile agricultural lands around Coalstoun Lakes. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils. The soil in Coalstoun Lakes has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that Coalstoun Lakes, and the surrounding areas, has extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Insufficient demand for any increased water supply* There is a risk that any additional water available from the expanded weir will not be purchased at the price required to recover the costs of both the weir raising and new pipeline. *Environmental and cultural heritage* While approvals and investigations have been obtained in relation to environmental impact, that was 20 years ago and it will be necessary to undated these investigations and determine if there are any risks that may impact the viability and success of this option. *Cost effective* Using a pipeline to transfer this water to Coalstoun Lakes, or another highly fertile area, will be less cost effective than river transmission. The additional cost to pipe water to Coalstoun Lakes (compared to allowing river transmission to river adjacent lands) should be measured against the reduction in transmission loses and increased effectiveness of the water within the local economy in the Coalstoun Lakes location. *Legal*

	This option will involve legal risks associated with the transactions and impact of the infrastructure on adjacent land holders. These risks should be managed through careful consideration, and consultation with adjacent land holders, as part of the development of the Detailed Business Case. *Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998; North Burnett farmers push Queensland government to solve looming water crisis, 2018; Soils of the Riparian Lands of the Burnett River between Mundubbera and Gayndah, Queensland: Suitability for Irrigated Agriculture, 1996.*
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis.

B.1.4 Option 3A: Raise Claude Wharton Weir

Option 3A: – Raise Claude Wharton Weir	
Background to this option	
Description	This option proposes a 1.5m raising of the Claude Wharton Weir Full Supply Level by installing crest gates. The purpose of the option would be to replace the volume lost from decommissioning of the fabri-dam by Sunwater, of the previous fabri-dam at Claude Wharton Weir. Reinstating the lost volume at Claude Wharton Weir would allow the reinstatement of 10,469ML of medium priority (that are currently not being supplied) which would then be suitable for irrigation. This water is currently being held by Burnett Water Pty Ltd but cannot be distributed as it is excluded from the scheme's water sharing rules unless water storage is reinstated (such as by raising Claude Wharton Weir). The raising of Claude Wharton Weir has been considered as one element of larger projects (including the GRID Project), and it will require further investigation and assessment to determine the cost and benefit of raising Claude Wharton Weir as a stand-alone project. *Source: Gayndah Regional Irrigation Development Project (GRID)*
Costs of this option	The cost estimate for the capital expenditure for this option is $7.5m. *Source: Gayndah Regional Irrigation Development Project (GRID)*
Hydrological benefits and how they will be realised	This option would result in 10,469 ML of medium priority water to be reinstated within the Upper Burnett Water Supply Scheme.
Customer benefits and how they will be realised	The customer benefits of this option is the supply of 10,469ML of medium priority water to irrigators downstream of Claude Wharton Weir, including the Gayndah irrigators and irrigators in surrounding areas. The supply of this water would be realised by accessing the reserve water held by Burnett Water Pty Ltd, and converting that water from low priority to medium priority. *Source: Gayndah Regional Irrigation Development Project (GRID)*
The problem(s) this option seeks to address	The problem that this option seeks to address is the existence of large areas of fertile land without to a reliable source of water hindering crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to provide new water to the highly fertile area downstream of Claude Wharton Weir, including the irrigation area around Gayndah. *Source: Gayndah Regional Irrigation Development Project (GRID)*
Strategic Considerations	

Option 3A: – Raise Claude Wharton Weir	
SIP Classification	Classified as 'Improve Existing' under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option broadly aligns with Government objectives in relation to: (a) The efficient use of existing water resources and infrastructure without the need for expenditure on new water infrastructure. (b) Supporting infrastructure development that provides a commercial return to bulk water providers. While this option does involve capital expenditure on infrastructure, the focus on improving existing infrastructure instead of major expenditure on a wholly new project aligns with the Governments fiscal efficiency policy focus. If this project can be developed on the basis of that the bulk water provider would achieve a commercial return from the new medium priority allocations, then it would potentially align closely with the objectives of the Government in this area. *Source: Queensland bulk water opportunities statement, 2019; Gayndah Regional Irrigation Development Project (GRID)*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	As a result of the decision to deflate and decommission the Claude Wharton fabri-dam in November 2008 (following the failure of a similar inflatable structure at Bedford Weir), the water sharing rules in the operations plan currently exclude 10,469 ML of medium priority water allocations. In effect, this means that 10,469 ML of medium priority water (held by Burnett Water) in the Upper Burnett Water Supply Scheme is unused and not able to access, or be supplied from, the water announced as being available in the scheme. Should the storage volume in the system be reinstated (through, for example, the construction of a new gated structure to replace the decommissioned fabri-dam), it is expected that these water allocations would be reinstated again. This is likely to require minor changes to the Operations Manual. *Source: Burnett Water Plan 2020 and Operations Manual.*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders that will be impacted by this option are: **(a) Sunwater** Sunwater would likely be responsible for the management of the new water allocations and the sale of water under this option. Sunwater have previously expressed general support for the raising of Claude Wharton Weir, although they will need to be consulted and involved in this option as it progresses. **(b) Irrigators within the Upper Burnett Water Supply Scheme** Irrigators within the Upper Burnett Water Supply Scheme will potentially benefit from this option. Further assessment will be required to determine the level of demand for additional water from the irrigators directly impacted by this option. There is considerable confirmed demand from irrigators in in nearby areas, particularly Coalstoun Lakes, which is immediately downstream of the Upper Burnett Water Supply Scheme and considered further in Options 3B and 4I. **(c) Urban and industrial water users**

Option 3A: – Raise Claude Wharton Weir	
	Urban and industrial water users will be impacted by reducing stress on the water storage and available water sources. Further investigations may be conducted to determine the impact on urban and industrial water reliability and availability. *Source: Gayndah Regional Irrigation Development Project (GRID); Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015.*
Environmental impact	There has been some assessment of the environmental impact of larger projects that incorporate the raising of Claude Wharton Weir, although it would not be suitable to apply those assessments here as they could potentially overstate the environmental impact. While the environmental impact of raising of Claude Wharton Weir may be limited, it would still be necessary to conduct a detailed review of the environmental impacts if this option progresses to a detail business case. Any review should consider whether it will be necessary to refer this project to the Commonwealth under the EPBC Act. *Source: Gayndah Regional Irrigation Development Project (GRID); Environmental Protection and Biodiversity Conservation Act, 1999.*
Timeframe considerations	Subject to the findings of an environmental assessment, the approvals, planning and construction of this project should not be long and do not pose a substantive barrier to the progress of this project.
Social and economic considerations	If this option was to deliver a reliable new water source to the irrigation area around Gayndah, it would provide greater scope for commercial investment and crop diversity for the impacted irrigators. Subject to the presence of strong demand for new water, this option could facilitate commercial investment and associated benefits to local businesses and employment. *Source: Gayndah Regional Irrigation Development Project (GRID).*
Access to water	This option would not require any water to be allocated from the water plan's unallocated reserves.
Proximity to demand	This option would potentially deliver a new reliable water source to a fertile agricultural area. Reinstating Claude Wharton Weir would allow the system yield of the Upper Burnett WSS to be reinstated. The benefit is not limited to putting the allocation back just at CW Weir, the location(s) of the reinstated water allocations could be anywhere in the UBWSS. The area downstream of Claude Wharton Weir, including the irrigation area around Gayndah, has significant parcels of land with class 1, 2 and 3 soil (studies have identified 6,000 hectares of class 1 soil between Munduberra and Gayndah). A high proportion of the land close to the Burnett River has been identified as suitable for irrigated cropping, although the largest parcels of class 1 soil are located on the southern side of the Burnett river and Coalstoun Lakes. The lands in this area have been identified as suitable for growing a large variety of crops, including some high value crops: asparagus, avocados, chickpea, citrus, cruciferae, cucurbits, grapes, lucerne, mango, mungbean, navybean, improved pastures, peanut, pecan, potato, safflower, soybean, stone fruits, summer grains, sunflower, vegetables and winter grains. *Source: Gayndah Regional Irrigation Development Project (GRID); Bundaberg Channel Upgrade Feasibility Study (Sunwater), 2018; Soils of the Riparian Lands of the Burnett River.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	

Option 3A: – Raise Claude Wharton Weir	
Risks	*Insufficient water to meet demand* The amount of water provided by this option is insufficient to meet the high demand in the area. This may be mitigated by combining this option with other projects in the area, such as in Option 4I. *Legal* This option will involve legal risks associated with the transactions and impact of the infrastructure on adjacent land holders. These risks should be managed through careful consideration, and consultation with adjacent land holders, as part of the development of the Detailed Business Case. *Source: Gayndah Regional Irrigation Development Project (GRID)*
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis.

B.1.5 Option 3B: Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand

Option 3B: – Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	
Background to this option	
Description	This option proposes a 1.5m raising of the Claude Wharton Weir Full Supply Level by installing crest gates. The purpose of the option would be to replace the volume lost from decommissioning of the fabri-dam by Sunwater, of the previous fabri-dam at Claude Wharton Weir. Reinstating the lost volume at Claude Wharton Weir would allow the conversion of 10,469ML of low priority water allocations to medium priority, which would then be suitable for irrigation. This water is currently being held by Burnett Water Pty Ltd but cannot be distributed as it is excluded from the scheme's water sharing rules unless water storage is reinstated (such as by raising Claude Wharton Weir). The raising of Claude Wharton Weir has been considered as one element of larger projects (including the GRID Project), and it will require further investigation and assessment to determine the cost and benefit of raising Claude Wharton Weir as a stand-alone project. This new medium priority water could then be transported through a pipeline to areas where demand and soil suitability is high, such as Coalstoun Lakes or the South side of the Burnett River. A pipeline reduces transmission losses and allows water to be delivered to suitable areas that are not adjacent to a river. If this water was delivered to Coalstoun Lakes, it would meet an existing demand for reliable new water for irrigation and would service agricultural production in an area with highly fertile soil. The feasibility of this option has been assessed on the basis that the water would be piped to Coalstoun Lakes, although the considerations in this option would be largely similar if the water was delivered to the highly fertile irrigation area on the South side of the Burnett River. An alternative option would be to utilise all or some of this new water for urban users in North Burnett. *Source: Gayndah Regional Irrigation Development Project (GRID); Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Costs of this option	The costs of the raising of Claude Wharton Weir has been estimated at $7.5million. The cost of the pipeline to Coalstoun Lakes (or an alternative area) has not been estimated. Further cost analysis will be required if this project progresses to a detailed business case. *Source: Gayndah Regional Irrigation Development Project (GRID)*

Option 3B: – Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	
Hydrological benefits and how they will be realised	This option would result in 10,469 ML of medium priority water to be reinstated within the Upper Burnett Water Supply Scheme and supplied (via a pipeline) to the Coalstoun Lakes area.
Customer benefits and how they will be realised	The customer benefit of this option is the supply of 10,469ML of medium priority water to existing demand in the highly fertile agricultural lands around Coalstoun Lakes. The supply of this water would be realised by accessing the reserve water held by Burnett Water Pty Ltd, and converting that water from low priority to medium priority. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils. The soil in Coalstoun Lakes has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that Coalstoun Lakes has extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Gaydah Regional Irrigation Development Project (GRID)*
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. The Coalstoun Lakes area, which would potentially receive new water under this option, has large parcels of high-quality soil, including significant parts with class 1 and 2 soil. *Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Gayndah Regional Irrigation Development Project (GRID)*
Strategic Considerations	
SIP Classification	Classified as 'Improve Existing' under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option broadly aligns with Government objectives in relation to: (a) The efficient use of existing water resources and infrastructure without the need for expenditure on new water infrastructure. (b) Supporting infrastructure development that provides a commercial return to bulk water providers. While this option does involve capital expenditure on infrastructure, the focus on improving existing infrastructure instead of major expenditure on a wholly new project aligns with the Governments fiscal efficiency policy focus. If this project can be developed on the basis of that the bulk water provider would achieve a commercial return from the new medium priority allocations, then it would potentially align more closely with the objectives of the Government in this area. *Source: Queensland bulk water opportunities statement, 2019; Gayndah Regional Irrigation Development Project (GRID)*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the strategic considerations.
Legal and Regulatory Considerations	

Option 3B: – Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	
Legislative and regulatory issues	As a result of the decision to deflate and decommission the Claude Wharton fabridam in November 2008 (following the failure of a similar inflatable structure at Bedford Weir), the water sharing rules in the operations plan currently exclude 10,469 ML of medium priority water allocations. In effect, this means that 10,469 ML of medium priority water (held by Burnett Water) in the Upper Burnett Water Supply Scheme are unused and not able to access, or be supplied from, the water announced as being available in the scheme. Should the storage volume in the system be reinstated (through, for example, the construction of a new gated structure to replace the decommissioned fabridam), it is expected that these water allocations would be reinstated again. This is likely to require minor changes to the Operations Manual. *Source: Burnett Water Plan 2020 and Operations Manual.*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders that will be impacted by this option are: **(a) Sunwater** Sunwater would likely be responsible for the management of the new infrastructure, water allocations and the sale of water under this option. Sunwater have previously expressed general support for the raising of Claude Wharton Weir (not the pipeline part of this option), and would need to be consulted and involved in this option if it progresses. **(b) Irrigators in Coalstoun Lakes** The irrigators in and around Coalstoun Lakes will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megaliter costs will be necessary. The lower cost of this option would presumably result in a lower water cost for irrigators, although that will need to be formally reviewed. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. **(c) North Burnett Regional Council** An alternative option to providing the new water to irrigators in Coalstoun Lakes, would be to allocate some of it to the North Burnett Regional Council for sale to urban and industrial users in the region. Both Biggenden and Mt Perry are presently under water restrictions. **(d) Irrigators in Gayndah area** The decision to transport water away from the Claude Wharton Weir via a pipeline instead of allocating it to irrigators downstream of the weir on the Burnett River, such as the irrigators in the Gayndah area, may raise objections. Further assessment should be undertaken to determine and confirm the most efficient and effective location for any new water. *Source: Gayndah Regional Irrigation Development Project (GRID); Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015.*
Environmental impact	There has been some assessment of the environmental impact of larger projects that incorporate the raining of Claude Wharton Weir, although it would not be suitable to apply those assessments here it could overstate the environmental impact. While the environmental impact of raising of Claude Wharton Weir and a pipeline to Coalstoun Lakes may be limited, it will still be necessary to conduct a detailed review of the environmental impacts if this option

Option 3B: – Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	
	progresses to a detail business case. Any review should consider whether it will be necessary to refer this project to the Commonwealth under the EPBC Act. *Source: Gayndah Regional Irrigation Development Project (GRID); Environmental Protection and Biodiversity Conservation Act, 1999.*
Timeframe considerations	Subject to the findings of an environmental assessment, the approvals, planning and construction of this project should not be long and do not pose a substantive barrier to the progress of this project. A full detailed timeline and risk management process will be necessary as part of a detailed business case on this option.
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of similar options have been undertaken, although further assessment would be required in any detailed business case. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Access to water	This option would not require any water to be allocated from the water plan's unallocated reserves.
Proximity to demand	This option seeks to deliver new water sources directly to existing demand in the highly fertile agricultural lands around Coalstoun Lakes. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils. The soil in Coalstoun Lakes has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that Coalstoun Lakes, and the surrounding areas, have extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having high feasibility against the public interest considerations.
Risk Considerations	
Risks	*Costs* The viability of this option is dependent on the water operator being able to recover the operational costs through water sales. There is a limited risk that the costs would not be recovered, which may be mitigated through a comprehensive demand and expression of interest process as part of the development of the Detailed Business Case. Consultations with irrigators in Coalstoun Lakes identified strong demand for additional water. *Cost effective* Using a pipeline to transfer this water to Coalstoun Lakes, or another highly fertile area, will be less cost effective than river transmission. The additional cost to pipe water to Coalstoun Lakes (compared to allowing river transmission to river adjacent lands) should be measured against the reduction in

Option 3B: – Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand	
	transmission loses and increased effectiveness of the water within the local economy in the Coalstoun Lakes location. *Legal* This option will involve legal risks associated with the transactions and impact of the infrastructure on adjacent land holders. These risks should be managed through careful consideration, and consultation with adjacent land holders, as part of the development of the Detailed Business Case. *Source: Gayndah Regional Irrigation Development Project (GRID); Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Feasibility assessment against risk considerations	This option has been assessed as having high feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis.

B.1.6 Option 4A: Up to 65,000ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes

Option 4A – Up to 65,000ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
Background to this option	
Description	This option proposes the construction of a storage (small dam or large weir) on Barambah Creek upstream of its confluence with the Burnett River and an irrigation network to transport and distribute water to irrigators in the Coalstoun Lakes area. This option would utilise an irrigation network system, with a pipeline and channel scheme to take the water from the dam to the irrigation area, including balancing storages and relift, due to the gain in elevation. The storage size and type (dam or weir) will depend on what will provide the most effective yield to satisfy the water demand in and around Coalstoun Lakes. Two of the options that have been considered are: • dam or weir with a full supply volume of 65,000ML and 18,500ML dead storage; or • dam or weir with a full supply volume of 47, 000ML and 0 ML dead storage. The purpose of this proposal is to provide additional new for the irrigators in and around Coalstoun Lakes. Previous studies have identified a willingness among irrigators in the Coalstoun Lakes area to pay commercial rates for a reliable new water source. The site for the proposed storage on Barambah Creek would be downstream of Silverleaf Weir, with the final location determined on the basis of hydrological and geotechnical evidence. Four primary locations on Barambah Creek have been investigated previously as sites for a potential dam, including at ATMD 32km, ATMD 39.3 km (see Option 4D), ATMD 41.6 km (see Option 4E) and ATMD 43.0 km (see Option 4F). The location of the storage will impact on the size, route and cost of the proposed irrigation network. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme (GHD, 2015); Dam Yield Estimates and Water Planning requirements for a potential dam on Barambah Creek @ AMTD 43 km, 2015*
Costs of this option	The costs (capital and operational) for this option have not been subject to formal modelling. The costs would be considerably less than the larger dams proposed in Options 4C-4F, and the irrigation network may be developed and constructed at a lower cost than the equivalent network proposed in Option 4C depending on where the storage is situated.

Option 4A – Up to 65,000ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
	Costs will be a factor in any comparison between the construction of a weir or dam, with the weir having lower comparative planning, environmental and construction costs.
Hydrological benefits and how they will be realised	The potential additional volume and reliability of water allocations that might be available under this option (or compliance with water plan environmental flow objectives and water allocation security objectives) has not been modelled. A target of 20GL to 30GL has been suggested in consultations with Coalstoun Lake irrigators. Although this requires detailed assessment using IQQM, previous studies suggest that a dam on Barambah Creek at AMTD 43 km with a full supply level of 160m, a capacity of 65500 ML and dead storage of 18,500 ML might yield the desired volumes for Coalstoun Lakes i.e. either: • 26,500 ML at a monthly reliability of 90% (and an annual reliability of just under 80%) or alternatively • 22,500 ML at a monthly reliability of 95% (and an annual reliability of just under 90%) It is noted that the modelling that these are based on was not IQQM and was based on a monthly (rather than daily timestep) spreadsheet model and therefore is likely to over-estimate yields. In addition, the modelling was not tested for compliance with water plan EFOs or WASOs which might require some passing flows that reduce the above yields.
Customer benefits and how they will be realised	The primary customer benefits will be the availability of additional new water for irrigators in the Coalstoun Lakes area. This benefit will be achieved through the creation of new allocations for the irrigators in this area, and pumping the water directly to the new irrigation system in Coalstoun Lakes.
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. The Coalstoun Lakes area, which would receive new water under this option, has large parcels of high-quality soil, including significant parts with class 1 and 2 soil. *Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	This option requires the construction of new water infrastructure, and could potentially utilize a user pays model that recovers all or most of the capital cost from the water users. On that basis, this option would align with the policy and objectives of the Queensland Government in relation to supporting infrastructure development that provides a commercial return to bulk water providers. While the State Government has declared a preference for projects that utilize existing infrastructure, this option would align with the State Government objective of achieving efficient water usage with the lowest practical expenditure. This option could be achieved for significantly lower cost that the alternative dam proposals.
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.

Option 4A – Up to 65,000ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders for this option include: **(a) Land holders and adjacent land holders** The landholders in the proximity of the proposed dam will be impacted by the changes the environment, land access and, potentially, land rights. The landholders will need to be consulted as part of any Detailed Business Case. The impact on land holders would be more limited than proposals that involve the construction of a dam. **(b) Irrigators** The irrigators in and around Coalstoun Lakes will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megalitre costs will be necessary. The lower cost of this option would presumably result in a lower water cost for irrigators, although that will need to be formally reviewed. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. **(c) Sunwater** Sunwater may potentially be responsible for the management of the infrastructure, transfer of water between schemes and the distribution to the irrigation areas under this option.
Environmental impact	A desktop assessment has previously been undertaken in relation to dam sites in this part of Barambah Creek, which included a basic environmental impact discussion. The advantage of this option is that the weir will have considerably lower environmental impacts and may avoid the need for an environmental impact statement. It will be necessary for a more detailed assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. The previous desktop assessment predicted the presence of two threatened ecological communities: *Brigalow* and *Lowland Rainforest of Subtropical Australia*. The study also identifies the existence of a diversity of flora that will require assessment against the existing environmental protection regulations. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Environmental Protection Act 1994; Environmental Protection Act 1994*
Timeframe considerations	The timeframe for undertaking this option will be medium, including detailed hydrological assessments, engineering assessment to identify the ideal location for the weir, regulatory approval, and development planning. The timeframe for completing the approvals, development and regulatory amendments would be considerably shorter than the alternative proposals for a dam on this part of Barambah Creek.
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of similar options have been undertaken, although further assessment would be required in any detailed business case. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*

Option 4A – Up to 65,000ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
Access to water	As this option is on the Barambah Creek upstream of the confluence with Burnett River, it would need to access 20 to 30 GL of unallocated water from the water plan which might primarily be sourced from water allocations moved upstream from Paradise Dam. Compliance with the Water Plan's environmental flow objectives (EFOs) and Water Allocation Security Objectives (WASOs) would need to be assessed for this option.
Proximity to demand	This option seeks to deliver new water sources directly to existing demand in the highly fertile agricultural lands around Coalstoun Lakes. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils. The soil in Coalstoun Lakes has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that the Coalstoun Lakes area specifically has extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having high feasibility against the public interest considerations.
Risk Considerations	
Risks	*Costs* While this option would be substantively less expensive that the alternative dam proposals, its viability is still dependent on the water operator being able to recover the operational costs through water sales. There is a risk that the costs would not be recovered, which may be mitigated through a comprehensive demand and expression of interest process as part of the development of the Detailed Business Case. *Legal* This option will involve legal risks associated with the transactions and impact of the infrastructure on adjacent land holders. These risks should be managed through careful consideration, and consultation with adjacent land holders, as part of the development of the Detailed Business Case. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. The smaller size of the proposed weir will minimize the potential for an impact on cultural heritage sites, although this may depend on the final location of the weir.
Feasibility assessment against risk considerations	This option has been assessed as having high feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.7 Option 4B: Build a pipeline from Paradise Dam to Coalstoun Lakes

Option 4B – Build a pipeline from Paradise Dam to Coalstoun Lakes	
Background to this option	
Description	This option proposes the construction of a 37-43 km (approximately) pipeline from Paradise Dam and Coalstoun Lakes to directly deliver reliable water to an area of high demand and highly fertile soils. This option would more efficient and lower cost than alternative pipeline proposals (such as Options 4G and 4H) involving Coalstoun Lakes on the basis that it would deliver water directly. Design and engineering assessment are required to determine the best formulation for the pipeline, including the requirement for buffer storage and the most efficient and cost-effective pipeline materials. This option would provide new, reliable water to irrigators in Coalstoun Lakes. This option could facilitate the creation of 4,000 to 6,000 ha of new irrigation areas in Coalstoun Lakes utilizing 20,000 ML to 30,000 ML of water annually. This option is an amalgamation of proposals considered in previous studies that seeks to maximize the efficiency and utilization of available additional water from Paradise Dam. Accordingly, some features in this proposal have not been subject to detailed assessment at this stage. *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Costs of this option	There has not been an estimation of the capital and operation costs of this option, although this option will be much lower cost than alternative pipeline and dam proposals to deliver water to Coalstoun Lakes. The route of the pipeline will have a significant impact on the operational costs of this option due to the mountains located between Paradise Dam and Coalstoun Lakes: • If the route goes directly across the mountains it will require substantial pumping, and the operational costs will be high. • If a less elevated route is used (such as following the existing roadway easement) the pumping and operational costs will be lower. *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018*
Hydrological benefits and how they will be realised	This option would provide an additional 20,000 ML to 30,000 ML of medium priority water allocations.
Customer benefits and how they will be realised	The customers that will benefit from this option are irrigators in the Coalstoun Lakes area. The benefits will be realised through the delivery of reliable new water directly from Paradise Dam, and the creation of new water allocations (and inter-scheme transfer of existing allocations) in the Barker Barambah Water Supply Scheme. *Sources: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015*
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. The Coalstoun Lakes area that will receive new water under this option has large parcels of high-quality soil (including significant parts with class 1 and 2 soil). *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	This option seeks to improve the efficiency of existing water resources by directing to an area of higher demand, soil quality and production potential. This option is lower cost than alternative pipeline and storage proposals. This option aligns generally with the policy and objectives of the Queensland Government in relation to:

Option 4B – Build a pipeline from Paradise Dam to Coalstoun Lakes	
	(a) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. (b) Supporting infrastructure development that provides a commercial return to bulk water providers. This option's reliance on water from Paradise Dam will be subject to the decision making in relation to how to distribute existing and future volume from that storage. This option may potentially be supported as part of the Paradise Dam investigations on the basis of the highly productive potential use for the water in the Coalstoun Lakes area. *Source: Paradise Dam Options Assessment 2020; Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require amendments to existing legislation, regulations and legislative instruments, including the Burnett Water Plan, operations manuals, water management protocols and bulk water service contracts. There will be flow on effects to various regulations that will require consideration and amendment as a result of this option. This option will require amendments to the rules providing for transfer of allocations between schemes and/or resetting of allocations under the Bundaberg Water Supply Scheme, Boyne River & Tarong Supply Scheme, and potentially other schemes in North Burnett. Further assessment should be undertaken to determine the specific legislative and regulatory amendments required to facilitate this option.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders for this option are: **(d) Existing water users in the areas surrounding Paradise Dam** These stakeholders may be concerned that any solution in respect of the water currently held within Paradise Dam (and future allocations from the dam after it is fixed) does not negatively impact water users in the Bundaberg Water Scheme. If this option is to progress, then it will need to be considered as part of the overall assessment of Paradise Dam being conducted by Building Queensland and Sunwater. **(e) Sunwater** Sunwater may potentially be responsible for the management of the infrastructure, transfer of water between schemes and the distribution to the irrigation areas under this option. **(f) Irrigators** The irrigators in and around Coalstoun Lakes will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Environmental impact	The previous studies on pipelines through this area have not produced a detailed environmental assessment, and it will be necessary for an extensive assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. This option covers a distance of 37-43km (subject to the route) in North Burnett. It is likely that there will be environmental impact complications that require further assessment, and potentially an Environmental Impact Assessment.

Option 4B – Build a pipeline from Paradise Dam to Coalstoun Lakes	
	Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.
Timeframe considerations	The timeframe for undertaking this option will be medium, including engineering, design and hydrological assessments, regulatory approval and detailed planning for the construction. *Source: Getting Water for Peanuts, 2018.*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of this option have been undertaken, although further assessment would be required in any detailed business case. Due to the highly fertile soil and prime growing conditions in the Coalstoun Lakes area, the introduction of new reliable water is likely to attract interest from agricultural businesses located outside of Coalstoun Lakes. Investors from outside the area could potentially be interested in acquiring existing farms, or farmable land, and introducing new capital and expanded production to the area. One impact of this investment could be that land values in the Coalstoun Lakes area would likely increase. According to a study that proposed to deliver a similar volume of new reliable water to Coalstoun Lakes, the direct agricultural production benefit of $140M could deliver an increase in economic activity of $490M annually, which would transform the region economically. Further assessment on this option is required to determine the actual direct and indirect benefits. *Source: Getting Water for Peanuts, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Access to water	This option relies on being able to secure large volumes of unsold water at Paradise Dam. It is unclear when / if these volumes might be available from Paradise Dam given it is currently being temporarily lowered for dam safety reasons.
Proximity to demand	This option seeks to deliver new water sources directly to existing demand in the highly fertile agricultural lands in and around Coalstoun Lakes. The Coalstoun Lakes area has fertile soil suitable for growing a diverse range of agricultural products. This area is dominated by well drained and friable red volcanic soils, which has been assessed extensively and predominantly classified as classes 1, 2 and 3 (one study identified 4,000 hectares of class 1 soil in Coalstoun Lakes, being 50 per cent of the studied soil in that area). The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that the Coalstoun Lakes area specifically has extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. Based on consultations and investigations, it is expected that the demand for new reliable water will be particularly high in the Coalstoun Lakes area due to the high fertile soil and prime growing conditions. Demand in Coalstoun Lakes could include: • Existing local irrigators that have strongly advocated for increased water supply and reliability in the area; • Nut growers based in Bundaberg that identify the high value production available in the Coalstoun Lakes area with the introduction of new, reliable water; and • Sugar cane growers based in Bundaberg that identify the high value production available in the Coalstoun Lakes area with the introduction of new, reliable water. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having high feasibility against the public interest considerations.

Option 4B – Build a pipeline from Paradise Dam to Coalstoun Lakes	
Risk Considerations	
Risks	*Return on investment* This option would need to recover a substantive proportion of its capital and operational cost from the water users through annual and volume water charges. *Access to water from Paradise Dam* This option relies on access to water from Paradise Dam and the future plan for that water is still being determined by the Government in consultation with stakeholders. This option may mitigate this risk by demonstrating the high value usage of the water in Coalstoun Lakes, which may attract investment from existing water users in the Bundaberg Water Supply Scheme. *Route could increase costs* Between Paradise Dam and Coalstoun Lakes there is a mountain range and if the pipeline was directed over that range it would increase the costs of both the pipeline and pumping. Further consideration of this option will need to assess the most viable and cost-effective route. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. The size of the proposed dam increases the potential for an impact on cultural heritage sites, although this will depend on the final location of the dam *Source: Getting Water for Peanuts, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.8 Option 4C: 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes

Option 4C – 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
Background to this option	
Description	This option proposes the construction of a 100,000 ML dam at Barambah Creek and a new irrigation network to distribute water to irrigators in Coalstoun Lakes, and surrounding areas. The construction involves the implementation of a pipeline and channel scheme to take the water from the dam to the irrigation area, including balancing storages and relift, due to the gain in elevation. This option would facilitate the creation of new irrigation areas in Coalstoun Lakes and downstream users. This option will require the creation of new water allocations for Coalstoun Lakes irrigators and irrigator downstream of the new dam on Barambah Creek. The site for the proposed weir on Barambah Creek will be downstream of Silverleaf Weir, with the final location determined on the basis of hydrological and geotechnical evidence. Four primary locations on Barambah Creek have been investigated previously as sites for a potential dam, including at ATMD 32km, ATMD 39.3 km (see Option 4D), ATMD 41.6 km (see Option 4E) and ATMD 43.0 km (see Option 4F). The current proposal suggests that the recovery of the upfront capital costs can be partially recovered through the water sales to the new allocation holders in Coalstoun Lakes and downstream of the dam site: • Water cost to Coalstoun Lakes of $1,400 ML • Water cost to users downstream of the dam of $900 ML *Sources: Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015*

Option 4C – 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
Costs of this option	The estimated capital cost is $98 million for the dam and $39 million for the irrigation network. Previous proposals have estimated the capital annual cost at $200 ML and the ongoing operational cost at $125 ML. The capital cost for the dam construction should be reviewed to consider alternative dam types and construction methods. Other studies of dam proposals in the area have favored a concreate faced rockfill dam based on the geological features and difficulties in finding suitable clay core. *Sources: Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme (GHD, 2015)*
Hydrological benefits and how they will be realised	Previous modelling suggests that the option may provide around 43,000 ML of additional medium priority water allocations.
Customer benefits and how they will be realised	The customer benefit for this option will be the availability of additional new water for irrigators in the Coalstoun Lakes area, and downstream of the dam on Barambah Creek. These benefits will be realised through the creation of new water allocations for these irrigators, and pumping water from the new dam directly to Coalstoun Lakes through a new irrigation system. *Sources: Barambah Creek Proposal, 2018.*
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. The areas that will receive new water under this option have large parcels of high-quality soil (including significant parts with class 1 and 2 soil). *Sources: Barambah Creek Proposal, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	This option requires the construction of new water infrastructure within a user pays model that allows the capital and operational costs to be recovered. This option does align, in principle, with the policy and objectives of the Queensland Government in relation to supporting infrastructure development that provides a commercial return to bulk water providers. While the Queensland Government does not oppose necessary expenditure on infrastructure, it has a clear policy of supporting the most cost effective and efficient option for any necessary water infrastructure. Accordingly, although this option may be justifiable on the basis of the commercial benefit to water users it is unlikely to be favored over an alternative proposal that addresses the same problem more efficiently (such as Option 4A). *Sources: Barambah Creek Proposal, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	

Option 4C – 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
Impact on stakeholders	The primary stakeholders for this option are: **(a) Land holders and adjacent land holders** The landholders in the proximity of the proposed dam will be impacted by the changes the environment, land access and, potentially, land rights. The landholders will need to be consulted as part of any Detailed Business Case. **(b) Irrigators** The irrigators in and around Coalstoun Lakes, and downstream of the dam site on Barambah Creek will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megaliter costs will be necessary. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. **(c) Sunwater** Sunwater may potentially be responsible for the management of the infrastructure, transfer of water between schemes and the distribution to the irrigation areas under this option. *Sources: Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015;*
Environmental impact	A desktop assessment has previously been undertaken in relation to dam sites in this area, which included a basic environmental impact discussion. It will be necessary for an extensive assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. The previous desktop assessment predicted the presence of two threatened ecological communities: Brigalow and Lowland Rainforest of Subtropical Australia. The study also identifies the existence of a diversity of flora that will require assessment against the existing environmental protection regulations. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Environmental Protection Act 1994; Barambah Creek Proposal, 2018.*
Timeframe considerations	The timeframe for undertaking this option will be long, including detailed hydrological assessments, engineering assessments, regulatory approval, changes to the Burnett Water Plan, and planning for the construction of significant infrastructure. A basic estimate would be between 5 and 8 years to complete this project after government approval and funding has been secured. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of this option have been undertaken, although further assessment would be required in any detailed business case. According to the primary study on this option, the existing agricultural output of the Coalstoun Lakes area is approximately $4 million, and the introduction of this new irrigation scheme would increase returns to approximately $55 million per annum. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*

Option 4C – 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes	
Access to water	This option would need to access unallocated water from the water plan (including a large volume of water allocations moved upstream from Paradise Dam. Compliance with the Water Plan's environmental flow objectives (EFOs) and Water Allocation Security Objectives (WASOs) would need to be assessed.
Proximity to demand	This option seeks to deliver new water sources directly to existing demand in the highly fertile agricultural lands around Coalstoun Lakes. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils, and the Biggenden region has both alluvial soils and volcanic rocks. The soil in Coalstoun Lakes has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that the Coalstoun Lakes area specifically has extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Costs* The relatively high costs of this option pose a substantive risk to its success. These risks can be mitigated through a clear plan for the recovery of costs from water users, although the project proposal suggests that uptake of water in Coalstoun Lakes would be 75% (immediately) increasing to 90% (in five years). This uptake rate may potentially mean that water manager would be unable to recover the full operational costs. *Legal* There are significant legal risks with this option due to the multiple legal transactions required to develop and execute the planning and construction of the dam and irrigation system. Consultation with existing land holders that will be impacted by the projects will be necessary and may require further legal consideration. *Regulatory* This option will require amendments to existing legislation and legislative instruments, including the Burnett Water Plan, operations manuals and bulk water service contracts. There is a risk with all amendments that there will be insufficient political and government support for the changes. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. The size of the proposed dam increases the potential for an impact on cultural heritage sites, although this will depend on the final location of the dam. *Hydrological* Further modelling is required to determine whether a dam of this size is the optimal size to deliver the required yield. Preliminary modelling suggests that this dam is larger than necessary and that the existing demand could be satisfied with a smaller dam or weir (such as Option 4A).
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.9 Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes

Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	
Background to this option	
Description	This option proposes the construction of a 200,000+ ML dam on Barambah Creek at 39.3 km and a pipeline reticulation system to transport water from the new dam to Coalstoun Lakes and other surrounding irrigation areas. The purpose of this option is to provide increased water supply for downstream irrigators in North Burnett. Earlier studies recommended a 48m high dam with storage of 250,000 ML at this site, although more recent analysis has focused on a smaller 210,000 ML dam. This option has been reviewed and assessed as part of multiple formal and informal studies. As a result of these studies, there are four variations of the pipeline reticulation system with differing beneficiaries, costs and performance that must be considered: **a) Coalstoun Lakes, Ban Ban Springs and Biggenden:** Irrigation of the Coalstoun Lakes and Ban Ban Springs areas through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. 3km tunnel to Biggenden. Total capacity of 52,100ML/a to irrigate 9,370 hectares for a cost of between $136 million to $279 million ($2015). **b) Coalstoun Lakes, Ban Ban Springs:** Irrigation of the Coalstoun Lakes, Ban Ban Springs and Biggenden areas through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. Total capacity of 42,690 ML/a to irrigate 8,200 hectares for a cost of between $136 million to $279 million ($2015). c) **Coalstoun Lakes/Biggenden Water Development Group Irrigation Area including Biggenden**: Irrigation of Coalstoun Lakes, Ban Ban Springs and Biggenden through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. 3km tunnel to Biggenden. Total capacity of 52,100ML/a to irrigate 8,686 hectares for a cost of between $136 million to $279 million ($2015). **d) Coalstoun Lakes/Biggenden Water Development Group Irrigation Area excluding Biggenden:** Irrigation of Coalstoun Lakes and Ban Ban Springs (not Biggenden) through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. Total capacity of 49,200 ML/a to irrigate 8,200 hectares for a cost of between $115 million to $215 million ($2015) *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*
Costs of this option	The upfront costs of this option include: ▪ $575 million ($2015) for the development and construction of a 210,000 ML dam; plus ▪ $115 million to $279 million ($2015) for the development and construction of the pipeline reticulation system and necessary pumping (the large range is a result of more recent proposals for alternative construction materials for the pipelines). The operational costs of this option will be significant, including maintenance and repairs, and administrative management of the infrastructure. A detailed model of the ongoing costs has not been identified in the past studies, and should be developed if this option progresses further. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018;*
Hydrological benefits and how they will be realised	Previous modelling suggests that the option may provide between 42,690 ML/a and 52,100ML/a of additional water allocations although this requires more modern assessment using IQQM to assess performance against water plan objectives.
Customer benefits and how they will be realised	The customers that will benefit from this option are irrigators located in Coalstoun Lakes, and the surrounding agricultural areas (the beneficiaries will differ for each of the pipeline variations being considered). The primary benefit that will be achieved through this option is the supply of additional water directly to fertile agricultural areas. The amount of new water that will be supplied to these areas will be between 42,690 ML/a and 52,100ML/a, which will irrigate 8,200 to 9,370 hectares of agricultural land (volume and land size depend on the variation selected). *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018;*

<table>
<tr><th colspan="2">Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes</th></tr>
<tr><td>The problem(s) this option seeks to address</td><td>This option seeks to address the problem of having large areas of fertile land in North Burnett that do not have access to a reliable source of water. Coalstoun Lakes, and the other irrigation areas impacted by this option, have high quality soil (including significant parts with class 1 and 2 soil). The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option is intended to deliver reliable water directly to highly fertile agricultural areas.
Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000</td></tr>
<tr><td colspan="2">Strategic Considerations</td></tr>
<tr><td>SIP Classification</td><td>Classified as 'New' under the State Infrastructure Plan Hierarchy</td></tr>
<tr><td>Alignment with Government policy and objectives</td><td>This option requires the construction of significant, high cost, water infrastructure that may not achieve a commercial return on capital or operational investment. This option has poor alignment with the policy and objectives of the Queensland Government in relation to:

a) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure.
b) Supporting infrastructure development that provides a commercial return to bulk water providers.
The existing State and National fiscal environment and limitations mean that a project of this size, complexity and cost will have significant funding challenges. The project beneficiaries are unlikely to be willing to pay the full cost associated with the option as required by National, and agreed policy settings, which means that a large non-refundable grant would be needed to fund the construction costs. Accordingly, this option is unlikely to be favored over an alternative proposal that addresses the same problem more efficiently and has a higher probability of recovering capital and operational costs.

Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Queensland bulk water opportunities statement, 2019.</td></tr>
<tr><td>Feasibility assessment against strategic considerations</td><td>This option has been assessed as having low feasibility against the strategic considerations.</td></tr>
<tr><td colspan="2">Legal and Regulatory Considerations</td></tr>
<tr><td>Legislative and regulatory issues</td><td>This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.</td></tr>
<tr><td>Feasibility assessment against legal and regulatory considerations</td><td>This option has been assessed as having medium feasibility against the legal and regulatory considerations.</td></tr>
<tr><td colspan="2">Public Interest Considerations</td></tr>
<tr><td>Impact on stakeholders</td><td>The primary stakeholders for this option are:
(a) Sunwater
Sunwater may potentially be responsible for the management of the infrastructure, transfer of water between schemes and the distribution to the irrigation areas under this option.

(b) Land holders and adjacent land holders
The landholders in the proximity of the proposed dam will be impacted by the changes the environment, land access and, potentially, land rights. The landholders will need to be consulted as part of any Detailed Business Case.

(c) Irrigators
The irrigators in and around Coalstoun Lakes, and downstream of the dam site on Barambah Creek will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megaliter costs will be necessary. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project.

Sources: Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015;</td></tr>
</table>

Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	
Environmental impact	A desktop assessment has previously been undertaken in relation to dam sites in this area, which included a basic environmental impact discussion. It will be necessary for an extensive assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. The previous desktop assessment predicted the presence of two threatened ecological communities: Brigalow and Lowland Rainforest of Subtropical Australia. The study also identifies the existence of a diversity of flora that will require assessment against the existing environmental protection regulations. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Environmental Protection Act 1994; Barambah Creek Proposal, 2018.*
Timeframe considerations	The timeframe for undertaking this option will be long, including detailed hydrological assessments, engineering assessments, regulatory approval, changes to the Burnett Water Plan, and planning for the construction of significant infrastructure. A basic estimate would be between 5 and 8 years to complete this project after government approval and funding has been secured. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of this option have been undertaken, although further assessment would be required in any detailed business case. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Access to water	This option would need to access unallocated water from the water plan (including a large volume of water allocations moved upstream from Paradise Dam. Compliance with the Water Plan's environmental flow objectives (EFOs) and Water Allocation Security Objectives (WASOs) would need to be assessed.
Proximity to demand	This option directly meets the demand for new supply of water to the highly fertile agricultural lands in Coalstoun Lakes and the surrounding areas. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. The proposed Coalstoun Lakes Irrigation Area is dominated by well drained and friable red volcanic soils. The proposed Ban Ban Springs Irrigation Area is dominated by alluvial soils, while the Biggenden region has both alluvial soils and volcanic rocks. The soil in the area has been assessed extensively and predominantly classified as classes 1, 2 and 3. Previous studies have identified and confirmed that Coalstoun Lakes, and the surrounding areas, have extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Cost recovery* The high costs of this option pose a substantive risk to its success. These risks can be mitigated through a clear plan for the recovery of costs from water users. However, the beneficiaries of this project are unlikely to be willing to pay the full cost associated with the option as required by National and agreed policy settings hence a non-refundable grant would be needed to fund the construction costs. *Costs* The uncertainty around the final version of irrigation system for this project, and the various assessment that are required to determine the optimal system, mean that the costs estimate is highly uncertain and could be subject to significant increases.

Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes	
	Legal There are significant legal risks with this option due to the multiple legal transactions required to develop and execute the planning and construction of the dam and irrigation system. Consultation with existing land holders that will be impacted by the projects will be necessary and may require further legal consideration. *Regulatory* This option will require amendments to existing legislation and legislative instruments, including the Burnett Water Plan, operations manuals and bulk water service contracts. There is a risk with all amendments that there will be insufficient political and government support for the changes. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. The size of the proposed dam increases the potential for an impact on cultural heritage sites, although this will depend on the final location of the dam. *Hydrological* Further modelling is required to determine whether a dam of this size is the optimal size to deliver the required yield. Preliminary modelling suggests that this dam is larger than necessary and that the existing demand could be satisfied with a smaller dam or weir (such as Option 4A).
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.10 Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes

Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	
Background to this option	
Description	This option proposes the construction of a dam at 41.6 km and a pipeline reticulation system to transport water from the new dam to Coalstoun Lakes and other surrounding irrigation areas. The purpose of this option is to provide increased water supply for downstream irrigators in North Burnett. The dam has been assessed and costed on the basis of 210,000 ML storage volume. This option has been reviewed and assessed as part of multiple formal and informal studies. As a result of these studies, there are four variations of the pipeline reticulation system with differing beneficiaries, costs and performance that must be considered: a) **Coalstoun Lakes, Ban Ban Springs and Biggenden**: Irrigation of the Coalstoun Lakes and Ban Ban Springs areas through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. 3km tunnel to Biggenden. Total capacity of 52,100ML/a to irrigate 9,370 hectares for a cost of between $136 million to $279 million ($2015). b) **Coalstoun Lakes, Ban Ban Springs**: Irrigation of the Coalstoun Lakes, Ban Ban Springs and Biggenden areas through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. Total capacity of 42,690 ML/a to irrigate 8,200 hectares for a cost of between $136 million to $279 million ($2015). c) **Coalstoun Lakes/Biggenden Water Development Group Irrigation Area including Biggenden**: Irrigation of Coalstoun Lakes, Ban Ban Springs and Biggenden through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. 3km tunnel to Biggenden. Total capacity of 52,100ML/a to irrigate 8,686 hectares for a cost of between $136 million to $279 million ($2015). d) **Coalstoun Lakes/Biggenden Water Development Group Irrigation Area excluding Biggenden**: Irrigation of Coalstoun Lakes and Ban Ban Springs (not Biggenden) through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. Total capacity of 49,200 ML/a to irrigate 8,200 hectares for a cost of between $115 million to $215 million ($2015) *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*

Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	
Costs of this option	The upfront costs of this option include: • $575 million ($2015) for the development and construction of a 210,000 ML dam; plus • $115 million to $279 million ($2015) for the development and construction of the pipeline reticulation system and necessary pumping (the large range is a result of more recent proposals for alternative construction materials for the pipelines). The operational costs of this option will be significant, including maintenance and repairs, and administrative management of the infrastructure. A detailed model of the ongoing costs has not been identified in the past studies, and should be developed if this option progresses further. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018;*
Hydrological benefits and how they will be realised	Previous modelling suggests that the option may provide between 42,690 ML/a and 52,100ML/a of additional water allocations although this requires more modern assessment using IQQM to assess performance against water plan objectives.
Customer benefits and how they will be realised	The customers that will benefit from this option are irrigators located in Coalstoun Lakes, and the surrounding agricultural areas (the beneficiaries will differ for each of the pipeline variations being considered). The primary benefit that will be achieved through this option is the supply of additional water directly to fertile agricultural areas. The amount of new water that will be supplied to these areas will be between 42,690 ML/a and 52,100ML/a, which will irrigate 8,200 to 9,370 hectares of agricultural land (volume and land size depend on the variation selected). *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018;*
The problem(s) this option seeks to address	This option seeks to address the problem of having large areas of fertile land in North Burnett that do not have access to a reliable source of water. Coalstoun Lakes, and the other irrigation areas impacted by this option, have high quality soil (including significant parts with class 1 and 2 soil). The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option is intended to deliver reliable water directly to highly fertile agricultural areas. *Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	This option requires the construction of significant, high cost, water infrastructure that may not achieve a commercial return on capital or operational investment. This option has poor alignment with the policy and objectives of the Queensland Government in relation to: (a) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. (b) Supporting infrastructure development that provides a commercial return to bulk water providers. The existing State and National fiscal environment and limitations mean that a project of this size, complexity and cost will have significant funding challenges. The project beneficiaries are unlikely to be willing to pay the full cost associated with the option as required by National, and agreed policy settings, which means that a large non-refundable grant would be needed to fund the construction costs. Accordingly, this option is unlikely to be favored over an alternative proposal that addresses the same problem more efficiently and has a higher probability of recovering capital and operational costs. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.

Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders for this option are: **(a) Sunwater** Sunwater may potentially be responsible for the management of the infrastructure, transfer of water between schemes and the distribution to the irrigation areas under this option. **(b) Land holders and adjacent land holders** The landholders in the proximity of the proposed dam will be impacted by the changes the environment, land access and, potentially, land rights. The landholders will need to be consulted as part of any Detailed Business Case. **(c) Irrigators** The irrigators in and around Coalstoun Lakes, and downstream of the dam site on Barambah Creek will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megaliter costs will be necessary. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. *Sources: Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015;*
Environmental impact	A desktop assessment has previously been undertaken in relation to dam sites in this area, which included a basic environmental impact discussion. It will be necessary for an extensive assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. The previous desktop assessment predicted the presence of two threatened ecological communities: Brigalow and Lowland Rainforest of Subtropical Australia. The study also identifies the existence of a diversity of flora that will require assessment against the existing environmental protection regulations. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Environmental Protection Act 1994; Barambah Creek Proposal, 2018.*
Timeframe considerations	The timeframe for undertaking this option will be long, including detailed hydrological assessments, engineering assessments, regulatory approval, changes to the Burnett Water Plan, and planning for the construction of significant infrastructure. A basic estimate would be between 5 and 8 years to complete this project after government approval and funding has been secured. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and

Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	
	downstream economic activity. Some limited assessment of the economic and social impact of this option have been undertaken, although further assessment would be required in any detailed business case. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Access to water	This option would need to access unallocated water from the water plan (including a large volume of water allocations moved upstream from Paradise Dam. Compliance with the Water Plan's environmental flow objectives (EFOs) and Water Allocation Security Objectives (WASOs) would need to be assessed.
Proximity to demand	This option directly meets the demand for new supply of water to the highly fertile agricultural lands in Coalstoun Lakes and the surrounding areas. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. The proposed Coalstoun Lakes Irrigation Area is dominated by well drained and friable red volcanic soils. The proposed Ban Ban Springs Irrigation Area is dominated by alluvial soils, while the Biggenden region has both alluvial soils and volcanic rocks. The soil in the area has been assessed extensively and predominantly classified as classes 1, 2 and 3. Previous studies have identified and confirmed that Coalstoun Lakes, and the surrounding areas, have extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Cost recovery* The high costs of this option pose a substantive risk to its success. These risks can be mitigated through a clear plan for the recovery of costs from water users. However, the beneficiaries of this project are unlikely to be willing to pay the full cost associated with the option as required by National and agreed policy settings hence a non-refundable grant would be needed to fund the construction costs. Costs The uncertainty around the final version of irrigation system for this project, and the various assessment that are required to determine the optimal system, mean that the costs estimate is highly uncertain and could be subject to significant increases. *Legal* There are significant legal risks with this option due to the multiple legal transactions required to develop and execute the planning and construction of the dam and irrigation system. Consultation with existing land holders that will be impacted by the projects will be necessary and may require further legal consideration. *Regulatory* This option will require amendments to existing legislation and legislative instruments, including the Burnett Water Plan, operations manuals and bulk water service contracts. There is a risk with all amendments that there will be insufficient political and government support for the changes. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. The size of the proposed dam increases the potential for an impact on cultural heritage sites, although this will depend on the final location of the dam.

Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes	
	Hydrological Further modelling is required to determine whether a dam of this size is the optimal size to deliver the required yield. Preliminary modelling suggests that this dam is larger than necessary and that the existing demand could be satisfied with a smaller dam or weir (such as Option 4A).
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.11 Option 4F: Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes

Option 4F – Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	
Background to this option	
Description	This option proposes the construction of a 200,000+ ML dam on Barambah Creek at 43.0 km and a pipeline reticulation system to transport water from the new dam to Coalstoun Lakes and other surrounding irrigation areas. The purpose of this option is to provide increased water supply for downstream irrigators in North Burnett. Earlier studies recommended a 62m high dam with storage of 280,000 ML at this site, although more recent studies have focused on a smaller 210,000 ML dam. This option has been reviewed and assessed as part of multiple formal and informal studies. As a result of these studies, there are four variations of the pipeline reticulation system with differing beneficiaries, costs and performance that must be considered: a) **Coalstoun Lakes, Ban Ban Springs and Biggenden**: Irrigation of the Coalstoun Lakes and Ban Ban Springs areas through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. 3km tunnel to Biggenden. Total capacity of 52,100ML/a to irrigate 9,370 hectares for a cost of between $136 million to $279 million ($2015). b) **Coalstoun Lakes, Ban Ban Springs**: Irrigation of the Coalstoun Lakes, Ban Ban Springs and Biggenden areas through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. Total capacity of 42,690 ML/a to irrigate 8,200 hectares for a cost of between $136 million to $279 million ($2015). c) **Coalstoun Lakes/Biggenden Water Development Group Irrigation Area including Biggenden**: Irrigation of Coalstoun Lakes, Ban Ban Springs and Biggenden through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. 3km tunnel to Biggenden. Total capacity of 52,100ML/a to irrigate 8,686 hectares for a cost of between $136 million to $279 million ($2015). d) **Coalstoun Lakes/Biggenden Water Development Group Irrigation Area excluding Biggenden**: Irrigation of Coalstoun Lakes and Ban Ban Springs (not Biggenden) through a pipeline reticulation system pumped from a new storage. Pump station with main pipeline located parallel to Isis Highway. Total capacity of 49,200 ML/a to irrigate 8,200 hectares for a cost of between $115 million to $215 million ($2015) *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*
Costs of this option	The upfront costs of this option include: • $575 million ($2015) for the development and construction of a 210,000 ML dam; plus • $115 million to $279 million ($2015) for the development and construction of the pipeline reticulation system and necessary pumping (the large range is a result of more recent proposals for alternative construction materials for the pipelines).

Option 4F – Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	
	The operational costs of this option will be significant, including maintenance and repairs, and administrative management of the infrastructure. A detailed model of the ongoing costs has not been identified in the past studies, and should be developed if this option progresses further. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018;*
Hydrological benefits and how they will be realised	Previous modelling suggests that the option may provide between 42,690 ML/a and 52,100ML/a of additional water allocations although this requires more modern assessment using IQQM to assess performance against water plan objectives.
Customer benefits and how they will be realised	The customers that will benefit from this option are irrigators located in Coalstoun Lakes, and the surrounding agricultural areas (the beneficiaries will differ for each of the pipeline variations being considered). The primary benefit that will be achieved through this option is the supply of additional water directly to fertile agricultural areas. The amount of new water that will be supplied to these areas will be between 42,690 ML/a and 52,100ML/a, which will irrigate 8,200 to 9,370 hectares of agricultural land (volume and land size depend on the variation selected). *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018;*
The problem(s) this option seeks to address	This option seeks to address the problem of having large areas of fertile land in North Burnett that do not have access to a reliable source of water. Coalstoun Lakes, and the other irrigation areas impacted by this option, have high quality soil (including significant parts with class 1 and 2 soil). The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option is intended to deliver reliable water directly to highly fertile agricultural areas. *Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	This option requires the construction of significant, high cost, water infrastructure that may not achieve a commercial return on capital or operational investment. This option has poor alignment with the policy and objectives of the Queensland Government in relation to: (c) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. (d) Supporting infrastructure development that provides a commercial return to bulk water providers. The existing State and National fiscal environment and limitations mean that a project of this size, complexity and cost will have significant funding challenges. The project beneficiaries are unlikely to be willing to pay the full cost associated with the option as required by National, and agreed policy settings, which means that a large non-refundable grant would be needed to fund the construction costs. Accordingly, this option is unlikely to be favored over an alternative proposal that addresses the same problem more efficiently and has a higher probability of recovering capital and operational costs. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.

Option 4F – Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders for this option are: **(a) Sunwater** Sunwater may potentially be responsible for the management of the infrastructure, transfer of water between schemes and the distribution to the irrigation areas under this option. **(b) Land holders and adjacent land holders** The landholders in the proximity of the proposed dam will be impacted by the changes the environment, land access and, potentially, land rights. The landholders will need to be consulted as part of any Detailed Business Case. **(c) Irrigators** The irrigators in and around Coalstoun Lakes, and downstream of the dam site on Barambah Creek will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megaliter costs will be necessary. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. *Sources: Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015;*
Environmental impact	A desktop assessment has previously been undertaken in relation to dam sites in this area, which included a basic environmental impact discussion. It will be necessary for an extensive assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. The previous desktop assessment predicted the presence of two threatened ecological communities: Brigalow and Lowland Rainforest of Subtropical Australia. The study also identifies the existence of a diversity of flora that will require assessment against the existing environmental protection regulations. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Environmental Protection Act 1994; Barambah Creek Proposal, 2018.*
Timeframe considerations	The timeframe for undertaking this option will be long, including detailed hydrological assessments, engineering assessments, regulatory approval, changes to the Burnett Water Plan, and planning for the construction of significant infrastructure. A basic estimate would be between 5 and 8 years to complete this project after government approval and funding has been secured. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of this option have been undertaken, although further assessment would be required in any detailed business case. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Barambah Creek Proposal, 2018.*
Access to water	This option would need to access unallocated water from the water plan (including a large volume of water allocations moved upstream from Paradise Dam. Compliance with the Water Plan's environmental flow objectives (EFOs) and Water Allocation Security Objectives (WASOs) would need to be assessed.

Option 4F – Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	
Proximity to demand	This option directly meets the demand for new supply of water to the highly fertile agricultural lands in Coalstoun Lakes and the surrounding areas. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. The proposed Coalstoun Lakes Irrigation Area is dominated by well drained and friable red volcanic soils. The proposed Ban Ban Springs Irrigation Area is dominated by alluvial soils, while the Biggenden region has both alluvial soils and volcanic rocks. The soil in the area has been assessed extensively and predominantly classified as classes 1, 2 and 3. Previous studies have identified and confirmed that Coalstoun Lakes, and the surrounding areas, have extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Cost recovery* The high costs of this option pose a substantive risk to its success. These risks can be mitigated through a clear plan for the recovery of costs from water users. However, the beneficiaries of this project are unlikely to be willing to pay the full cost associated with the option as required by National and agreed policy settings hence a non-refundable grant would be needed to fund the construction costs. Costs The uncertainty around the final version of irrigation system for this project, and the various assessment that are required to determine the optimal system, mean that the costs estimate is highly uncertain and could be subject to significant increases. *Legal* There are significant legal risks with this option due to the multiple legal transactions required to develop and execute the planning and construction of the dam and irrigation system. Consultation with existing land holders that will be impacted by the projects will be necessary and may require further legal consideration. *Regulatory* This option will require amendments to existing legislation and legislative instruments, including the Burnett Water Plan, operations manuals and bulk water service contracts. There is a risk with all amendments that there will be insufficient political and government support for the changes. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. The size of the proposed dam increases the potential for an impact on cultural heritage sites, although this will depend on the final location of the dam. *Hydrological* Further modelling is required to determine whether a dam of this size is the optimal size to deliver the required yield. Preliminary modelling suggests that this dam is larger than necessary and that the existing demand could be satisfied with a smaller dam or weir (such as Option 4A).
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	

Option 4F – Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.12 Option 4G: Build a pipeline from Paradise Dam to Boondooma pipeline via Coalstoun Lakes

Option 4G – Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	
Background to this option	
Description	This option proposes the construction of a 100km pipeline between Paradise Dam and Boondooma Dam to transfer surplus water allocations in Paradise Dam to areas of higher demand. Multiple pump stations and 2.2MW of power will be required to the manage elevation on the route. This option would connect the dams at Wivenhoe, Boondooma and Paradise and facilitate greater efficiency between these storages by locating surplus water to areas of high demand within the Burnett Water Plan area. This option would provide new water to irrigators in: • Coalstoun Lakes, via the new pipeline; and • the South Burnett region via the existing Tarong-Boondooma Pipeline. This option would facilitate the generation of 20,000ha of new irrigation areas in these two regions. This option involves resetting the water allocations in the Boyne River and Tarong Scheme so that Tarong Power Station sources all of its water from Wivenhoe Dam through the Tarong-Wivenhoe pipeline. *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Costs of this option	The upfront capital investment for this option is estimated at $425m, although this estimation has not been subject to detailed scrutiny and significant additional work is required to determine accurate capital and operational cost for this project. *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015.*
Hydrological benefits and how they will be realised	This option would provide an additional 30,000 ML+ of medium priority water allocations.
Customer benefits and how they will be realised	The customer benefits of this option will be the availability of new water for irrigators in the Boyne River Irrigation Scheme (primarily Coalstoun Lakes) and South Burnett. These benefits will be realised through the creation of new water allocations for irrigators in the respective schemes, and pumping water from Paradise Dam in the Bundaberg Water Supply Scheme. *Source: Getting Water for Peanuts, 2018*
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett and South Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. The areas that will receive new water under this option have large parcels of high-quality soil (including significant parts with class 1 and 2 soil). *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	While this option does seek to improve the efficiency of existing water resources, it requires the construction of significant, high cost, water infrastructure that is may not achieve a return on a commercial return on capital or operational investment. This option has poor alignment with the policy and objectives of the Queensland Government in relation to:

Option 4G – Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	
	(e) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. (f) Supporting infrastructure development that provides a commercial return to bulk water providers. The existing State and National fiscal environment and limitations mean that a project of this size, complexity and cost will have significant funding challenges. The project beneficiaries are unlikely to be willing to pay the full cost associated with the option as required by National, and agreed policy settings, which means that a large non-refundable grant would be needed to fund the construction costs. This option's reliance on water from Paradise Dam will be subject to the decision making in relation to how to distribute existing and future volume from that storage. *Source: Paradise Dam Options Assessment 2020; Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require substantive amendments to existing legislation, regulations and legislative instruments, including the Burnett Water Plan, operations manuals, water management protocols and bulk water service contracts. There will be multiple flow on effects to various regulations that will require consideration and amendment as a result of this option. This option will require amendments to the rules providing for transfer of allocations between schemes and/or resetting of allocations under the Bundaberg Water Supply Scheme, Boyne River & Tarong Supply Scheme, and potentially other schemes in North Burnett. It is likely that the level of legislative and regulatory amendment required will impede the progress of this project, and could mean that it could not proceed. This option will involve multiple administrative law considerations including land access, public easements for new infrastructure, infrastructure management and potentially compensation for affected parties.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders for this option are: **(a) Existing water users in the areas surrounding Paradise Dam** These stakeholders could be concerned that any solution in respect of the water currently held within Paradise Dam, and future allocations from the dam, does not negatively impact water users in the Bundaberg Water Scheme. If this option progresses it will need to be considered as part of the overall assessment of Paradise Dam being conducted by Building Queensland and Sunwater. **(b) Sunwater** Sunwater may potentially be responsible for the management of the infrastructure, transfer of water between schemes and the distribution to the irrigation areas under this option. **(c) Stanwell (Tarong Power Station)** Under the original option, Tarong Power Station will be required to source its water exclusively from Wivenhoe Dam. This would have significant impacts for Stanwell in relation to water security; power generation security; additional costs for sourcing that water; Stanwell's financial contribution to Boondooma Dam; and the capacity of existing infrastructure (including the Tarong-Wivenhoe Pipeline). Stanwell are currently undertaking a comprehensive review of its water needs and infrastructure and if this option progresses it will need to be considered within that review. The Stanwell review is scheduled to be completed in 2021. **(d) Irrigators** The irrigators in and around Coalstoun Lakes, and in South Burnett, will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. Many

Option 4G – Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	
	of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Environmental impact	The previous studies on this option have not produced a detailed environmental assessment, and it will be necessary for an extensive assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. This option covers a large area and will require the construction of a large quantity of pipelines across North Burnett. It is likely that there will be environmental impact complications that require further assessment, and potentially an Environmental Impact Assessment. *Source: Getting Water for Peanuts, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Timeframe considerations	The timeframe for undertaking this option will be long, including detailed hydrological assessments, regulatory approval, and detailed planning for the construction of major infrastructure. A basic estimate would be at between 4 and 6 years to complete this project after government approval and funding has been secured. *Source: Getting Water for Peanuts, 2018.*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source would facilitate greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of this option have been undertaken, although further assessment would be required if this option progresses. Due to the highly fertile soil and prime growing conditions in the Coalstoun Lakes area, the introduction of new reliable water is likely to attract interest from agricultural businesses located outside of Coalstoun Lakes. Investors from outside the area could potentially be interested in acquiring existing farms, or farmable land, and introducing new capital and expanded production to the area. One impact of this investment could be that land values in the Coalstoun Lakes area would likely increase. According to the primary study on this option, the direct agricultural production benefit of $140M could deliver an increase in economic activity of $490M annually, which would transform the region economically. The study estimated that the option would lead to the generation of 2,700 new jobs and greater utilization of existing public infrastructure. *Source: Getting Water for Peanuts, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Access to water	This option relies on being able to secure large volumes of unsold water at Paradise Dam. It is unclear when / if these volumes might be available from Paradise Dam given it is currently being temporarily lowered for dam safety reasons.
Proximity to demand	This option seeks to deliver new water sources directly to existing demand in the highly fertile agricultural lands around Gayndah, Coalstoun Lakes and South Burnett. All of these areas have fertile soil suitable for growing a diverse range of agricultural products. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils, and the Biggenden region has both alluvial soils and volcanic rocks. The soil in Coalstoun Lakes has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that the Coalstoun Lakes area specifically has extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land.

Option 4G – Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes	
	Based on consultations, it is expected that the demand for new reliable water will be particularly high in the Coalstoun Lakes area due to the high fertile soil and prime growing conditions. Demand in Coalstoun Lakes would include: • Existing local irrigators that have strongly advocated for increased water supply and reliability in the area; • Nut growers based in Bundaberg that identify the high value production available in the Coalstoun Lakes area with the introduction of new, reliable water; and • Sugar cane growers based in Bundaberg that identify the high value production available in the Coalstoun Lakes area with the introduction of new, reliable water. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Return on investment* While the modelling previously undertaken on this option has produced high rates of return and net present value for the project, those financial models are heavily based on assumptions regard water and energy prices that are unreliable and potentially subject to significant change. If this option were to progress it would require detailed, critical financial modelling that considers negative scenarios for commodity pricing. *High Costs* The costs of this option are prohibitively high and pose an unacceptable risk to its success and completion. The requirement to source non-refundable investment from Government sources will negatively impact the viability of this option. *Legal* There are significant legal risks associated with this option due to the multiple legal transactions required to develop and execute the planning and construction of the major water and energy infrastructure. This option will impact a large number of land holders, and there is the potential of significant resistance from impacted land owners and rights holders. *Regulatory* This option will require amendments to existing legislation and legislative instruments, including the Burnett Water Plan, operations manuals and bulk water service contracts. There is a risk with all amendments that there will be insufficient political and government support to achieve and complete these changes. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. *Source: Getting Water for Peanuts, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.1.13 Option 4H: Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes

Option 4H - Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes	
Background to this option	
Description	This option proposes to source 55,000 ML of water from Paradise Dam and pump it through a 170 km pipeline to the Tarong-Boondooma Pipeline via the highly fertile agricultural Coalstoun Lakes area. This option would use electricity generated through a pumped-hydro energy storage system to pump water along the pipeline, with excess electricity fed into the electricity grid. This option would involve the development and construction of major water infrastructure (170km pipeline, pump-stations, balance reservoirs, distribution networks); and energy infrastructure (head and tail ponds, penstock, transmission). This option relocates water from Paradise Dam to other areas. The areas that will receive new water under this option have identified urban demand for additional water and/or potential for agricultural expansion with identified demand. This option is complex and will require a staged construction and delivery to overcome multiple challenges, including rising elevation of 375m over the length of the 170km pipeline that requires significant pumping infrastructure. This option has a diverse water distribution network covering a large area of North Burnett and parts of South Burnett, including multiple urban locations (including Murgon, Biggenden and Kingaroy) and agricultural areas (including Coalstoun Lakes, the Boyne Irrigation Scheme and Biggenden irrigation). *Source: Water Transfer and Hydro Storage Study, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Costs of this option	The total capital cost is estimated between $1.24 and $1.73 billion, including water and energy infrastructure. Detailed operational costs and expenditure information is not available at this stage and would be required if this option progresses further. The initial proposal on this option identifies the need for a scalable public investment of between $350m and $833m. A preliminary analysis indicates that there would be a significant shortfall in cost recovery from water users for capital and operational costs on this option. *Source: Water Transfer and Hydro Storage Study, 2018*
Hydrological benefits and how they will be realised	• Stage 1a. Starting with a pump-station at Paradise Dam a pipeline would carry water at continuous duty to Buffer Storage which also serves as a Tail Dam for a pumped hydro installation. A gravity flow via Mt Hastings Creek would provide about 13.1GL of irrigation and augmented urban supply to Biggenden. Transmission losses of 25% and 3.2GL for evaporative losses were allowed for in this scenario. This scenario estimated a net cost of $229/ML for MP supply including a pipeline capex share of 25%. The estimate considered 75% and 100% utilisation to supply around 2000ha of cane, dairying and other irrigation uses. • Stage 1b A 17 km pipeline from the buffer storage to Coalstoun Lakes supplying **21GL** of MP irrigation water, which would be sufficient to irrigate 7,118ha at an annualised average of 5.0ML/ha/year and a peak flow equivalent to 3.3mm/ha/day. In this scenario an estimated $241/ML cost of unpressurised supply for at 100% utilisation was derived. This is considered feasible for MP irrigation use with a marginal rate of return greater than the $250/ML for many crops currently grown in the area. The capital cost estimate included a provisional estimate for the distribution of irrigation water throughout the Coalstoun Lakes – Ban Ban Springs area through a flow-telescoped pipeline based on previous estimates by PPK for a similar area and application volume 5ML/ha/year and the same unit rate ($2600/ha). • Stage 2 Comprising Coalstoun Lakes to Tingoora via pipeline extension to AHD300 supplying about **8.9GL** of irrigation water and up to 3.4GL of HP water for urban supplies in Wondai, Tingoora, Wooroolin and Memerambi en-route. This scenario identified and estimated a cost of supply of $602/ML for MP water at 100% utilisation. This is considered affordable for high value horticultural crops including wine grapes, vegetables and tree crops. • Stage 3. Comprising Tingoora to Kingaroy/Boondooma via relift and pipeline interconnecting with the existing Tarong pipeline at Ellwoods Rd relift station. This scenario estimated the cost of medium priority irrigation supply at $802/ML 100% utilisation (considered potentially affordable only for high value horticultural uses, intensive animal production, urban and industrial use) and $1000/ML for high priority urban and industrial demand around Kingaroy. *Source: Water Transfer and Hydro Storage Study, 2018*

Option 4H - Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes	
Customer benefits and how they will be realised	The new irrigation areas in Coalstoun Lakes, Biggenden and Barambah would benefit most significantly from this option through the delivery of new additional water directly to prime agricultural land that is in close proximity to food processing facilities and export infrastructure. There are a large number of customers that would potentially benefit from a new reliable water source pumped from Paradise Dam under this option: • Coalstoun Lakes irrigators would receive 15GL/a that would irrigate an area of 15,500 hectares of prime agricultural land that is in close proximity to food processing facilities and export infrastructure. • Biggenden irrigators would receive 4 GL/a • Biggenden urban and industrial would receive 0.5 GL/a • Murgon urban would receive 0.5 GL/a. • Barambah irrigation scheme would receive 9.5 GL/a. • Wondai urban would receive 0.1 GL/a. • Tingoora urban would receive 0.1 GL/a. • Kingaroy irrigation scheme would receive 10 GL/a. • Boyne irrigation scheme would receive 5 GL/a. • Kingaroy urban and industrial would receive 2 GL/a. *Source: Water Transfer and Hydro Storage Study, 2018*
The problem(s) this option seeks to address	This option seeks to address three specific problems identified in the Strategic Business Case: • There are large areas of fertile land in North Burnett that do not have access to a reliable source of water. This includes Coalstoun Lakes, and the surrounding areas, that have high quality soil (including significant parts with class 1 and 2 soil). The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. • The agricultural sector needs a more reliable water source in order to grow. This option will address this problem by providing reliable water directly to irrigators for expanded agricultural production. • Kingaroy has a low level of urban water reliability and an increasing demand for water. This option proposes, among other outcomes, to provide an additional 2GL of water to Kingaroy for urban and industrial use. *Source: Water Transfer and Hydro Storage Study, 2018; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	This option requires the construction of major, high cost, water infrastructure that is unlikely to achieve a return on a commercial return on either capital or operational investment. This option has poor alignment with the policy and objectives of the Queensland Government in relation to: (a) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. (b) Supporting infrastructure development that provides a commercial return to bulk water providers. The existing State and National fiscal environment and limitations mean that a project of this size, complexity and cost will have significant funding challenges. The project beneficiaries are unlikely to be willing to pay the full cost associated with the option as required by National, and agreed policy settings, which means that a large non-refundable grant would be needed to fund the construction costs. Further, this option's reliance on 55,000 ML of water from Paradise Dam does not align with the Stage Government's stated intention to focus on water users that would ordinarily benefit from Paradise Dam in determining how to distribute that water in the future. It is possible that some water from Paradise Dam may be available, although the amount sought in this option is unlikely to be accessible. *Source: Paradise Dam Options Assessment 2020; Queensland bulk water opportunities statement, 2019; Water Transfer and Hydro Storage Study, 2018.*

Option 4H - Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes	
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require substantive amendments to existing legislation, regulations and legislative instruments, including the Burnett Water Plan, operations manuals, water management protocols and bulk water service contracts. There will be multiple flow on effects to various regulations that will require consideration and amendment as a result of this option. This option will require amendments to the rules providing for transfer of allocations between schemes and/or resetting of allocations under the Bundaberg Water Supply Scheme, Boyne River & Tarong Supply Scheme, and potentially other schemes in North Burnett. It is likely that the level of legislative and regulatory amendment required will impede the progress of this project, and could mean that it could not proceed. This option will involve multiple administrative law considerations including land access, public easements for new infrastructure, infrastructure management and potentially compensation for affected parties.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having low feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	Due to the size of the proposed project, and the large volume of water that would be distributed to a diverse range of water users, there are a large number of stakeholders that would be directly impacted by this option. The primary stakeholders include: **(a) Existing water users in the areas surrounding Paradise Dam** These stakeholders will be concerned that any solution in respect of the water currently held within Paradise Dam, and future allocations from the dam after it is fixed, does not negatively impact water users in the Bundaberg Water Scheme. If this option is to progress, then it will need to be considered as part of the overall assessment of Paradise Dam being conducted by Building Queensland and Sunwater. **(b) Sunwater** Sunwater would potentially be responsible for the management of the transfer of water between schemes and the distribution to the irrigation and urban areas under this option. This option would dramatically alter the existing irrigation schemes and urban water arrangements across large parts of North and South Burnett. Sunwater would be required to take a central, leading role in reshaping the water system and the Burnett Water Plan under this option. **(c) Councils and urban water users** Urban water users under this proposed option would receive new water in multiple townships. There would need to be extensive consultation with councils regarding needs and the proposed new water that would be provided to these townships. **(d) Powerlink Queensland** As the owner and operator of the Queensland transmission network, Powerlink Queensland will be interested in the proposal to feed hydro-electricity back into the grid. **(e) Irrigators** The irrigators in Coalstoun Lakes, Biggenden and Barambah will be a primary stakeholder in this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project.

Option 4H - Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes	
	Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; $1.5 million for Coalstoun Lakes Irrigation Pipeline Feasibility Study, 1 November 2019.
Environmental impact	The previous studies on this option have not produced a detailed environmental assessment, and it will be necessary for an extensive assessment of potential environmental impacts to be undertaken as part of a detailed business case relating to this option. This option covers an extensive land area and will require the construction of a large quantity of pipelines across North Burnett. It is likely that there will be environmental impact complications that require further assessment, and potentially an Environmental Impact Assessment. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Water Transfer and Hydro Storage Study, 2018; Environmental Protection Act 1994.*
Timeframe considerations	The timeframe for undertaking this option will be long. This option involves multiple stages that will each take considerable time and be subject to potential delays, including environmental assessments, detailed hydrological assessments, regulatory approval, changes to the Burnett Water Plan, and planning and construction of major infrastructure. A basic estimate of the potential timeframe would be between four and seven years to complete this project after government approval and funding has been secured. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018;*
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater potential investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of this option have been undertaken, although further assessment will be required if this option progresses. The project proposal estimates that the development and construction of this option will lead to 1,350 direct permanent jobs plus up to 4,725 indirect jobs. The proposal states that the option will have a GRP of $790m (6% of regional economy) and combined taxation receipts of $618m. Due to the highly fertile soil and prime growing conditions in the Coalstoun Lakes area, the introduction of new reliable water is likely to attract interest from agricultural businesses located outside of Coalstoun Lakes. Investors from outside the area could potentially be interested in acquiring existing farms, or farmable land, and introducing new capital and expanded production to the area. One impact of this investment could be that land values in the Coalstoun Lakes area would likely increase. Further, this option seeks to provide renewable energy source to the wider region, and align with the Powering Queensland Plan by providing a mechanism for power generation and management that includes pumped storage generation capacity. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Barambah Creek Proposal, 2018; Water Transfer and Hydro Storage Study, 2018; Powering Queensland Plan 2017*
Access to water	This option relies on being able to secure large volumes of unsold water at Paradise Dam. It is unclear when / if these volumes might be available from Paradise Dam given it is currently being temporarily lowered for dam safety reasons.
Proximity to demand	This option seeks to deliver additional new water directly to existing demand in the highly fertile agricultural lands around Coalstoun Lakes, Biggenden and Barambah, and multiple area of demand urban. The Coalstoun Lakes area is dominated by well drained and arable red volcanic soils, and the Biggenden region has both alluvial soils and volcanic rocks. The soil in Coalstoun Lakes, Biggenden and Barambah has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in these areas are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that the Coalstoun Lakes area specifically has extensive areas that are suitable for irrigation, including: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for

Option 4H - Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes	
	stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. Based on consultations, it is expected that the demand for new reliable water will be particularly high in the Coalstoun Lakes area due to the highly fertile soil and prime growing conditions. Demand in Coalstoun Lakes would likely include: • Existing local irrigators that have strongly advocated for increased water supply and reliability in the area; • Nut growers based in Bundaberg that identify the high value production available in the Coalstoun Lakes area with the introduction of new, reliable water; and • Sugar cane growers based in Bundaberg that identify the high value production available in the Coalstoun Lakes area with the introduction of new, reliable water. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.; Water Transfer and Hydro Storage Study, 2018*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Return on investment* While the modelling previously undertaken on this option has produced high rates of return and net present value for the project, those financial models are heavily based on assumptions regarding water and energy prices that are unreliable and subject to change. If this option were to progress it would require detailed, critical financial modelling that considers negative scenarios for commodity pricing. *High Costs* The costs of this option are prohibitively high and pose an unacceptable risk to its success and completion. The requirement to source non-refundable public investment without a string prospect of economic return will negatively impact the viability of this option. *Legal* There are significant legal risks associated with this option due to the multiple legal transactions required to develop and execute the planning and construction of the major water and energy infrastructure. This option will impact a large number of land holders, and there is the potential for resistance from impacted land owners and rights holders. *Regulatory* This option will require amendments to existing legislation and legislative instruments, including the Burnett Water Plan, operations manuals and bulk water service contracts. There is a risk with all amendments that there will be insufficient political and government support to achieve and complete these changes. *Project Complexity* This option is highly complex and has multiple interdependencies that would complicate the coordination of the project and increase the risk of project failure. This includes complications relating to feeding electricity into the grid and any instability that creates for the nearby power generation and storage systems. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Water Transfer and Hydro Storage Study, 2018*
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as being feasible and will not proceed to Shortlisting through Multi-Criteria Analysis.

B.1.14 Option 4I: Raise Jones Weir, Raise Claude Wharton Weir. build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme

Option 4I: – Raise Jones Weir, Raise Claude Wharton Weir, build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	
Background to this option	
Description	This option proposes undertaking a combination of construction projects in order to supply 20,000 – 25,000ML of water to the highly fertile agricultural area in and around Coalstoun Lakes. This option includes: • 1.5m raising of the Claude Wharton Weir Full Supply Level by installing crest gates or some other construction (outlined in detail in Option 3A); • Raising Jones Weir by 1.4m (outlined in detail in Option 2A); • Building a new weir on the Burnett River, downstream of the confluence with Barambah Creek; and • Building a pipeline, or similar, to transport the water to Coalstoun Lakes • Extending the downstream extent of the Upper Burnett Water Supply Scheme to include the location of the new weir on the Burnett River The purpose of this option is to deliver reliable new water to the highly fertile agricultural area around Coalstoun Lakes. This option would be facilitated by the creation of 20,000-25,000ML of new medium priority water allocations at an annual price that would allow the capital and operational costs of the project to be partially recovered from the water users. This option has been designed in order to capitalise on the presence of potential water allocations in upper Burnett, and facilitate the movement of water to an area of high economic potential and growth. The size and location of the new weir on the Burnett River will be subject to further hydrological and engineering review in order to maximize the effectiveness of that water storage. The location of that weir will impact on the route, length and construction of the pipeline to Coalstoun Lakes. *Source: Gayndah Regional Irrigation Development Project (GRID); Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; State Development and Public Works Organisation Act 1971; Initial Advice Statement: Jones Weir Stage II, 1998.*
Costs of this option	This option has multiple costs elements: • 1.5m raising of the Claude Wharton Weir has been estimated at $7.5million. • 1.4 raising of Jones Weir was estimated at $5.9 million in 2001 and the Paradise Dam Options Assessment (2020) indicated it could cost approximately $25 million. • There is currently no cost estimate for the weir on the Burnett River and this will require further analysis of both capital and operational costs. • There is currently no cost estimate for the pipeline or similar irrigation network, and this will require further analysis of both capital and operational costs. *Source: Gayndah Regional Irrigation Development Project (GRID); Sources: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1)*
Hydrological benefits and how they will be realised	This option has not been modelled in detail, but might be expected to yield 20 to 30 GL of medium priority water allocations.
Customer benefits and how they will be realised	The customer benefit of this option is the supply of 20,000-25,000ML of medium priority water to existing demand in the highly fertile agricultural lands around Coalstoun Lakes. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils. The soil in Coalstoun Lakes has been assessed

Option 4I: – Raise Jones Weir, Raise Claude Wharton Weir, build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	
	extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that Coalstoun Lakes has extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes, 4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000; Gayndah Regional Irrigation Development Project (GRID)*
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. The Coalstoun Lakes area, which would potentially receive new water under this option, has large parcels of high-quality soil, including significant parts with class 1 and 2 soil. *Sources: Agricultural Land Resource Assessment of Coalstoun Lakes, 2000*; *Gayndah Regional Irrigation Development Project (GRID)*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option includes broadly aligns with Government objectives in relation to the efficient use of existing water resources and infrastructure, and seeking to support projects that may provide a financial return for commercial return to bulk water providers. This project is designed to relocated inefficient water to a potential area of high production, which aligns with State Government economic policy and objectives. *Source: Queensland bulk water opportunities statement, 2019; Gayndah Regional Irrigation Development Project (GRID)*
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	*Raising Claude Wharton Weir* As a result of the decision to deflate and decommission the Claude Wharton fabridam in November 2008 (following the failure of a similar inflatable structure at Bedford Weir), the water sharing rules in the operations plan currently exclude 10,469 ML of medium priority water allocations. In effect, this means that 10,469 ML of medium priority water (held by Burnett Water) in the Upper Burnett Water Supply Scheme are unused and not able to access, or be supplied from, the water announced as being available in the scheme. Should the storage volume in the system be reinstated (through, for example, the construction of a new gated structure to replace the decommissioned fabridam), it is expected that these water allocations would be reinstated again. This is likely to require minor changes to the Operations Manual. *Raising Jones Weir* This has limited legislative issues and is unlikely to require direct amendment to legislation, although there may be some necessary amendments to legislative instruments in respect of any new water allocations. Subject to the final design and increased storage provided by the raising of Jones Weir, this project will be

Option 4I: – Raise Jones Weir, Raise Claude Wharton Weir, build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	
	consistent with the Burnett Water Plan, as amended as applicable to consider environmental flows and water allocation security objective outcomes. *New Weir and pipeline* This part of the project is likely to have limited legislative issues and is unlikely to require direct amendment to legislation, although there may be some necessary amendments to legislative instruments in respect of any new water allocations. *Extending Sunwater's Upper Burnett Water Supply Scheme* This would require amendment of the Resource Operations Licence for the Upper Burnett Water Supply Scheme, the Operations Manual and the Water Management Protocol. *Source: Burnett Water Plan 2020 and Operations Manual.*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders that will be impacted by this option are: **(a) Sunwater** Sunwater would potentially be responsible for the management of the new infrastructure, new water allocation, the sale of water and the operation of the new weir under this option. Sunwater will need to be consulted and involved in this option as it progresses. **(b) Irrigators in Coalstoun Lakes** The irrigators in and around Coalstoun Lakes will be key stakeholders and beneficiaries of this option. While there is broad support in these regions for an option that provides a new reliable water source the cost of the new water products must be commercially viable for the irrigators. A proper assessment of the willingness to pay the necessary per megaliter costs will be necessary. The lower cost of this option would presumably result in a lower water cost for irrigators, although that will need to be formally reviewed. Many of the impacted existing irrigators are represented by the Coalstoun Lakes Development Group, which has been successful in advocating for the study and potential development of a water infrastructure project in the area. In 2019, $1.5 million was awarded from the National Water Infrastructure and Development Fund to assess the benefits and viability of the Coalstoun Lakes Irrigation Pipeline project. (c) I*Source: Gayndah Regional Irrigation Development Project (GRID); Barambah Creek Proposal, 2018; Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998.*
Environmental impact	*Raising Claude Wharton Weir* There has been some assessment of the environmental impact of larger projects that incorporate the raising of Claude Wharton Weir, although it would not be suitable to apply those assessments here it could overstate the environmental impact. While the environmental impact of raising of Claude Wharton Weir, it will still be necessary to conduct a detailed review of the environmental impacts if this option progresses to a detail business case. Any review should consider whether it will be necessary to refer this project to the Commonwealth under the EPBC Act. *Raising Jones Weir* This raising of the weir has been subject to environmental review and has been approved by the Commonwealth Government, subject to the satisfaction of conditions designed to mitigate any likely determine impacts of the expanded infrastructure. The Department of Natural Resources commissioned a Review of Environmental Factors in 1998. This review identified the environmental impacts of this option and proposed mitigation actions for the planning and construction. An Environmental Management Plan

Option 4I: – Raise Jones Weir, Raise Claude Wharton Weir, build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	
	was prepared for this option, which covered predevelopment, construction and operational phases. The Queensland Government provided certification that the proposal had been assessed to the greatest extent possible. Commonwealth Government approval under the EPBC Act was granted in 2001. *New Weir and pipeline or irrigation network* Further and additional assessment will be required to determine the environmental impact of the new weir on the Burnett Rover and the pipeline to Coalstoun Lakes may be limited. It will be necessary to conduct a detailed of the environmental impacts if this option progresses to a detail business case. Any review should consider whether it will be necessary to refer this project to the Commonwealth under the EPBC Act. *Sources: Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Initial Advice Statement: Jones Weir Stage II, 1998; Gayndah Regional Irrigation Development Project (GRID); Environmental Protection and Biodiversity Conservation Act, 1999.*
Timeframe considerations	Subject to the findings of an environmental assessment, the approvals, planning and construction of this project should not be long and do not pose a substantive barrier to the progress of this project. A full detailed timeline and risk management process will be necessary as part of a detailed business case on this option.
Social and economic considerations	Agriculture is a major economic driver in the Coalstoun Lakes area with crops dominated by citrus, fodder crops such as Lucerne, small crops, broad acre crops such as peanuts, soya and navy beans, stone fruit, avocadoes, rock melons and potatoes. The introduction of a new reliable water source will allow for greater investment in a diversity of crops, and lead to potential increases in production, employment and downstream economic activity. Some limited assessment of the economic and social impact of similar options have been undertaken, although further assessment would be required in any detailed business case. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Access to water	Unallocated water might be assembled from a combination of: • moving 10,459 ML of MP from Claude Wharton plus • utilising part or all of the unallocated water reserves in the upper Burnett and Barker Barambah systems plus moving unsupplemented and/or supplemented water purchased from an upstream of the new weir and transforming it to new supplemented water at the required offtake location If the above strategies do not provide sufficient water allocations to underpin the proposed option, then some water from downstream either from Paradise Dam or the unallocated reserve in the Bundaberg Water Supply Scheme might be required. Compliance with the Water Plan's environmental flow objectives (EFOs) and Water Allocation Security Objectives (WASOs) would need to be assessed for this option.
Proximity to demand	This option seeks to deliver new water sources directly to existing demand in the highly fertile agricultural lands around Coalstoun Lakes. The Coalstoun Lakes area is dominated by well drained and friable red volcanic soils. The soil in Coalstoun Lakes has been assessed extensively and predominantly classified as classes 1, 2 and 3. The climatic conditions in the area are unpredictable, and the rainfall in the catchment is relatively low and unreliable. Previous studies have identified and confirmed that Coalstoun Lakes, and the surrounding areas, have extensive areas that are suitable for irrigation: 6,290 ha suitable for sugarcane, 5,793 ha for asparagus, cruciferae and vegetables, 5,713 ha for beans, 5,793 ha for cucurbits, 4,190 ha for lucerne, 5,580 ha suitable for navybean and potato, 4,596 ha for sorghum, 4,418 ha for soybean, 4,596 ha for sweet corn, 5,660 ha for sweet potato, 6,281 ha for avocado, macadamia, citrus, lychee and mango, 4,325 ha for grapes,

Option 4I: – Raise Jones Weir, Raise Claude Wharton Weir, build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme	
	4,289 ha for stonefruit, 4,781 ha for peanuts, 4,596 ha for maize and 6,591 ha for pasture. Furrow irrigation of sugarcane is suitable on only 1,284 ha of land. *Sources: Review for Lower Barambah Coalstoun Lakes Irrigation Scheme, 2015; Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Assessment against public interest consideration	This option has been assessed as having high feasibility against the public interest considerations.
Risk Considerations	
Risks	*Costs* The viability of this option is impacted by the ability of the water operator being able to recover the operational costs through water sales. There is a limited risk that the costs would not be recovered, which may be mitigated through a comprehensive demand and expression of interest process as part of the development of the Detailed Business Case. Consultations with irrigators in Coalstoun Lakes identified strong demand for additional water. *Legal* This option will involve legal risks associated with the transactions and impact of the infrastructure on adjacent land holders. These risks should be managed through careful consideration, and consultation with adjacent land holders, as part of the development of the Detailed Business Case. *Source: Gayndah Regional Irrigation Development Project (GRID); Agricultural Land Resource Assessment of Coalstoun Lakes, 2000.*
Feasibility assessment against risk considerations	This option has been assessed as having high feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis.

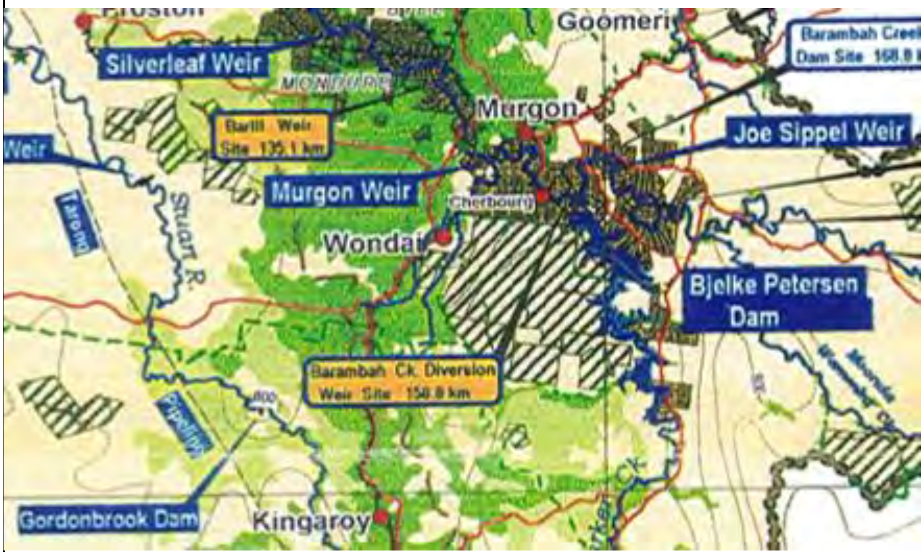
B.2 South Burnett Options

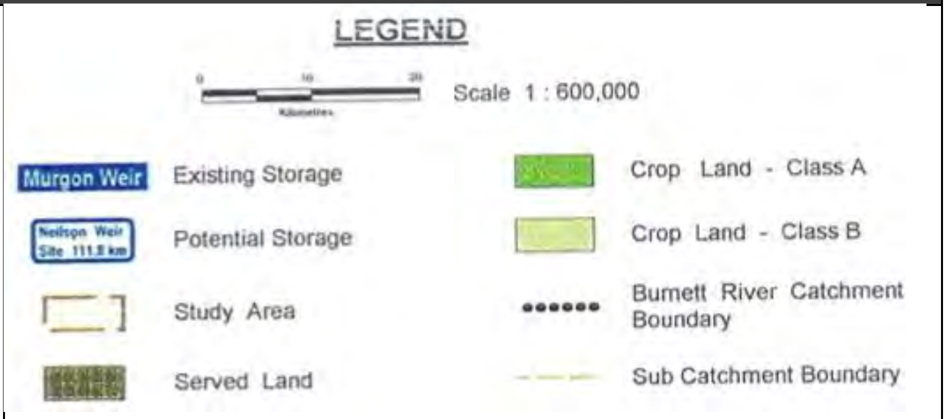
B.2.1 Option 5: Construct a re-regulating weir on the Barambah Creek (Barlil Weir)

Option 5: Construct a re-regulating weir on the Barambah Creek	
Background to this option	
Description	This option proposes the construction of a 1,000 ML capacity re-regulating weir on Barambah Creek downstream of Bjelke-Petersen Dam. This proposed project is known as Barlil Weir. The proposed site for the Barlil Weir is on Barambah Creek at 135.2 km AMTD, downstream of Bjelke-Petersen Dam and about 8 km north-west of the township of Murgon. The purpose of this new weir would be to increase medium priority water allocations at the reregulating weir plus indirectly benefit all water users in the Barker Barambah Water Supply Scheme through increases in its system operation efficiency. This option will also improve alignment of agricultural water allocations to demand in areas containing fertile soils. *Sources: Barlil Weir – Initial Advice Statement, 1998; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002;*

Option 5: Construct a re-regulating weir on the Barambah Creek	
Costs of this option	The cost of this option has been estimated at approximately $2.8 million ($2002), although the project concept has been subject to revisions since that time. An updated cost estimate that includes obtaining new/updated approvals is likely to be between $6.5million and $8.5million. Updated costing, including considering alternative construction methods, should be conducted if this option progresses. *Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002;*
Hydrological benefits and how they will be realised	This option would result in approximately 3,000 ML of additional medium priority water allocations.
Customer benefits and how they will be realised	The customers that would directly benefit from this option are irrigators that hold existing medium priority allocations around the area of Barlil Weir. These irrigators will benefit from increased reliability for allocations that have typically been highly unreliable due to dependence on releases from Bjelke Petersen Dam. The indirect beneficiaries of this option will be all medium priority allocation holders in the Barker Barambah Water Supply Scheme, as this re-regulating weir will increase the efficiency for the whole scheme and indirectly improve reliability for all allocations. *Sources: Barlil Weir – Initial Advice Statement, 1998*
The problem(s) this option seeks to address	This option seeks to address the problem of large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. This option seeks to address this problem by providing a large quantity of reliable water. The proposed Barlil Weir would increase the reliability for a large area of agricultural land from the weir site through to Stonelands (from 135.2 to 89.9 AMTD on Barambah Creek). *Sources: Barlil Weir – Initial Advice Statement, 1998*
Strategic Considerations	
SIP Classification	Classified as 'New' under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option has previously received support and approval from State and Commonwealth Governments, and was classified as an Infrastructure facility of Significance by the Commonwealth Government 2002. This option is relatively low-cost option (especially compared to alternative proposals, such as a dam on upper Barambah Creek) that would provide tangible benefits. This project is broadly suitable within the current fiscal environment. This option aligns generally with the policy and objectives of the Queensland Government in relation to: (a) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. While some expenditure would be required for this weir construction, it is relatively low compared to alternative infrastructure proposals for the area. (b) Supporting infrastructure development that provides a commercial return to bulk water providers provided commitments can be obtained from users and a cost recovery model can be developed. *Source: Queensland bulk water opportunities statement, 2019; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002;*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the risk considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option has limited legislative issues and is unlikely to require direct amendment to legislation, although there may be some necessary amendments to legislative instruments (Operations Manual and Water Management Protocol) in respect of any new water allocations. Subject to the final

Option 5: Construct a re-regulating weir on the Barambah Creek	
	design and increased storage provided by the construction of Barlil Weir, this option will be consistent with the Burnett Water Plan, as amended as applicable to consider environmental flows and water allocation security objective outcomes. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002;*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the risk considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders that will be impacted by this option include: **(a) Sunwater** Sunwater would potentially be responsible for the management of this new water infrastructure asset and the introduction of this re-regulating weir will impact the flows and reliability of the allocation announcements in the Barker Barambah Water Supply Scheme. Sunwater will need to provide further consultation regarding this option, although it is noted that Sunwater have detailed knowledge of some of the previous work undertaken on this option. **(b) Irrigators around, and downstream of, Barlil Weir** The irrigators around, and downstream of, the proposed weir will benefit directly from the construction of the weir and will experience improvements to water reliability. These irrigators will likely need to demonstrate willingness to contribute to the cost recovery of this project in water prices. **(c) Other water users in the Water Scheme** Other water users (particularly irrigators) will indirectly benefit from the improvements to efficiency in the Barker Barambah Water Supply Scheme. **(d) Adjacent land holders and other land holders in the area** Adjacent land holders will be impacted through the construction of the weir, including associated issues of land access, land acquisition and the environmental impacts of the weir and its construction. Land holders generally in the area will potentially experience increased land values with the improvements to water reliability for irrigators. *Source: Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Barlil Weir – Initial Advice Statement, 1998*
Environmental impact	This option has been subject to environmental review and has been approved by the Commonwealth Government, subject to the satisfaction of conditions designed to mitigate any likely impacts of the expanded infrastructure. The Department of Natural Resources commissioned a Review of Environmental Factors in 1998. This review identified the environmental impacts of this option and proposed mitigation actions for the planning and construction. An Environmental Management Plan was prepared for this option, which covered predevelopment, construction and operational phases. The Queensland Government provided certification that the proposal had been assessed to the greatest extent possible. Commonwealth Government approval under the EPBC Act was granted in 2001. Permission was previously granted by the Executive Director of Fisheries to construct the weir without the need to incorporate a fishway into the structure. *Sources: Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Barlil Weir – Initial Advice Statement, 1998; Fisheries Act 1994 sections 114,6*

Option 5: Construct a re-regulating weir on the Barambah Creek	
Timeframe considerations	The timeframes for this project should not hinder its progress on the basis that much of the necessary planning has been completed and necessary approvals have been obtained. While there will need to be updates and reviews of previous preparation work for this project, it should be relatively efficient to move to construction of this project once the funding mechanism has been confirmed. *Sources: Environment Protection and Biodiversity Conservation Act 1999; Statement Giving Reasons (Infrastructure Facilities of Significance) Notice (no 1) 2002; Barlil Weir – Initial Advice Statement, 1998*
Social and economic considerations	The proposed weir will increase the reliability of water for irrigators in the local area, and have a significant impact on the townships of Goomeri, Murgon and Cherbourg and Wondai, and the rural communities in the area. The area will benefit from increased employment and economic activity from the construction and increased investment in the agricultural industry facilitated by increased water reliability and security Some preliminary consultation shave been held with the traditional owners of the land and further investigations and studies will be required. Initial investigations identified no apparent non-indigenous cultural and heritage issues in the proposed area of the weir. Further investigations and studies will be required to confirm and update these studies. *Sources: Barlil Weir – Initial Advice Statement, 1998*
Access to water	This option would require up to 4,250 ML to be allocated from the unallocated reserve for water infrastructure on Barker Barambah Creek within the Barker Barambah Water Supply Scheme.
Proximity to demand	This option would provide increased water allocations directly to an area of demand that has highly fertile soils and cropping land. The demand for increased water in the area of the proposed Barlil Weir is high, with high quality soils, existing agricultural operations and opportunities for expanded production. The soil and land assessments of the area have identified significant unserved land that would be suitable for irrigation. Image 2 is a map of the area around the proposed weir site, showing a high concentration of Class A Crop Land. **Image 2 – Cropping land around Barlil Weir site** 

Option 5: Construct a re-regulating weir on the Barambah Creek	
	 *Sources: Barlil Weir – Initial Advice Statement, 1998*
Assessment against public interest consideration	This option has been assessed as having high feasibility against the risk considerations.
Risk Considerations	
Risks	*Funding* The funding for this option is uncertain and would need to be established in order to demonstrate that the project could be fully funded and the costs recovered. This risk may be mitigated through a comprehensive demand assessment and commitments from water users that will benefit from improved reliability. The Initial Advice Statement from 1998 identified that irrigators at the time had indicated a willingness to contribute 30% of the capital cost of the weir. *Aboriginal and Torres Strait Islander cultural heritage* Further investigations and consultations are required to identify the state of any cultural heritage matters relating to this option. *Requirement for additional review and approvals* While a large volume of studies have been completed on Barlil Weir, and approvals obtained from State and Commonwealth Governments, much of this work was completed up to 22 years ago. There is a risk that substantive further investigations, and approvals, may be required due to changes in laws and circumstances in the intervening time period. *Sources: Barlil Weir – Initial Advice Statement, 1998*
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.2.2 Option 6: Flood harvesting from Barambah Creek into Bjelke-Petersen Dam

Option 6 – Flood harvesting from Barambah Creek into Bjelke-Petersen Dam
Background to this option

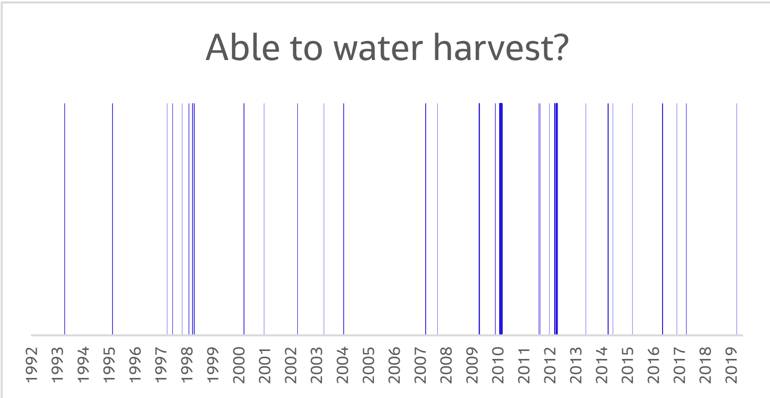
Description	This option proposes to develop and implement system and process for pumping flood waters, at times of significant inflows, from Barambah creek, into Barker Creek to be stored in Bjelke-Petersen Dam. As Bjelke-Petersen Dam is rarely full, there is capacity to improve the capture of water to be used by current and new irrigators. The purpose of this option is to improve the reliability for irrigators that hold medium priority allocations in the Barker Barambah Water Supply Scheme. The Bjelke-Petersen Dam is not a high performing water storage, and this option would improve the performance of water products that rely on the dam for supply. This option would require review and refinement of existing flood management regulations and practices to ensure that during times of flood that there is a ready system and process that would allow flood waters to be harvested efficiently, safely and effectively. This option involves the building of a substantial channel for the transmission of high volumes of water over a short period (4-5 days) in the event of a flood event. The channel is estimated to be 2.0km in length, and at least 2m deep and 14m wide. The possible location of the channel is shows in below **Possible location of flood harvesting channel** 
Costs of this option	The preliminary estimate of the costs of this project are: • Capital costs for the channel construction $15+million; and • Capital costs for the pump station construction $2-5million. Operational costs, including electricity charges, would potentially be high.
Hydrological benefits and how they will be realised	To access the water, additional water harvesting rights would need to be obtained. These rights are within the total available allocation is the river – which is 4,250. If this volume was used for this purpose, then it would not be available for other projects, such as Barlil Weir. Water harvesting can occur in accordance with the rules of the Water Management Area, shown below:

The water allocation groups for unsupplemented water harvesting for the Barker Barambah Creeks Water Management Area are detailed in Table 3.

Table 3: Water allocation groups

WRP Subcatchment	Water Allocation Groups	Flow Condition	Zone
H	Class 1H	Start 875 ML/day at Silverleaf Weir Gauging Station. Cease 200 ML/day at Ficks Crossing Gauging Station or its replacement.	Barker Barambah HJ, HK, HL
	Class 2H	Start 950 ML/day at Ficks Crossing Gauging Station or its replacement. Cease 432 ML/day at Ficks Crossing Gauging Station or its replacement.	
	Class 3H	Start 300 ML/day at Litzows Gauging Station and 1 400 ML/day at Ficks Crossing Gauging Station or its replacement. Cease 432 ML/day at Ficks Crossing Gauging Station or its replacement.	
J	Class 1J	Start 500 ML/day at Litzows Gauging Station. Cease 432 ML/day at Ficks Crossing Gauging Station or its replacement.	Barker Barambah JC, JD
	Class 2J	300 ML/day at Glenmore Gauging Station and Bjelke-Petersen Dam is overflowing.	

Water harvesting by its nature is an opportunistic, normally rare, event. In this case, the flows need to meet two thresholds (Litzow and Ficks Crossing). Based on the available data since 1992, the water could be pumped for five days a year, on average. The bars on the below graph shows the days when pumping is allowed.



In order to access the 4,250 ML across five days, the pumps would need to be able to transfer 850 ML per day.

Customer benefits and how they will be realised

The customers that will benefit from this option are irrigators in the Barker Barambah Water Supply Scheme that rely on Bjelke-Petersen Dam for water supply. These irrigators will benefit from increased reliability for their allocations from Bjelke-Petersen Dam, which will be possible because of the increased water level and yield from the dam.

The problem(s) this option seeks to address

This option will address to the problem of existing agricultural supplemented water allocations are highly unreliable resulting in reduced agricultural output, jobs & investment. This option would increase reliability for irrigators and facilitate greater commercial stability, growth and investment.

Strategic Considerations

SIP Classification

Classified as New under the State Infrastructure Plan Hierarchy.

Alignment with Government policy and objectives

This option is relatively higher-cost option (especially compared to alternative proposals, such as Barlil Weir) and the benefits are unreliable. While this project aligns generally some policies and objectives of the Queensland Government there would be significant concerns that it would be unable to provide a commercial return for its considerable capital and operational costs.

Source: Queensland bulk water opportunities statement, 2019

Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option would likely require amendments to the Water Management Protocol, Operations Plan and Water Plan.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	**(a) Irrigators around, and downstream of, Bjelke Petersen Dam** The irrigators around, and downstream of, Bjelke Petersen Dam would potentially benefit from increased reliability of their existing water allocations if this option resulted in improved performance by Bjelke Petersen Dam. **(b) Land holders** Land holders on and around the channel route will be impacted by the construction and operation of the channel.
Environmental impact	The environmental impact of this option would relate to both the construction and the operation of the channel during periods of flood. There has not been any investigation of the potential environmental impacts at this stage, and it is likely that this option would require an Environmental Impact Statement due to the substantive potential impact of the proposed construction.
Timeframe considerations	The timeframe for the planning, approvals and construction for this option could be significant. Due to the irregular performance of the option (i.e. approximately 1 in 4 years), delays in implementation could impact the effectiveness in the initial years of operation.
Social and economic considerations	The proposed weir could potentially increase the reliability of water for irrigators in the local area. However, due to the unreliable and irregular performance of the option, it is questionable that it would result in increased investment and production for local irrigators due to the inability to undertake effective business planning.
Access to water	This option could potentially result in an additional 4,250 ML of water in Bjelke Petersen Dam, which would require the purchasing of water harvesting rights.
Proximity to demand	This option would potentially provide increased reliability directly to an area of demand that has highly fertile soils and cropping land. The demand for increased reliability in the area of the Bjelke-Petersen Dam is high, with high quality soils, existing agricultural operations and opportunities for expanded production. The soil and land assessments of the area have identified significant unserved land that would be suitable for irrigation. *Sources: Barlil Weir – Initial Advice Statement, 1998*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	***Costs*** The benefits of this option are unreliable and the cost is relatively high compared to some alternative options in the area. There could be difficulty in recovering the costs from water users.

	Construction The channel required for this project is significant in size and could create substantive environmental and other disruption in the area.
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.2.3 Option 7: Convert Gordonbrook Dam to irrigation use

Option 7: – Convert Gordonbrook Dam to irrigation use

Background to this option

Description

This option proposes converting Gordonbrook Dam to exclusive irrigation use, and removing the existing high priority allocation for urban usage in Kingaroy township. The purpose of this option is to provide improved reliability for irrigators with existing medium priority allocation holders in Boyne River & Tarong Water Supply Scheme.

South Burnett Regional Council holds an 1,809 ML high priority water allocation from Gordonbrook Dam that supplements the water supply for Kingaroy. The primary water supply for Kingaroy is Boondooma Dam. Gordonbrook Dam is a 6,600 ML storage located 14km northwest of Kingaroy on the Stuart River. It is owned and operated by the South Burnett Regional Council.

Gordonbrook Dam has significant water quality issues that mean that South Burnett Regional Council will only utilise the storage for urban water supply when it is storing more than 3,250 ML (50% of full supply volume).

South Burnett Regional Council currently draws approximately 30% of Kingaroy's water supply from Gordonbrook Dam and 70% from Boondooma Dam. Under this option, South Burnett Regional Council would need to increase its draw from Boondooma Dam for Kingaroy, potentially through purchasing water allocations from the Tarong Power Stations. Purchasing allocations from Stanwell (owner of the Tarong Power Stations) cannot be confirmed with certainty, and would be subject to detailed analysis by Stanwell on the potential impacts on water security at the Tarong Power Stations.

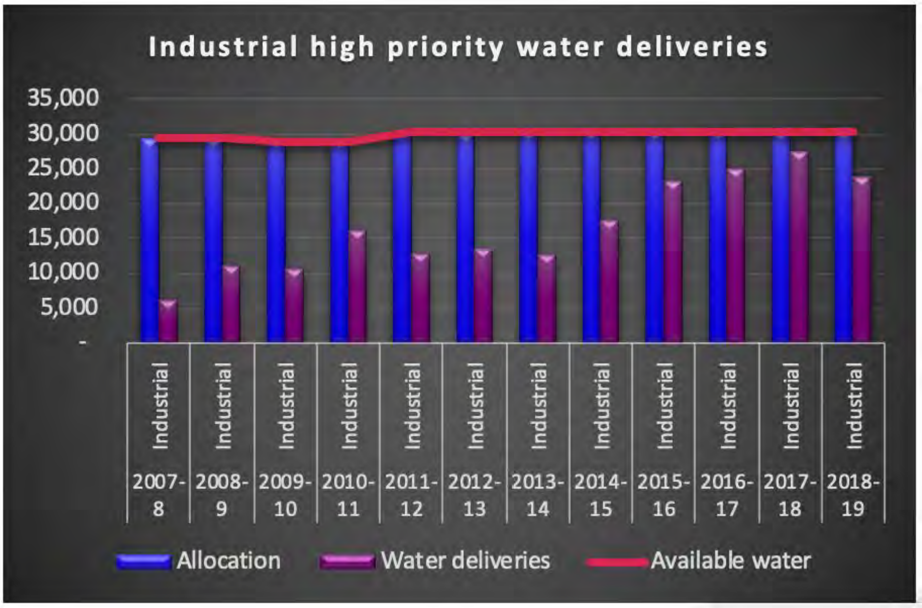
The Boyne River & Tarong Scheme presently has an allocation of 30,333ML/year for industrial (high priority) water, although since 2007-8 the actual industrial water deliveries has average 55% of the available allocation. Table 7 and Figure 7 show industrial water deliveries reported by Sunwater in each year since 2007-8 (it should be noted that 2009/10 to 2001/12 have been estimated on the basis of available information due to a change in reporting structure in those years).

Table 7 – Industrial water deliveries 2007-2019

Year	Customer Segment	Allocation	Water deliveries	Available water
2007-8	Industrial	29,374	6,177	29,345
2008-9	Industrial	29,374	11,087	29,374
2009-10	Industrial	29,226	10,722	28,934
2010-11	Industrial	29,226	16,120	28,934
2011-12	Industrial	30,558	12,873	30,252
2012-13	Industrial	30,134	13,567	30,453

2013-14	Industrial	30,455	12,716	30,453
2014-15	Industrial	30,453	17,695	30,453
2015-16	Industrial	30,453	23,254	30,453
2016-17	Industrial	30,453	25,071	30,453
2017-18	Industrial	30,333	27,443	30,333
2018-19	Industrial	30,333	23,814	30,333

Figure 7 – Industrial water deliveries



Importantly, there are multiple commercial and other factors that contribute to an industrial water user taking part or all of their water allocation in any particular year. It should not be assumed that an industrial water user will take less than their full allocation in any particular year.

Other alternative sources (other than Boondooma Dam) that South Burnett Regional Council could consider for accessing increased urban water include are borefield south of Kingaroy or water harvesting strategies.

Sources: Kingaroy Regional Water Supply Security Assessment, 2020; Kingaroy Water Supply: Augmentation of Raw Water Supply, 1995; Sustainable Water Alternatives for the Southern Burnett, 2004, Sunwater Annual Reports 2007/8-2018/9

Costs of this option	The primary cost for this option would be sourcing a secure, permanent water supply for Kingaroy urban and industrial usage. This water could potentially be sourced through purchases from the Tarong Power Stations at a commercial rate that allows Stanwell to recover all of its costs, or via a new storage considered in one of the other options in this study.
Hydrological benefits and how they will be realised	This option would provide up to 1,809 ML of high priority water for irrigation if Kingaroy were to source its water from another source. At present, Council only accesses water from the dam when it is above 50% of its full supply volume due to water quality issues and capacity constraints at the water treatment plant. This means that although it is high priority water, the actual performance is currently less. If this water were to be made available (and considered a suitable water quality) for irrigation, this constraint may be removed. **Gordonbrook Dam: recorded storage behaviour from January 1993 to January 2019**

Customer benefits and how they will be realised	The customers that would benefit from this option are potentially irrigators that purchase the high priority water allocations. These irrigators would benefit from additional new water.
The problem(s) this option seeks to address	This option seeks to address the problem of existing agricultural supplemented water allocations are highly unreliable resulting in reduced agricultural output, jobs & investment. This option may potentially improve reliability for existing medium priority allocation holders in South Burnett.
Strategic Considerations	
SIP Classification	Classified as Better Use under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option generally aligns with the Government objective to facilitate the efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. However, this option relies on finding a new source of water for the township of Kingaroy. Unless such a suitable, secure and cost-efficient alternative water source is secured, this option (alone) would conflict with Government policy and therefore meet with significant objections. *Source: Queensland bulk water opportunities statement, 2019*
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	There would be limited regulatory issues associated with this option other than potentially changing the 'purpose of use' for the existing water allocation from Gordonbrook Dam to enable its use by irrigators.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having low feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	**a) South Burnett Regional Council** This option would require the Council to source additional high priority water for Kingaroy from an alternative source, which may be difficult to locate and costly. Importantly, urban water shortages for Kingaroy are a specific problem identified in the Strategic Business Case, and this option would directly exacerbate (rather than address) that problem. **b) Irrigators** If this option increased the supply for water in the Boyne River and Tarong Water Supply Scheme, the irrigators would benefit considerably. During direct consultations, irrigators in South Burnett have expressed support for projects that increase the water availability and reliability. The irrigators advised

	that increased supplies would have tangible benefits for the area, including greater business certainty, employment growth and commercial stability and investment. *Sources: Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020; Sustainable Water Practices, a top priority for Tarong Power Stations (Stanwell), 2019.*
Environmental impact	The environmental impacts of this option would be minimal because it should not make a tangible difference to the amount of water extracted from Gordonbrook Dam provided that a suitable minimal storage buffer is applied to the dam. Gordonbrook Dam has had considerable water quality issues, although these issues relate to the use of the water for drinking and other urban uses, and do not appear to be evidence of environmental impact or distress at the dam.
Timeframe considerations	Subject to necessary approval, the timeframe for this option would be short.
Social and economic considerations	Agriculture is an important part of the South Burnett regional economy, with large areas of suitable soils providing a wide range of agricultural activities including animal production, broadacre cropping (such as peanuts, navy beans and soybeans), fodder crops, horticulture, macadamia nuts and sugarcane. The area around Gordonbrook Dam on the Stuart Rover, and downstream of Boondooma Dam, would potentially experience increased investment as a result of improved water reliability that would lead to increased production capacity, employment and benefits to the region. *Sunwater letter to Boyne Irrigators, 2017*
Access to water	This option would not require any water from unallocated reserves. The option would not have any water plan implications other than enabling a change of use from urban to agriculture.
Proximity to demand	There is significant demand for increased water and water reliability from irrigators in the Boyne River and Tarong Water Supply Scheme. If this option increased the supply and/or reliability for those irrigators it could directly meet the demand in that area. Studies have identified 3,800 hectares of class 1 soil around Kingaroy, which is highly fertile for agricultural production. The irrigation lands around Gordonbrook Dam and Boondooma Dam have been assessed as being suitable for increased agricultural production and could expand current irrigation operations with increased water reliability. This option would provide increased reliability to land that is considered suitable for a broad range of agriculture, including tree and vine crops. Sources: *Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Soils and Agricultural Suitability of the South Burnett Agricultural Lands, 2001*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Removing urban water from Kingaroy* Kingaroy has a low level of urban water reliability and an increasing demand for water. Without increasing supply, there is a one in four probability that urban water needs cannot be met in any given year. Kingaroy is already experiencing a significant urban water shortage (it has been on level 3 water restrictions since 15 March 2017). This option would increase the risk of water failure for Kingaroy and its population of 10,398. This risk could be mitigated through securing an alternative supplementary water supply that could remove the need for Gordonbrook Dam for urban and industrial use.
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.2.4 Option 8: Construct water recycling plant at Swickers facility in Kingaroy

Option 8 – Construct water recycling plant at Swickers facility in Kingaroy	
Background to this option	
Description	This option proposes to upgrade and expand water treatment system at the Swickers processing and packaging facility in Kingaroy for the onsite recycling and reuse of water for use in the Swickers operations. The proposed water treatment system will allow Swickers to treat and reuse between 5.00ML and 8.8ML per week. The purpose of this option is to make Swickers self-sufficient for a part of its daily water usage for industrial purposes. Swickers currently use around 14 ML per week on site from a combination of sources: • 7-8 ML per week is sourced from the Kingaroy water treatment plant and is purchased from South Burnett Regional Council at commercial rates. • 6 ML per week is sourced from bores owned and operated by Swickers. • 0- 4 ML is sourced from existing onsite recycling, although this water is only suitable for cleaning vehicles. The volume of water that can be sourced from Kingaroy water treatment plant is limited by the council owned water infrastructure, which is designed to pump water at 18L/second but only is capable of pumping at 12L/second. If Swickers were to exceed this pumping rate it would result in substantive water quality problems for Swickers and potentially for urban water users in Kingaroy. This option would allow Swickers to either reduce the amount of water it takes from Kingaroy, or expand its operation on the basis of the additional water supply it secures from the new water treatment system.
Costs of this option	The capital cost of this is approximately $2.8 million. It currently costs $1.60 per kl to treat water on site. $3.65 per KL full life cycle to reuse water on site. Initial modelling suggests that the avoided costs of purchasing water from the council is greater than the upfront and ongoing costs of the water recycled plant. That is, the Net Present Value is positive.
Hydrological benefits and how they will be realised	It is unclear whether this option will increase water supply and security in Kingaroy as it may not result in a reduction in the volume of water that Swickers access from the Kingaroy urban supply (that is, Swickers may expand their operations use the additional water to support that expansion).
Customer benefits and how they will be realised	The customer that will directly benefit from this option is Swickers through the accessing of lower cost, higher reliability water from the onsite water treatment system.
The problem(s) this option seeks to address	This option will seek to directly address the problem of poor security of urban water limiting industrial expansion. By making a portion of its water supply self-sufficient, Swickers will improve the water security for its operations.
Strategic Considerations	
SIP Classification	Classified as Improve Existing under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option includes broadly aligns with Government objectives in relation to the efficient use of existing water resources and infrastructure without the need for expenditure on new water infrastructure. While this option does involve capital expenditure on infrastructure, the focus on improving existing infrastructure instead of major expenditure on a wholly new project aligns with the Governments fiscal efficiency policy focus. This option aligns with Government support for water solutions with a lower environmental impact. *Source: Queensland bulk water opportunities statement, 2019*

Option 8 – Construct water recycling plant at Swickers facility in Kingaroy	
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	Not legislative change will be required for this option. The construction of the improved water treatment facility will require the necessary regulatory approvals for construction and water treatment.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The primary stakeholders that will be impacted by this option are: **(a) Swickers** Swickers will receive significant benefit from this option by increasing the security and reliability of a portion of its water supply for its commercial operations. **(b) Urban and industrial water users** Urban and other industrial water users will potentially be impacted by reducing stress on the water storage and available water sources.
Environmental impact	This option should not have any significant negative environmental impact. The potential positive impact from this option is significant as it allows water to be reused and reduces the volume of waste water released by the Swickers plant.
Timeframe considerations	The estimated timeframe for construction of this plant is 9 months from approvals, although this would likely extend to 12 months before the water treatment plant is fully operational.
Social and economic considerations	This option allows Swickers to continue, and potentially expand, its operations in Kingaroy. Swickers is one of the largest businesses and employers in Wide Bay Burnett and is critical to the stability and growth of employment and linked businesses.
Access to water	This option would provide an additional 5ML per week, which would be produced through the treatment of 7 ML (a loss of 2 ML through the treatment process). This would provide an additional 260 ML per year to the Swickers operations.
Proximity to demand	Swickers have indicated in consultations that it could use a significant additional quantity of water in its operations and that it intended expand its operations as greater water volume is available.
Assessment against ***public interest consideration***	This option has been assessed as having high feasibility against the public interest considerations.
Risk Considerations	
Risks	*Water treatment system performance* There is a risk that the water treatment facility does not perform as highly as anticipated and the return on the investment is slower and weaker than anticipated. This risk should be managed through contractual protections with the provider building the water treatment plant.
Feasibility assessment against risk considerations	This option has been assessed as having high feasibility against the risk considerations.
Outcome of High-Level Assessment	

Option 8 – Construct water recycling plant at Swickers facility in Kingaroy	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.2.5 Option 9A: Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)

Option 9A – Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	
Background to this option	
Description	This option proposes that the Tarong Power Stations source more of its water from Wivenhoe Dam through the Wivenhoe pipeline, which would reduce its usage of Boondooma Dam. Under this option, the Tarong Power Stations would then sell (by way of permanent transfer) approximately 500ML/year to 1,300ML/year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy, while retaining Gordonbrook Dam for urban water usage, will be subject to further review and will depend on the level of urban water security sought by the South Burnett Regional Council. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). Under this option, the South Burnett Regional Council would retain Gordonbrook Dam for urban usage and continue the treatment and mixing of water from Gordonbrook Dam with the water from Boondooma Dam. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14million ($2013). The Tarong Power Stations presently use approximately 32,000 ML of water per year. The power stations currently source High Priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma-Tarong Pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme which produces purified recycled water. This water is supplied through the Wivenhoe Pipeline. Both sources of water are important to the water security and power generation requirements of the stations. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Stations, and any alteration to Stanwell's water allocation from the dam must not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the State Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019-20, the Tarong Power Stations will take around 50 per cent of their water from Wivenhoe Dam. Option 7 in this appendix provides further discussion on the industrial high priority water deliveries in the Boyne River & Tarong Scheme from 2007/8 to 2018/9. This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Stations *Sources: Boyne River & Tarong Bulk Water Service Contract 2018/19-2023/24*
Costs of this option	The costs of this option will primarily result from the additional operational costs to Stanwell to permanently source and pump additional water from the more expensive source of Wivenhoe Dam. It is essential that Stanwell are not financially disadvantaged by any arrangement and receive full

Option 9A – Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	
	compensation for any additional costs resulting from this option, including water, operational and other associated costs.
Hydrological benefits and how they will be realised	This option would free up a volume of high priority water allocations and supplies from Boondooma Dam that is equivalent to the increase in volume of water to be sourced from Wivenhoe by Tarong Power Station via the Wivenhoe Pipeline.
Customer benefits and how they will be realised	The customer benefit for this option is the supply of additional high priority water for urban and industrial use in South Burnett, particularly for Kingaroy. This option proposes that Stanwell make a permanent arrangement to source a significant proportion of its high priority water from Wivenhoe so that more water is permanently available for other users from Boondooma Dam. This arrangement may be achieved through the permanent transfer of Stanwell's high priority allocation at Boondooma Dam to other high priority customers.
The problem(s) this option seeks to address	This option will directly address the problem of poor security of urban water supply.
Strategic Considerations	
SIP Classification	Classified as Better Use under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option aligns closely with the State Government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of South Burnett (and more generally to North Burnett). Furthermore, this option is potentially lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation prioritizes the safety and security of power generating facilities, including ensuring that water security is maintained and protected. This option will need to be closely reviewed and considered by the Energy Division of the Department of National Resources, Mines and Energy, and Stanwell, to determine whether this option poses a risk to water security and power generation at the Tarong Power Stations. If this option poses an unacceptable risk that cannot be successfully mitigated, then it is unlikely to proceed. The progress of this option will depend on the outcome of a review of water requirements at the Tarong Power Stations. *Sources: Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require no legislative changes and only minimal regulatory changes that are needed to reflect the changes in water allocations in the Boyne River & Tarong Water Supply Scheme. Most of the changes required for this option will be in commercial negotiations and contracts between Stanwell and Sunwater (who manage Boondooma Dam) and Seqwater (who manage Wivenhoe Dam). If the Tarong Power Stations were less reliant on Boondooma Dam, there may be a stronger argument for the removal of the 70,000 ML cut-off for medium priority allocations from the dam. This risk mitigation mechanism was implemented to protect water (and energy generation) security for the stations, and could potentially be removed or reduced if Stanwell was permanently accessing a higher proportion of its water from Wivenhoe Dam. Removal of the 70,000 ML cut-off is outlined in Option 11.

Option 9A – Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	
	Sources: Boyne River & Tarong Water Supply Scheme
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders impacted by the option include: **(a) Seqwater** Seqwater own and manage Wivenhoe Dam. Seqwater will be a primary participant in any negotiation to increase the volume of water that the Tarong Power Stations access from Wivenhoe Dam. **(b) Sunwater** Sunwater manage the water allocations from Boondooma Dam under the Boyne River & Tarong Water Supply Scheme. Sunwater will be a primary participant in any negotiation to decrease Stanwell's high priority allocation from Boondooma Dam, and potentially increase the allocation to other urban, industrial and irrigation users. **(c) Stanwell** Stanwell are a major stakeholder in this option and will be impacted significantly in relation to water and generation security, commercial certainty, financial management, operations and general management. Stanwell own and manage the Wivenhoe Pipeline and will need to assess the engineering capacity and capability of the pipeline to manage any increased volume and usage. **(d) South Burnett Regional Council** The council is highly interested in securing increased water supply for urban and industrial users in the region. The water supply risk at Kingaroy is significant and this option would completely solve that problem for the Council. **(e) Industrial** Industrial businesses in South Burnett are very interested in any proposal that increases the security of water in the region. The largest business (other than Stanwell) operating in South Burnett is Swickers, which is significantly reliant on water for its operations.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raising Boondooma Dam. This will need to be considered further if this option progresses.
Timeframe considerations	This timeframe for implementing this option would be short, although obtaining the necessary Government support could take considerable time. A permanent arrangement for the transfer of allocations from Stanwell to South Burnett Regional Council would be subject to further analysis by Stanwell in relation to impacts on water security at the Tarong Power Stations. However, Stanwell and the Council may be able to reach an arrangement for a temporary transfer to secure Kingaroy's water supply until after Stanwell have been able to complete its review.
Social and economic considerations	The Tarong Power Stations have a critical role in the social and economic environment of South Burnett, as the largest employer and supporter of public institutions and private businesses. If this option undermines or risks the security and integrity of the Tarong Power Station's then that could have a significant social and economic impact across the region. Improved water supply and security for urban water users in South Burnett, particularly Kingaroy, will impact social wellbeing and commercial values in the region. Increased water supply for industrial users will create greater opportunity for commercial investment, business growth and increases in employment in the region.

Option 9A – Tarong Power Station to source more of its water from Wivenhoe Dam (keep Gordonbrook Dam)	
	Source: Kingaroy Regional Water Security Assessment, 2020; Irrigation from the Boyne River: The Value of Improved Water Security, 2019
Access to water	This option would not require access to unallocated reserves or have any implications for the Water Plan's objectives.
Proximity to demand	Kingaroy could access additional water through the existing pipeline.
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Suitability of the pipeline* Use of the Wivenhoe Pipeline is owned and managed by Stanwell and would require formal engineering and operational review to determine the capability to increase capacity to accommodate and increase (or changes in) use. *Commercial impact on Seqwater* It is essential that additional supply from Wivenhoe Dam does not impact on Seqwater ability to meet its water security objectives for South East Queensland. Commercial transactions may not be possible between Stanwell and other customers (such as councils, industrial users or irrigators) for the temporary or permanent transfer of allocations. *Commercial impact on Sunwater* This option will potentially impact Sunwater's water scheme management and they must be consulted closely in relation to this option. *Cost recovery* Supplying water from Wivenhoe Dam is more expensive than from Boondooma Dam for Tarong Power Station or other potential water users accessing water from Wivenhoe Dam. This option cannot result increased, unrecoverable costs for Stanwell as owner and operator of the Tarong Power Stations, including any additional costs related to the Wivenhoe Pipeline. *Energy generation security* If this option compromises the energy security in the National Energy Market by reducing the water security for the Tarong Power Stations, that would create a substantive risk for Stanwell that would potentially prevent this option from progressing further. *Costs* This option may ultimately increase the costs for Stanwell (due to accessing more water from the more expensive source) to the point where the cost of compensating Stanwell is too high to justify. Formal costs modelling will be required if this option progresses further.
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.2.6 Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)

Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
Background to this option	
Description	This option proposes that the Tarong Power Stations source more of its water from Wivenhoe Dam through the Wivenhoe pipeline, which would reduce its usage of Boondooma Dam. Under this option, the Tarong Power Stations would then sell (by way of permanent transfer) approximately 500ML/year to 1,300ML/year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy, and allow South Burnett Regional Council to cease using Gordonbrook Dam for urban water usage, will be subject to further review and will depend on the level of urban water security sought by the South Burnett Regional Council. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). The purposes of this option are to provide urban water security for Kingaroy and Nanango, reduce urban reliance on the low-quality water in Gordonbrook Dam and increase the reliability for irrigators with existing medium priority allocation holders in Boyne River & Tarong Water Supply Scheme. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14million (2013). The Tarong Power Stations presently use approximately 32,000 ML of water per year. The power stations currently source High Priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma-Tarong Pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme which produces purified recycled water. This water is supplied through the Wivenhoe Pipeline. Both sources of water are important to the water security and power generation requirements of the stations. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Stations, and any alteration to Stanwell's water allocation from the dam must not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the State Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019-20, the Tarong Power Stations will take around 50 per cent of their water from Wivenhoe Dam. Option 7 in this appendix provides further discussion on the industrial high priority water deliveries in the Boyne River & Tarong Scheme from 2007/8 to 2018/9. This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Stations *Sources: Boyne River & Tarong Bulk Water Service Contract 2018/19-2023/24*
Costs of this option	The costs of this option will primarily result from the additional operational costs to Stanwell to permanently source and pump additional water from the more expensive source of Wivenhoe Dam. It is essential that Stanwell are not financially disadvantaged by any arrangement and receive full compensation for any additional costs resulting from this option, including water, operational and other associated costs.

Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
Hydrological benefits and how they will be realised	This option would free up a volume of high priority water allocations and supplies from Boondooma Dam that is equivalent to the increase in volume of water to be sourced from Wivenhoe by Tarong Power Station via the Wivenhoe Pipeline.
Customer benefits and how they will be realised	The customer benefits for this option are: • The supply of additional high priority water for urban and industrial use in South Burnett, particularly for Kingaroy and Nanango. • Improved water quality for urban water users in South Burnett by eliminating urban reliance on Gordonbrook Dam. • Increased reliability for irrigators with existing medium priority allocation holders in Boyne River & Tarong Water Supply Scheme. This option proposes that Stanwell make a permanent arrangement to source a significant proportion of its high priority water from Wivenhoe so that more water is permanently available for other users from Boondooma Dam. This arrangement may be achieved through the permanent transfer of Stanwell's high priority allocation at Boondooma Dam to other high priority customers.
The problem(s) this option seeks to address	This option will directly address the problem of poor security of urban water supply, and increases the reliability for irrigators in South Burnett.
Strategic Considerations	
SIP Classification	Classified as Better Use under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option aligns closely with the State Government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of South Burnett (and more generally to North Burnett). Furthermore, this option is potentially lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation prioritizes the safety and security of power generating facilities, including ensuring that water security is maintained and protected. This option will need to be closely reviewed and considered by the Energy Division of the Department of National Resources, Mines and Energy, and Stanwell, to determine whether this option poses a risk to water security and power generation at the Tarong Power Stations. If this option poses an unacceptable risk that cannot be successfully mitigated, then it is unlikely to proceed. The progress of this option will depend on the outcome of the Stanwell review of water requirements at the Tarong Power Stations. *Sources: Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require no legislative changes and only minimal regulatory changes that are needed to reflect the changes in water allocations in the Boyne River & Tarong Water Supply Scheme. Most of the changes required for this option will be in commercial negotiations and contracts between Stanwell and Sunwater (who manage Boondooma Dam) and Seqwater (who manage Wivenhoe Dam and the Wivenhoe Pipeline). If the Tarong Power Stations were less reliant on Boondooma Dam, there may be a stronger argument for the removal of the 70,000 ML cut-off for medium priority allocations from the dam.

Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
	This risk mitigation mechanism was implemented to protect water (and energy generation) security for the stations, and could potentially be removed or reduced if Stanwell was permanently accessing a higher proportion of its water from Wivenhoe Dam. Removal of the 70,000 ML cut-off is outlined in Option 11. *Sources: Boyne River & Tarong Water Supply Scheme*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders impacted by the option include: **(a) Seqwater** Seqwater own and manage Wivenhoe Dam. Seqwater will be a primary participant in any negotiation to increase the volume of water that the Tarong Power Stations access from Wivenhoe Dam. **(b) Sunwater** Sunwater manage the water allocations from Boondooma Dam under the Boyne River & Tarong Water Supply Scheme. Sunwater will be a primary participant in any negotiation to decrease Stanwell's high priority allocation from Boondooma Dam, and potentially increase the allocation to other urban, industrial and irrigation users. **(c) Stanwell** Stanwell are a major stakeholder in this option and will be impacted significantly in relation to water and generation security, commercial certainty, financial management, operations and general management. Stanwell own and manage the Wivenhoe Pipeline and will need to assess the engineering capacity and capability of the pipeline to manage any increased volume and usage. **(d) South Burnett Regional Council** The council is highly interested in securing increased water supply for urban and industrial users in the region. The water supply risk at Kingaroy is significant and this option would completely solve that problem for the Council. **(e) Industrial** Industrial businesses in South Burnett are very interested in any proposal that increases the security of water in the region. The largest business (other than Stanwell) operating in South Burnett is Swickers, which is significantly reliant on water for its operations. **(f) Irrigators in South Burnett** Irrigators in South Burnett would get increased reliability for medium priority allocations providing greater security and certainty in water supply for agricultural production.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raining Boondooma Dam. This will need to be considered further if this option progresses.
Timeframe considerations	This timeframe for implementing this option would be short, although obtaining the necessary Government support could take considerable time. A permanent arrangement for the transfer of allocations from Stanwell to South Burnett Regional Council would be subject to further analysis by Stanwell in relation to impacts on water security at the Tarong Power Stations. However, Stanwell and the Council may be able to reach an arrangement for a temporary transfer to secure Kingaroy's water supply until after Stanwell have been able to complete its review.

Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
Social and economic considerations	The Tarong Power Stations have a critical role in the social and economic environment of South Burnett, as the largest employer and supporter of public institutions and private businesses. If this option undermines or risks the security and integrity of the Tarong Power Station's then that could have a significant social and economic impact across the region. Improved water supply and security for urban water users in South Burnett, particularly Kingaroy, will impact social wellbeing and commercial values in the region. Increased water supply for industrial users will create greater opportunity for commercial investment, business growth and increases in employment in the region. The water quality from Gordonbrook Dam is a significant concern among urban water users consulting as part of this study. Removing Gordonbrook Dam from urban water usage for Kingaroy would potentially increase quality of life factors for residents of that township. Increased water reliability for irrigators in South Burnett would potentially increase the security and certainty for agricultural production and business growth and employment opportunities in the region. *Source: Kingaroy Regional Water Security Assessment, 2020 [NB: confirmation is required from SBRC prior to referencing this in a published document]; Irrigation from the Boyne River: The Value of Improved Water Security, 2019*
Access to water	This option would not require access to unallocated reserves or have any implications for the Water Plan's objectives.
Proximity to demand	Kingaroy could access additional water through the existing pipeline. There is significant demand for increased water and water reliability from irrigators in the Boyne River and Tarong Water Supply Scheme. If this option increased the supply and/or reliability for those irrigators it could directly meet the demand in that area. Studies have identified 3,800 hectares of class 1 soil around Kingaroy, which is highly fertile for agricultural production. The irrigation lands around Gordonbrook Dam and Boondooma Dam have been assessed as being suitable for increased agricultural production and could expand current irrigation operations with increased water reliability. This option would provide increased reliability to land that is considered suitable for a broad range of agriculture, including tree and vine crops. Sources: *Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Soils and Agricultural Suitability of the South Burnett Agricultural Lands, 2001*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Suitability of the pipeline* Use of the Wivenhoe Pipeline is owned and managed by Stanwell and would require formal engineering and operational review to determine the capability to increase capacity to accommodate and increase (or changes in) use. *Commercial impact on Seqwater* It is essential that additional supply from Wivenhoe Dam does not impact on Seqwater ability to meet its water security objectives for South East Queensland. Commercial transactions may not be possible between Stanwell and other customers (such as councils, industrial users or irrigators) for the temporary or permanent transfer of allocations. *Commercial impact on Sunwater* This option will potentially impact Sunwater's water scheme management and they must be consulted closely in relation to this option.

Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
	Cost recovery Supplying water from Wivenhoe Dam is more expensive than from Boondooma Dam for Tarong Power Station or other potential water users accessing water from Wivenhoe Dam. This option cannot result increased, unrecoverable costs for Stanwell as owner and operator of the Tarong Power Stations, including any additional costs related to the Wivenhoe Pipeline. *Energy generation security* If this option compromises the energy security in the National Energy Market by reducing the water security for the Tarong Power Stations, that would create a substantive risk for Stanwell that would potentially prevent this option from progressing further. *Costs* This option may ultimately increase the costs for Stanwell (due to accessing more water from the more expensive source) to the point where the cost of compensating Stanwell is too high to justify. Formal costs modelling will be required if this option progresses further.
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.2.7 Option 10A: Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)

Option 10A – Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	
Background to this option	
Description	This option proposes that the Tarong Power Stations source more of its water from purified recycled water sourced from the Luggage Point treatment plant (instead of Wivenhoe Dam) through the Wivenhoe Pipeline. This same option could be used where other manufactured water plants need to be kept running for operational reasons, but not for water security reasons, and the water could be used by the Tarong Power Stations. This would reduce the usage of Boondooma Dam. Under this option, the Tarong Power Stations would then sell (by way of permanent transfer) approximately 500ML/year to 1,300ML/year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy, while retaining Gordonbrook Dam for urban water usage, will be subject to further review and will depend on the level of urban water security sought by the South Burnett Regional Council. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). Under this option, the South Burnett Regional Council would retain Gordonbrook Dam for urban usage and continue the treatment and mixing of water from Gordonbrook Dam with the water from Boondooma Dam. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14million ($2013). The Tarong Power Stations presently use approximately 32,000 ML of water per year. The power stations currently source High Priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma-Tarong Pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme which produces

Option 10A – Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	
	purified recycled water. This water is supplied through the Wivenhoe Pipeline. Both sources of water are important to the water security and power generation requirements of the stations. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Stations, and any alteration to Stanwell's water allocation from the dam must not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the State Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019-20, the Tarong Power Stations will take around 50 per cent of their water from Wivenhoe Dam. Option 7 in this appendix provides further discussion on the industrial high priority water deliveries in the Boyne River & Tarong Scheme from 2007/8 to 2018/9. This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Stations *Sources: Boyne River & Tarong Bulk Water Service Contract 2018/19-2023/24*
Costs of this option	The costs of this option will primarily result from the additional operational costs to Stanwell to permanently source and pump additional water from a more expensive source. It is essential that Stanwell are not financially disadvantaged by any arrangement and receive full compensation for any additional costs resulting from this option, including water, operational and other associated costs. Consultations with Stanwell have confirmed that the use of purified recycled water can decrease the productivity of the Tarong Power Stations (due to the high concentration of Boron in the purified recycled water). This can be addressed by either using more water at the power station (to dilute the concentration of boron in the purified recycled water) or removing the boron from the purified recycled water through water treatment processes such as reverse osmosis or ion exchange. Managing the impacts of boron may result in an additional cost to Stanwell, and this would need to be factored into any consideration of this option.
Hydrological benefits and how they will be realised	This option would free up a volume of high priority water allocations and supplies from Boondooma Dam that is equivalent to the increase in volume of water to be sourced from manufactured water products by Tarong Power Station via the Wivenhoe Pipeline.
Customer benefits and how they will be realised	The customer benefit for this option is the supply of additional high priority water for urban and industrial use in South Burnett, particularly for Kingaroy. This option proposes that Stanwell make a permanent arrangement to source a significant proportion of its high priority water from manufactured water products so that more water is permanently available for other users from Boondooma Dam. This arrangement may be achieved through the permanent transfer of Stanwell's high priority allocation at Boondooma Dam to other high priority customers.
The problem(s) this option seeks to address	This option will directly address the problem of poor security of urban water supply.
Strategic Considerations	
SIP Classification	Classified as Better Use under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option aligns closely with the State Government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve

Option 10A – Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	
	the water balance and requirements of South Burnett (and more generally to North Burnett). Furthermore, this option is potentially lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation prioritizes the safety and security of power generating facilities, including ensuring that water security is maintained and protected. This option will need to be closely reviewed and considered by the Energy Division of the Department of National Resources, Mines and Energy, and Stanwell, to determine whether this option poses a risk to water security and power generation at the Tarong Power Stations. If this option poses an unacceptable risk that cannot be successfully mitigated, then it is unlikely to proceed. Government policy in relation to the use of manufactured water, and that is managed, will impact the viability of this option. Further consultation will be required, including with Seqwater and the Department of Natural resources, Mines and Energy if this option progresses. *Sources: Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require no legislative changes and only minimal regulatory changes that are needed to reflect the changes in water allocations in the Boyne River & Tarong Water Supply Scheme. Most of the changes required for this option will be in commercial negotiations and contracts between Stanwell and Sunwater (who manage Boondooma Dam) and Seqwater (who manage the Wivenhoe Pipeline). If the Tarong Power Stations were less reliant on Boondooma Dam, there may be a stronger argument for the removal of the 70,000 ML cut-off for medium priority allocations from the dam. This risk mitigation mechanism was implemented to protect water (and energy generation) security for the stations, and could potentially be removed or reduced if Stanwell was permanently accessing a higher proportion of its water from manufactured water products. Removal of the 70,000 ML cut-off is outlined in Option 11. *Sources: Boyne River & Tarong Water Supply Scheme*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders impacted by the option include: **(a) Seqwater** Seqwater own and manage Wivenhoe Dam. Seqwater will be a primary participant in any negotiation to increase the volume of water that the Tarong Power Stations access from Wivenhoe Dam. **(b) Sunwater** Sunwater manage the water allocations from Boondooma Dam under the Boyne River & Tarong Water Supply Scheme. Sunwater will be a primary participant in any negotiation to decrease Stanwell's high priority allocation from Boondooma Dam, and potentially increase the allocation to other urban, industrial and irrigation users. **(c) Stanwell**

Option 10A – Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	
	Stanwell are a major stakeholder in this option and will be impacted significantly in relation to water and generation security, commercial certainty, financial management, operations and general management. Stanwell own and manage the Wivenhoe Pipeline and will need to assess the engineering capacity and capability of the pipeline to manage any increased volume and usage. **(d) South Burnett Regional Council** The council is highly interested in securing increased water supply for urban and industrial users in the region. The water supply risk at Kingaroy is significant and this option would completely solve that problem for the Council. **(e) Industrial** Industrial businesses in South Burnett are very interested in any proposal that increases the security of water in the region. The largest business (other than Stanwell) operating in South Burnett is Swickers, which is significantly reliant on water for its operations.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raining Boondooma Dam. This will need to be considered further if this option progresses.
Timeframe considerations	This timeframe for implementing this option would be short, although obtaining the necessary Government support could take considerable time. A permanent arrangement for the transfer of allocations from Stanwell to South Burnett Regional Council would be subject to further analysis by Stanwell in relation to impacts on water security at the Tarong Power Stations. However, Stanwell and the Council may be able to reach an arrangement for a temporary transfer to secure Kingaroy's water supply until after Stanwell have been able to complete its review.
Social and economic considerations	The Tarong Power Stations have a critical role in the social and economic environment of South Burnett, as the largest employer and supporter of public institutions and private businesses. If this option undermines or risks the security and integrity of the Tarong Power Station's then that could have a significant social and economic impact across the region. Improved water supply and security for urban water users in South Burnett, particularly Kingaroy, will impact social wellbeing and commercial values in the region. Increased water supply for industrial users will create greater opportunity for commercial investment, business growth and increases in employment in the region. Increased water reliability for irrigators in South Burnett would potentially increase the security and certainty for agricultural production and business growth and employment opportunities in the region. *Source: Kingaroy Regional Water Security Assessment, 2020; Irrigation from the Boyne River: The Value of Improved Water Security, 2019*
Access to water	This option would not require access to unallocated reserves or have any implications for the Water Plan's objectives.
Proximity to demand	Kingaroy could access additional water through the existing pipeline. Sources: *Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Soils and Agricultural Suitability of the South Burnett Agricultural Lands, 2001*
Assessment against public interest consideration	This option has been assessed as having low feasibility against the public interest considerations.
Risk Considerations	

Option 10A – Tarong Power Station to source more of its water from manufactured water products (keep Gordonbrook Dam)	
Risks	*Suitability of the pipeline* Use of the Wivenhoe Pipeline is owned and managed by Stanwell and would require formal engineering and operational review to determine the capability to increase capacity to accommodate and increase (or changes in) use. *Commercial impact on Seqwater* It is essential that additional supply from Wivenhoe Dam does not impact on Seqwater ability to meet its water security objectives for South East Queensland. Commercial transactions may not be possible between Stanwell and other customers (such as councils, industrial users or irrigators) for the temporary or permanent transfer of allocations. *Commercial impact on Sunwater* This option will potentially impact Sunwater's water scheme management and they must be consulted closely in relation to this option. *Cost recovery* Supplying water from Wivenhoe Dam is more expensive than from Boondooma Dam for Tarong Power Station or other potential water users accessing water from Wivenhoe Dam. This option cannot result increased, unrecoverable costs for Stanwell as owner and operator of the Tarong Power Stations, including any additional costs related to the Wivenhoe Pipeline. *Energy generation security* If this option compromises the energy security in the National Energy Market by reducing the water security for the Tarong Power Stations, that would create a substantive risk for Stanwell that would potentially prevent this option from progressing further. *Costs* This option may ultimately increase the costs for Stanwell (due to accessing more water from the more expensive source) to the point where the cost of compensating Stanwell is too high to justify. Formal costs modelling will be required if this option progresses further.
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.2.8 Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)

Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
Background to this option	
Description	This option proposes that the Tarong Power Stations source more of its water from purified recycled water sourced from the Luggage Point treatment plant (instead of Wivenhoe Dam) through the Wivenhoe Pipeline. This same option could be used where other manufactured water plants need to be kept running for operational reasons, but not for water security reasons, and the water could be used by the Tarong Power Stations. This would reduce the usage of Boondooma Dam. Under this option, the Tarong Power Stations would then sell (by way of permanent transfer) approximately

Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
	500ML/year to 1,300ML/year of high priority water to South Burnett Regional Council to secure the urban water supply for Kingaroy. The actual volume of water required to secure urban water supply for Kingaroy, and allow South Burnett Regional Council to cease using Gordonbrook Dam for urban water usage, will be subject to further review and will depend on the level of urban water security sought by the South Burnett Regional Council. It is possible that less water may be required. This solution may potentially be extended to secure the water supply for Nanango (although this would require more water). The purposes of this option are to provide urban water security for Kingaroy and Nanango, reduce urban reliance on the low-quality water in Gordonbrook Dam and increase the reliability for irrigators with existing medium priority allocation holders in Boyne River & Tarong Water Supply Scheme. Gordonbrook Dam is subject to a dam safety upgrade requirement that is estimated to cost approximately $14 million ($2013). The Tarong Power Stations presently use approximately 32,000 ML of water per year. The power stations currently source High Priority water from Boondooma Dam (29,000 ML allocation) through the Boondooma-Tarong Pipeline. Tarong has a secondary supply agreement with Seqwater for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme which produces purified recycled water. This water is supplied through the Wivenhoe Pipeline. Both sources of water are important to the water security and power generation requirements of the stations. Critically, Boondooma Dam was purpose built to secure water for the Tarong Power Stations, and any alteration to Stanwell's water allocation from the dam must not have a net disbenefit for energy security and Stanwell's commercial mandate that is directed by the State Government. Under normal operating conditions, the Tarong Power Station seeks to maximise its supply from Boondooma Dam (its lowest cost source), and supplement that supply with water from the higher cost Wivenhoe Dam. In drought conditions, Stanwell typically reduces its water usage from Boondooma Dam to help preserve drinking water supplies for the South Burnett community. This requires that Stanwell increase its supply from Wivenhoe Dam. Stanwell advises that in 2019-20, the Tarong Power Stations will take around 50 per cent of their water from Wivenhoe Dam. Option 7 in this appendix provides further discussion on the industrial high priority water deliveries in the Boyne River & Tarong Scheme from 2007/8 to 2018/9. This option proposes that Stanwell make a permanent arrangement to source an annual volume of its high priority water from Wivenhoe Dam so that the same volume is permanently available for Kingaroy. Ultimately, Stanwell would need to agree to a permanent transfer of its high priority allocation at Boondooma Dam, which would be subject to a comprehensive review of Stanwell's water security requirements at the Tarong Power Stations *Sources: Boyne River & Tarong Bulk Water Service Contract 2018/19-2023/24*
Costs of this option	The costs of this option will primarily result from the additional operational costs to Stanwell to permanently source and pump additional water from a more expensive source. It is essential that Stanwell are not financially disadvantaged by any arrangement and receive full compensation for any additional costs resulting from this option, including water, operational and other associated costs. Consultations with Stanwell have confirmed that the use of purified recycled water can decrease the productivity of the Tarong Power Stations (due to the high concentration of Boron in the purified recycled water). This can be addressed by either using more water at the power station (to dilute the concentration of boron in the purified recycled water) or removing the boron from the purified recycled water through water treatment processes such as reverse osmosis or ion exchange. Managing the impacts of boron may result in an additional cost to Stanwell, and this would need to be factored into any consideration of this option.

Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
Hydrological benefits and how they will be realised	This option would free up a volume of high priority water allocations and supplies from Boondooma Dam that is equivalent to the increase in volume of water to be sourced from manufactured water products by Tarong Power Station via the Wivenhoe Pipeline.
Customer benefits and how they will be realised	The customer benefits for this option are: • The supply of additional high priority water for urban and industrial use in South Burnett, particularly for Kingaroy and Nanango. • Improved water quality for urban water users in South Burnett by eliminating urban reliance on Gordonbrook Dam. • Increased reliability for irrigators with existing medium priority allocation holders in Boyne River & Tarong Water Supply Scheme. This option proposes that Stanwell make a permanent arrangement to source a significant proportion of its high priority water from manufactured water products so that more water is permanently available for other users from Boondooma Dam. This arrangement may be achieved through the permanent transfer of Stanwell's high priority allocation at Boondooma Dam to other high priority customers.
The problem(s) this option seeks to address	This option will directly address the problem of poor security of urban water supply, and increases the reliability for irrigators in South Burnett.
Strategic Considerations	
SIP Classification	Classified as Better Use under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option aligns closely with the State Government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of South Burnett (and more generally to North Burnett). Furthermore, this option is potentially lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation prioritizes the safety and security of power generating facilities, including ensuring that water security is maintained and protected. This option will need to be closely reviewed and considered by the Energy Division of the Department of National Resources, Mines and Energy, and Stanwell, to determine whether this option poses a risk to water security and power generation at the Tarong Power Stations. If this option poses an unacceptable risk that cannot be successfully mitigated, then it is unlikely to proceed. The progress of this option will depend on the outcome of the Stanwell review of water requirements at the Tarong Power Stations. *Sources: Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require no legislative changes and only minimal regulatory changes that are needed to reflect the changes in water allocations in the Boyne River & Tarong Water Supply Scheme. Most of the changes required for this option will be in commercial negotiations and contracts between Stanwell and Sunwater (who manage Boondooma Dam) and Seqwater (who manage the Wivenhoe Pipeline).

Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
	If the Tarong Power Stations were less reliant on Boondooma Dam, there may be a stronger argument for the removal of the 70,000 ML cut-off for medium priority allocations from the dam. This risk mitigation mechanism was implemented to protect water (and energy generation) security for the stations, and could potentially be removed or reduced if Stanwell was permanently accessing a higher proportion of its water from manufactured water products. Removal of the 70,000 ML cut-off is outlined in Option 11. *Sources: Boyne River & Tarong Water Supply Scheme*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders impacted by the option include: **(a) Seqwater** Seqwater own and manage Wivenhoe Dam. Seqwater will be a primary participant in any negotiation to increase the volume of water that the Tarong Power Stations access from Wivenhoe Dam. **(b) Sunwater** Sunwater manage the water allocations from Boondooma Dam under the Boyne River & Tarong Water Supply Scheme. Sunwater will be a primary participant in any negotiation to decrease Stanwell's high priority allocation from Boondooma Dam, and potentially increase the allocation to other urban, industrial and irrigation users. **(c) Stanwell** Stanwell are a major stakeholder in this option and will be impacted significantly in relation to water and generation security, commercial certainty, financial management, operations and general management. Stanwell own and manage the Wivenhoe Pipeline and will need to assess the engineering capacity and capability of the pipeline to manage any increased volume and usage. **(d) South Burnett Regional Council** The council is highly interested in securing increased water supply for urban and industrial users in the region. The water supply risk at Kingaroy is significant and this option would completely solve that problem for the Council. **(e) Industrial** Industrial businesses in South Burnett are very interested in any proposal that increases the security of water in the region. The largest business (other than Stanwell) operating in South Burnett is Swickers, which is significantly reliant on water for its operations. **(f) Irrigators in South Burnett** Irrigators in South Burnett would get increased reliability for medium priority allocations providing greater security and certainty in water supply for agricultural production.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raining Boondooma Dam. This will need to be considered further if this option progresses.
Timeframe considerations	This timeframe for implementing this option would be short, although obtaining the necessary Government support could take considerable time. A permanent arrangement for the transfer of allocations from Stanwell to South Burnett Regional Council would be subject to further analysis by Stanwell in relation to impacts on water security at the Tarong Power Stations. However, Stanwell

Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
	and the Council may be able to reach an arrangement for a temporary transfer to secure Kingaroy's water supply until after Stanwell have been able to complete its review.
Social and economic considerations	The Tarong Power Stations have a critical role in the social and economic environment of South Burnett, as the largest employer and supporter of public institutions and private businesses. If this option undermines or risks the security and integrity of the Tarong Power Station's then that could have a significant social and economic impact across the region. Improved water supply and security for urban water users in South Burnett, particularly Kingaroy, will impact social wellbeing and commercial values in the region. Increased water supply for industrial users will create greater opportunity for commercial investment, business growth and increases in employment in the region. The water quality from Gordonbrook Dam is a significant concern among urban water users consulting as part of this study. Removing Gordonbrook Dam from urban water usage for Kingaroy would potentially increase quality of life factors for residents of that township. Increased water reliability for irrigators in South Burnett would potentially increase the security and certainty for agricultural production and business growth and employment opportunities in the region. *Source: Kingaroy Regional Water Security Assessment, 2020 [; Irrigation from the Boyne River: The Value of Improved Water Security, 2019*
Access to water	This option would not require access to unallocated reserves or have any implications for the Water Plan's objectives.
Proximity to demand	Kingaroy could access additional water through the existing pipeline. There is significant demand for increased water and water reliability from irrigators in the Boyne River and Tarong Water Supply Scheme. If this option increased the supply and/or reliability for those irrigators it could directly meet the demand in that area. Studies have identified 3,800 hectares of class 1 soil around Kingaroy, which is highly fertile for agricultural production. The irrigation lands around Gordonbrook Dam and Boondooma Dam have been assessed as being suitable for increased agricultural production and could expand current irrigation operations with increased water reliability. This option would provide increased reliability to land that is considered suitable for a broad range of agriculture, including tree and vine crops. Sources: *Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Soils and Agricultural Suitability of the South Burnett Agricultural Lands, 2001*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Suitability of the pipeline* Use of the Wivenhoe Pipeline is owned and managed by Stanwell and would require formal engineering and operational review to determine the capability to increase capacity to accommodate and increase (or changes in) use. *Commercial impact on Seqwater* It is essential that additional supply from Wivenhoe Dam does not impact on Seqwater ability to meet its water security objectives for South East Queensland. Commercial transactions may not be possible between Stanwell and other customers (such as councils, industrial users or irrigators) for the temporary or permanent transfer of allocations. *Commercial impact on Sunwater*

Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)	
	This option will potentially impact Sunwater's water scheme management and they must be consulted closely in relation to this option. *Costs* Supplying water from Wivenhoe Dam is more expensive than from Boondooma Dam for Tarong Power Station or other potential water users accessing water from Wivenhoe Dam. This option cannot result increased, unrecoverable costs for Stanwell as owner and operator of the Tarong Power Stations, including any additional costs related to the Wivenhoe Pipeline. *Energy generation security* If this option compromises the energy security in the National Energy Market by reducing the water security for the Tarong Power Stations, that would create a substantive risk for Stanwell that would potentially prevent this option from progressing further. *Costs* This option may ultimately increase the costs for Stanwell (due to accessing more water from the more expensive source) to the point where the cost of compensating Stanwell is too high to justify. Formal costs modelling will be required if this option progresses further.
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

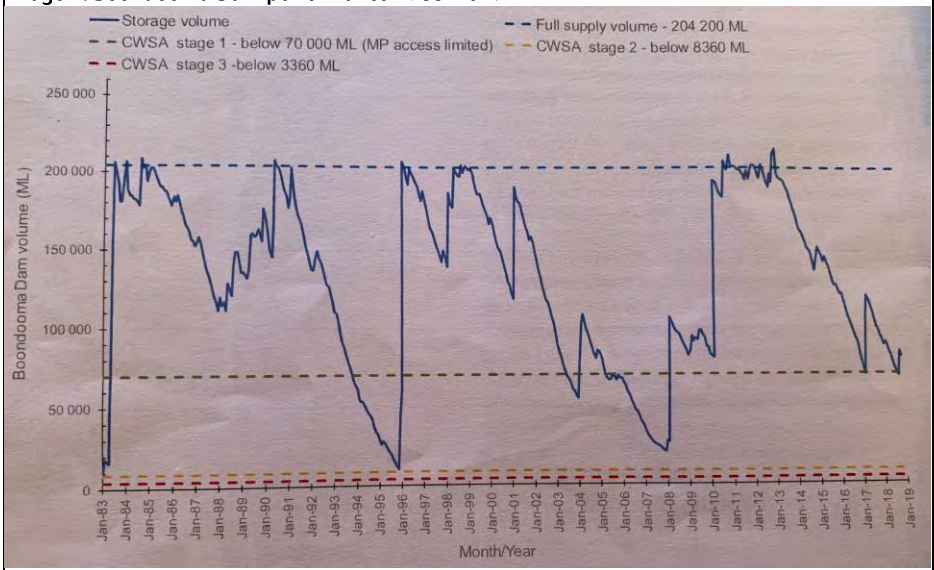
B.3 Both North and South Burnett

B.3.1 Option 11: Remove the 70,000 ML cut-off rule in Boondooma dam

Remove the 70,000 ML cut-off rule in Boondooma dam	
Background to this option	
Description	This option proposes amending the critical water supply arrangements for Boondooma Dam to remove the rule that stops all supply to medium priority water allocation holders when dam levels fall below the set threshold. The purpose of this option is to increase the reliability of water for medium priority water allocations in the Boyne River and Tarong Water Supply Scheme. Boondooma Dam is managed by Sunwater and has special critical water supply arrangements that Sunwater implements in circumstances of a critical water situation. Under those arrangements, if the stored water in Boondooma Dam falls below a threshold level (approximately 70,000ML) then Stage One of the arrangements is implemented. Under the Stage One arrangements, there can be no distribution of water to medium priority allocation holders in Boyne River and Tarong Water Supply Scheme (the Cut-Off Rule). The original purpose of the Cut-Off Rule was to protect the security of the high priority water allocations in the Boyne River and Tarong Water Supply Scheme, and particularly the allocation held by the Tarong Power Stations. At the time the Cut-Off Rule was introduced, Boondooma Dam was the only source of water for the Tarong Power Stations, and the Cut-Off Rule was considered essential to protect water security for the critical power generation function of Tarong Power Stations. Since that time, the Wivenhoe Pipeline was constructed in the late 1990s to provide a secondary water source for the Tarong Power Stations. The Tarong North unit was constructed in 2003 based on the availability of water from the Wivenhoe Pipeline.

<table>
<tr><td></td><td>The argument for this option is that the Cut-Off Rule is no longer required to protect the water security for the Tarong Power Stations, and that the necessary risk management for the stations can be achieved through the existing allocation announcement system that priorities HP allocations above MP allocations. Under this option, it is suggested that the Cut-Off Rule imposes an artificial and arbitrary restriction on MP allocation holders.

All the medium priority allocation holders in Boyne River and Tarong Water Supply Scheme are irrigators, and the imposition of the Cut-Off Rule means that those irrigators cannot access their water allocations under the scheme. Since 1983 there have been four significant periods when the Cut-Off Rule has been imposed. Image 1 shows the Boondooma Dam performance from 1983 to January 2019 (the fourth imposition of the Cut-Off Rule was enacted on 26 March 2019 and is not shown in Image 1). Image 1 also shows that since 1983 Boondooma Dam has not fallen below its minimum operating volume of 8,360 ML and Stage Two critical water supply arrangements have not been imposed.

Image 1: Boondooma Dam performance 1983-2019


Sources: Water Plan (Burnett Basin) 2014; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020; Sunwater Presentation to Boyne Irrigators, 16 August 2018; Sunwater's daily storage records from January 1983 to January 2019 for Boondooma Dam (SBRC);</td></tr>
<tr><td>**Costs of this option**</td><td>This option does not have identified upfront and ongoing costs for its implementation and operation, and it is unlikely to substantially increase the administrative costs for Sunwater in the operation of the scheme.

This option may potentially result in indirect cost increases for Stanwell as the owner of the Tarong Power Stations. The removal of the Cut-Off Rule may decrease the water security for the Tarong Power Stations from Boondooma Dam. This could conceivably result in circumstance where Stanwell are required to access greater water quantities from the Wivenhoe pipeline at a higher cost. This additional cost would need to be reflected in higher water charges for Medium Priority users.

Sources: Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020.</td></tr>
<tr><td>**Hydrological benefits and how they will be realised**</td><td>The Water Plan states that the water allocation security objectives for water allocations in the Boyne River and Tarong Water Supply Scheme are:
• For medium priority allocations – the monthly supplemented water sharing index is to be at least 70%
• For high priority allocations – the monthly supplemented water sharing index is to be at least 95%.

The monthly supplemented water sharing index is defined in the water plan and, in essence, means the percentage of months in the IQQM simulation period in which a high or medium group of allocations are fully supplied.</td></tr>
</table>

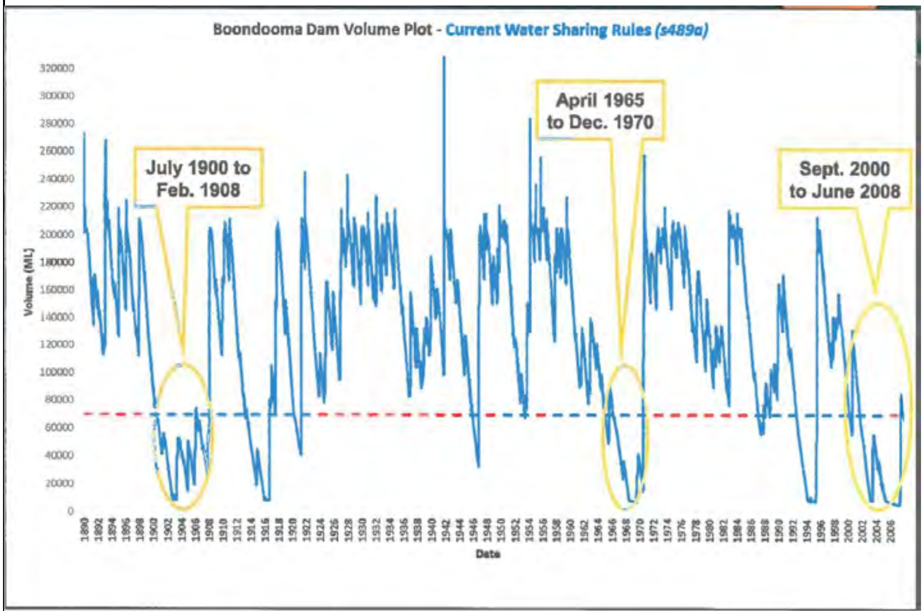
Further detailed would be required to fully assess the implications of removing the cut-off rule for compliance with the above medium and high priority water allocation security objectives. However, simply removing the cut-off rule without making other complementary adjustments to the water sharing rules and/or parameters will almost certainly increase (improve) medium priority performance at the expense of a reduction in high priority performance. The quantum of such changes in performance from removing the cut-off rule are unknown.

Simulated historical Boondooma Dam volumes under current water sharing rules (see Image 2 below) suggests that the duration of the periods when medium priority water allocations are not supplied for to the cut-off rules can extend up to eight years at a time. Although removing the cut-off rule might extend medium priority access by several months at the start of each of these periods (as the storage continues to draws down below 70,000 ML), this is unlikely to reduce these to total duration of these periods (and long-term monthly reliability) by more than, say, 4% to 5% (= (7 dry periods x 9 months extended medium priority access per period) / (177 years x 12 months)) of the total simulation period.

Boondooma Dam has a storage capacity of 204,000 ML and provides water to:

- Tarong Power Stations under a 29,900 ML high priority allocation;
- Urban usage under a 1,825 ML high priority allocation; and
- Irrigators (primarily located downstream of the Dam) under an aggregate of 9,142ML medium priority allocations.

Image 2: Modelled Boondooma Dam volume 1890 – 2007



Sources: Water Plan (Burnett Basin) 2014; Sunwater Presentation to Boyne Irrigators, 16 August 2018; Boyne River & Tarong Bulk Water Service Contract, 2018,

Customer benefits and how they will be realised

The primary customer benefit of this option would be increased reliability for irrigators in the Boyne River and Tarong Water Supply Scheme.

If the Cut-Off Rule was removed it would be expected to decrease in the frequency and duration of periods with no announced allocation for medium priority water users. However, even if the Cut-Off Rule was removed as a mechanism under the critical water supply arrangements there would still be periods when there would be no announced allocation for medium priority water users. For example, Image 1 shows that in both 1995-6 and 2008 the water volume of Boondooma Dam fell below the combined high priority allocations of 31,815 ML.

Importantly, urban and power generation water security requirements mean that some form of critical water supply arrangement may still be required under the scheme, which could impact the annual announced allocation for medium priority holders.

Sources: Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020.

The problem(s) this option seeks to address	This option is intended to address the low reliability for medium priority water allocation holders in the Boyne River and Tarong Water Supply Scheme. The low reliability has resulted poor supply and commercial uncertainty for irrigators in the scheme and limited the growth, investment and employment in the agricultural sector in the region. *Source: Kingaroy Regional Water Security Assessment, 2020 [NB: we need to confirm this may referenced].*
Strategic Considerations	
SIP Classification	Classified as Reform under the State Infrastructure Plan Hierarchy
Alignment with Government policy and objectives	This option proposes to increase the efficiency of water in North and South Burnett without the need for expenditure on water infrastructure. This option is well suited to the current fiscal environment. This option generally aligns with the Government objective to maximize the efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. The Cut-Off Rule was implemented as a risk management mechanism for the Tarong Power Stations, and arguably still plays a role in mitigating water security risks for both the power stations and the Kingaroy urban water supplies. *Source: Queensland bulk water opportunities statement; Water Plan (Burnett Basin) 2014; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020;*
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option would require amendments to the Boyne River and Tarong Water Supply Scheme Operations Manual to remove or amend the the Cut-Off Rule. If the Cut-Off Rule was removed as a mechanism under the critical water supply, urban and power generation water security requirements mean that some form of critical water supply arrangement may still be required under the scheme. *Source: Water Plan (Burnett Basin) 2014; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020;*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having low feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The critical issues relating to the removal of the Cut-Off Rule for each key stakeholder group are: **a) Sunwater** Sunwater manage the Boyne River and Tarong Scheme and would be responsible for the coordination of any changes in water allocation, allocation announcements and critical water supply arrangements that may result from the removal of the Cut-Off Rule. Sunwater must be consulted regarding the viability of this option from a regulatory and political perspective. **b) Stanwell** This option would remove an existing risk management mechanism for the protection water security for the Tarong Power Station. The water security at Tarong Power Station relies on a diversity of supply from a combination of water agreements with Sunwater (for supplies from Boondooma Dam) and Seqwater (for supplies from Wivenhoe Dam and/or the Western Corridor Recycled Water Scheme which produces purified recycled water). Any action that impacts the reliability of Tarong Power Stations high priority allocation from Boondooma Dam would need to be carefully considered and assessed by Stanwell. **c) South Burnett Regional Council**

	This option would remove an existing risk management mechanism for the protection of the urban water supply for the township of Kingaroy (within the South Burnett Regional Council area). **d) MP Water Allocation Holders (irrigators)** The irrigators would directly benefit from this option through increase reliability. The irrigators located within the Boyne River and Tarong Scheme that have been consulted during this study have expressed support for this option. The irrigators have advised that the increased reliability would have tangible benefits for the rea, including greater business certainty, employment growth and commercial stability and investment. *Sources: Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020; Sustainable Water Practices, a top priority for Tarong Power Stations (Stanwell), 2019.*
Environmental impact	No environmental studies have been identified that directly address the environmental impact of the removal of the Cut-Off Rule. This option could result in increased stress on Boondooma Dam and a lower average water level in the dam, which would potentially result in greater environmental impact and risk for the area surrounding the dam. Further study and analysis may be required to fully understand the impact that lower water levels would have on the area.
Timeframe considerations	The timeframe for implementing this option would potentially be long due to the requirement for extensive consultations, risk planning and regulatory oversight. This option would require consultation, and potentially approval, from multiple government and non-government bodies concerned with water and power generation security. Sunwater would need to oversee changes to, at least, the Boyne River & Tarong Bulk Water Service Contract and Boyne River and Tarong Water Supply Scheme Operations Manual. This option may be undertaken in combination with other options that decrease the stress on Boondooma Dam to limit the increased risk resulting from the removal of the Cut-Off Rule. For example, this option could be implemented in combination with Option 9A or 9B, which both require the Tarong Power Stations to decrease water usage from Boondooma Dam. If this option is undertaken in combination with other option(s) then that may result in an increased timeframe for completion. *Sources: Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020.*
Social and economic considerations	This option proposes removing a risk mitigation mechanism that has the practical affect increasing the urban and industrial water security for Kingaroy. This study has identified that Kingaroy is at risk of urban water failure 1 in every 13 years. If the removal of this mechanism contributed to a water failure in Kingaroy that would have significant negative social and economic impacts. Agriculture is an important part of the South Burnett regional economy, with large areas of suitable soils providing a wide range of agricultural activities including animal production, broadacre cropping (such as peanuts, navy beans and soybeans), fodder crops, horticulture, macadamia nuts and sugarcane. The area downstream of Boondooma Dam would potentially experience increased investment as a result of improved water reliability that would lead to increased production capacity, employment and benefits to the region. *Source: Kingaroy Regional Water Security Assessment, 2020.*
Access to water	This option would not require access to unallocated water. The Water Plan's water allocation security objectives for high priority water allocations may not be met under this option unless other complementary changes were to be made to the water sharing rules and/or parameters.
Proximity to demand	There is significant demand for increased water reliability from irrigators downstream of Boondooma Dam, including the holders of existing medium priority allocations. The removal of the Cut-Off Rule would be expected to increase the reliability for those irrigators and meet the direct demand in that area. The irrigation lands below Boondooma Dam have been assessed as being suitable for increased agricultural production and could expand current irrigation operations

	with increased water reliability. This option could potentially provide increased reliability to land that is considered suitable for a broad range of agriculture, including tree and vine crops. Sources: *Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Soils and Agricultural Suitability of the South Burnett Agricultural Lands, 2001*
Assessment against public interest consideration	This option has been assessed as having low feasibility against the public interest considerations.
Risk Considerations	
Risks	*Regulatory* Sunwater operates Boondooma Dam under the terms of the Boyne River and Tarong Water Supply Scheme Operations Manual and other instruments and agreements. The Cut-Off Rule has formally been in place since 1987 and was first applied from October 1993 to November 1995. It has been subject to review on multiple occasions and it has remined in place despite significant opposition. It may unviable to remove the Cut-Off Rule in these circumstances. Further, there are significant regulatory and legislative challenges and required approval to amend the operations manual and bulk water service contract. *Increase reliance on Wivenhoe Dam* The removal of the Cut-Off Rule could potentially impose greater pressure on Wivenhoe Dam, which is part of the South East Queensland Grid. *Decreased urban water security* There is a risk that the removal of this mechanism could cause or contribute to urban water failure in Kingaroy. If the Cut-Off Rule is removed it would need to be replaced by alternative risk management mechanism. *Sources: Sunwater Presentation to Boyne Irrigators, 16 August 2018;*
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.3.2 Option 12: Raise Boondooma Dam

Option 12: - Raise Boondooma Dam	
Background to this option	
Description	This option proposes raising the height of Boondooma Dam by 12 metres (or similar) in order to increase the storage capacity. This proposal would use a fixed crest structure without gates, and would increase the storage capacity from 204,000 ML to 600,000 ML, which is an estimated increase of 396,000 ML. The purpose of this option would be to provide additional new water to irrigators in the Boyne River & Tarong Water Scheme or improve the reliability of existing allocations. The medium priority allocations within the scheme are currently highly unreliable due to a combination of low water levels in the dam, the impact of the 70,000 ML cut off (see Option 11) and the high demand from Boondooma Dam from urban, industrial and irrigation users. This option would also potentially increase reliability for water users in Mundubbera downstream of Jones Weir.

Option 12: - Raise Boondooma Dam	
	This option could potentially, wholly or partially, address the urban water security concerns in some or all of the towns in South Burnett. *Source: Sunwater letter to Boyne Irrigators, 2017; Boyne River & Tarong Water Scheme: Water Supply Arrangements and Service Targets*
Costs of this option	A previous estimate of this option costed it at $110 million, including planning and approvals. This cost estimate is considered to be low and may not consider significant costs that would arise from the construction, including necessary reshaping of the spillway and other critical costs. If this option were to progress it would require detailed cost modelling for capital and operational expenses, which may result in substantial increase in that estimate. *Sunwater letter to Boyne Irrigators, 2017*
Hydrological benefits and how they will be realised	Further detailed hydrologic modelling would be required to fully assess the implications of this option including its compliance with the medium and high priority water allocation security objectives. Sunwater have provided some commentary on the findings of preliminary modelling to the Boyne River Water Supply Scheme General Irrigator Advisor Committee, including that the raising Boondooma Dam by 12m increases the median monthly reliability for medium priority water allocations to 90.1%, with no additional yield being created. *Source: Meeting Minutes, Boyne River Water Supply Scheme General Irrigator Advisor Committee (IAC) Meeting, 26 April 2018*
Customer benefits and how they will be realised	The customer that would benefit from this option are: • Irrigators in the Boyne River & Tarong Water Scheme, including holders of existing medium priority holders that may benefit from increased reliability, and potentially irrigators that acquire additional allocations if any additional water is available. If this option resulted in additional water then this option may also enable removal of the 70,000-cut-off rule (Option 11). • Kingaroy and other South Burnett townships would potentially receive an increase water allocation for urban and industrial usage if additional new water was available. • Tarong Power Station (Stanwell) would potentially increase the reliability of its high priority allocation from Boondooma Dam. The realisation of these benefits would be dependent on this option actually increasing the yield from Boondooma Dam, which is unlikely based on the available commentary. *Source: Sunwater letter to Boyne Irrigators, 2017; Boyne River & Tarong Water Scheme; Meeting Minutes, Boyne River Water Supply Scheme General Irrigator Advisor Committee (IAC) Meeting, 26 April 2018*
The problem(s) this option seeks to address	This option will potentially seek to address the all three of the primary problems identified in South Burnett: • Large areas of fertile land have no access to a reliable source of water hindering crop yields, value and diversity due to dependence on unreliable seasonal rains. • Security of urban water supply is poor and deteriorating harming community welfare and limiting industrial expansion. This problem would be addressed directly in Kingaroy. • Existing agricultural supplemented water allocations are highly unreliable resulting in reduced agricultural output, jobs & investment. This option may potentially improve reliability for existing medium priority allocation holders in South Burnett. Addressing some of these problems is dependent on this option actually increasing the yield from Boondooma Dam, which is unlikely based on the available commentary Source: *Boyne River & Tarong Water Scheme: Water Supply Arrangements and Service Targets; Meeting Minutes, Boyne River Water Supply Scheme General Irrigator Advisor Committee (IAC) Meeting, 26 April 2018*
Strategic Considerations	

Option 12: - Raise Boondooma Dam	
SIP Classification	This option is classified 'Improve Existing' under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option includes a major construction that is unlikely to achieve a return on a commercial return on either capital or operational investment. This option does not align with the policy and objectives of the Queensland Government in relation to: (a) The efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. (b) Supporting infrastructure development that provides a commercial return to bulk water providers. The existing State and National fiscal environment and limitations mean that a project of this size, complexity and cost will have significant funding challenges. The project beneficiaries are unlikely to be willing to pay the full cost associated with the option as required by National, and agreed, policy settings, which means that a large non-refundable grant would be needed to fund the construction costs. *Source: Queensland bulk water opportunities statement, 2019; Sunwater letter to Boyne Irrigators, 2017.*
Feasibility assessment against strategic considerations	This option has been assessed as having low feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require legislative and regulatory amendment to the Water Management Protocol and Operations Manual, as well as amendments to the Burnett Water Plan (in relation to updating environmental flow objectives and water allocation security objectives). This option may also require the creation of new water allocations, particularly medium priority allocations for irrigators in South Burnett.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders impacted by this option are: **a) Sunwater** Sunwater manage the Boyne River and Tarong Scheme and would be responsible for the coordination of any changes in water allocation, allocation announcements and critical water supply arrangements that may result from the raising of Boondooma Dam. Sunwater have expressed doubts regarding the viability of this project, especially if financial investment commitments cannot be secured from foundation customers that would take up new water allocations. **b) Stanwell** This option could potentially increase the available water in Boondooma Dam and could positively impact water security and reliability for the Tarong Power Stations. **c) South Burnett Regional Council** This option would potentially increase the available water for urban usage in South Burnett and the reliability and security for existing high priority allocations, including urban and industrial usage by Kingaroy. It is noted that based on available commentary that an increase in water is unlikely under this option. **d) MP Water Allocation Holders (irrigators)**

Option 12: - Raise Boondooma Dam	
	If this option increases the available water from Boondooma Dam and reliability for existing allocation holders, the irrigators located within the Boyne River and Tarong Scheme would benefit directly. During direct consultations, irrigators in South Burnett have expressed support for projects that increase the water availability and reliability. The irrigators advised that the increased reliability would have tangible benefits for the area, including greater business certainty, employment growth and commercial stability and investment. *Sources: Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River & Tarong Bulk Water Service Contract, 2018; Boyne River and Tarong Water Supply Scheme Operations Manual, 2020; Sustainable Water Practices, a top priority for Tarong Power Stations (Stanwell), 2019.*
Environmental impact	This project is likely to have a substantive environmental impact. Sunwater have conducted a desktop review of some of the environmental considerations relating to this option in the context of their management and previous works around Boondooma Dam. Sunwater expressed an opinion that the proposed raising of Boondooma Dam would trigger both a referral to the Commonwealth Government and a range of assessments under Queensland legislation. Sunwater identified that: • Repairs previously conducted by Sunwater on the Boondooma Dam spillway triggered a Commonwealth referral to determine whether it would have an impact on matters of national environmental significance under the EPBC Act. • A full Environmental Impact Statement will likely be required. • Queensland government approvals may include waterway barrier works approval, various operational works approvals and other environmentally relevant activities such as installing a fishway on the structure. • Significant environmental offsets may be required. • 10+ years of environmental monitoring may be required post construction. *Sources: Sunwater letter to Boyne Irrigators, 2017; Environmental Protection and Biodiversity Conservation Act*
Timeframe considerations	Sunwater have suggested that this project could take up to six years to complete including the necessary environmental and other approvals. *Sources: Sunwater letter to Boyne Irrigators, 2017*
Social and economic considerations	Agriculture is an important part of the South Burnett regional economy, with large areas of suitable soils providing a wide range of agricultural activities including animal production, broadacre cropping (such as peanuts, navy beans and soybeans), fodder crops, horticulture, macadamia nuts and sugarcane. The area downstream of Boondooma Dam would potentially experience increased investment as a result of improved water or water reliability, which would lead to increased production capacity, employment and benefits to the region. *Source: Kingaroy Regional Water Security Assessment, 2020 [NB: confirmation is required from SBRC as to whether this reference may be published]; Sunwater letter to Boyne Irrigators, 2017*
Access to water	This option may require a portion of the unallocated reserves in the water plan to be relocated to, and allocated, downstream of Boondooma Dam.
Proximity to demand	There is significant demand for increased water and water reliability from irrigators downstream of Boondooma Dam, including the holders of existing medium priority allocations. If the raising of Boondooma Dam increased the supply and/or reliability for those irrigators it could directly meet the demand in that area. The irrigation lands below Boondooma Dam have been assessed as being suitable for increased agricultural production and could expand current irrigation operations with increased water reliability. This option would provide increased reliability to land that is considered suitable for a broad range of agriculture, including tree and vine crops.

Option 12: - Raise Boondooma Dam	
	Sources: *Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Soils and Agricultural Suitability of the South Burnett Agricultural Lands, 2001*
Assessment against public interest consideration	This option has been assessed as having low against the public interest considerations.
Risk Considerations	
Risks	*Insufficient yield and hydrological performance* While hydrological evidence is still to be provided, the available commentary suggests that this option would create no additional yield. Subject to contrary evidence, there is a risk that raising Boondooma Dam would be a poor return on investment and provide no additional water. *Cost recovery* The relatively high costs of this option pose a substantive risk to its viability, and there is a risk that the capital and operational costs would not be recoverable from the beneficiaries. This option would not result in additional water and so the capital and operational costs would need to be recovered from existing water users. *Increased cost estimate* The current cost estimate is likely to be a significant under-estimation and there is a high risk that the actual cost will be much higher. *Legal* There are significant legal risks with this option due to the multiple legal transactions required to develop and execute the planning and delivery of the dam raising. Consultation with existing land holders that will be impacted by the projects will be necessary and may require further legal consideration. *Cultural* This project may attract special requirements in relation to cultural heritage and associated regulations. The size of the proposed dam increases the potential for an impact on cultural heritage sites, although this will depend on the final location of the dam. *Source: Sunwater letter to Boyne Irrigators, 2017; Meeting Minutes, Boyne River Water Supply Scheme General Irrigator Advisor Committee (IAC) Meeting, 26 April 2018*
Feasibility assessment against risk considerations	This option has been assessed as having low feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.3.3 Option 14: Optimise in-scheme unsupplemented access rules

Option 14: Optimise in-scheme unsupplemented access rules	
Background to this option	
Description	This option proposes operational improvements to the administration of water harvesting entitlements. This would involve optimising in-scheme unsupplemented access rules, in schemes across the North and South Burnett, to enable the use of projected downstream water levels when making water harvesting announcements (in relation to both the commencement and cessation of water harvesting events). This proposal will allow greater utilisation of water harvesting

Option 14: Optimise in-scheme unsupplemented access rules	
	opportunities by existing unsupplemented water allocations and support expansion of irrigated agriculture. This option would involve reforms and refinement to the access rules and the practices of Sunwater in the management and delivery of harvesting announcements. This option is based on anecdotal evidence that water harvesting opportunities are either cut short or do not commence because the triggers are specified too far downstream from the location of the water allocations. Building in the ability to predict whether downstream levels will be triggered (rather than waiting them to be met) will allow water allocations to actually access their entitlements and offer them greater water security to support expansion of irrigated agriculture.
Costs of this option	The costs of this option will be largely administrative and may require additional personnel and contractors dedicated to maximising both rules and the operational processes for implementing those rules.
Hydrological benefits and how they will be realised	The hydrologic benefit of this option has not been (and may not practically be able to be) modelled. It is possible that the unsupplemented water allocation security objectives in the water plan have been set based on the optimal commencement and cessation of triggers already being achieved. If so, this may mean that some unsupplemented water allocation holders may currently not be able to fully harvest the volumes of water that they are entitled to. The hydrologic benefit of this option is more likely to be informed through consultations with local water harvesters about the management of recent flood events rather than through undertaking detailed IQQM modelling (at least in the first instance).
Customer benefits and how they will be realised	The potential beneficiaries of optimising in-scheme unsupplemented access rules includes irrigators and medium priority allocation holders across North and South Burnett.
The problem(s) this option seeks to address	This option would seek to address two problems identified in the Strategic Business Case: • There are large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. • The agricultural sector needs a more reliable water source in order to grow. This option will address this problem by providing reliable water directly to irrigators for expanded agricultural production.
Strategic Considerations	
SIP Classification	Classified as Reform under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option proposes to increase the efficiency of water in North and South Burnett without the need for expenditure on water infrastructure. This option is well suited to the current fiscal environment. This option generally aligns with the Government objective to maximize the efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. *Source: Queensland bulk water opportunities statement*
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	There are unlikely to be any water planning issues associated with this option.

Option 14: Optimise in-scheme unsupplemented access rules	
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders for this option would be irrigators across North and South Burnett who may be able to access additional water for irrigation.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raining Boondooma Dam (see Option 5). This will need to be considered further if this option progresses.
Timeframe considerations	This timeframe for implementing this option would be short, although obtaining the necessary Government support could take time.
Social and economic considerations	The potential social and economic benefits of this option are linked to the ability to generate additional water that can facilitate irrigated farming in the region, which can potentially lead to increased production, growth and employment.
Access to water	As this option is about improving the operational efficiency and effectiveness of existing water harvesters, it is unlikely to require any additional water from unallocated water reserves.
Proximity to demand	Consultations have identified significant demand from irrigators across North and South Burnett for increased water supply and improved reliability. This option should focus on improvements to existing rules that would provide the highest benefit to the areas with the greatest potential for increased production.
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Lack of tangible benefit* There is a risk that the proposed rule changes do not result in a significant increase in benefit for irrigators in North and South Burnett. Further investigation and analysis is required to determine the achievable improvements from this option.
Feasibility assessment against risk considerations	This option has been assessed as having high feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	State whether this option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.3.4 Option 15: Greater utilisation of the Wivenhoe pipeline (for Blackbutt irrigation)

Option 15: Greater utilisation of the Wivenhoe pipeline (for Blackbutt irrigation)	
Background to this option	
Description	This option proposes increasing the usage of the Wivenhoe Pipeline to access more water from Wivenhoe Dam for use by irrigators in Blackbutt in South Burnett. Consultations with irrigators in

	and around Blackbutt have identified demand for approximately 2,350ML/year. The Blackbutt irrigators are currently reliant on water allocations from Boondooma Dam that are unreliable and impacted by the 70,000ML cut-off for medium priority allocation holders. This option would provide a reliable source of additional water to a highly fertile area that is significantly impacted by water shortages, which has a negative impact on local economic conditions, employment and social issues. There currently is a pipeline from Wivenhoe Dam to the Tarong Power Station. It is primarily used to supply water to the Tarong Power Station (used in conjunction with Boondooma Dam), and was constructed to provide water security for the station. It would be important that the additional usage of the Wivenhoe Pipeline did not impact the water reliability for the Tarong Power Stations. The Tarong Power Stations are owned by Stanwell and are a major stakeholder in water in South Burnett.
Costs of this option	The costs of this option will include engineering and operational assessments, and any subsequent upgrades, to the Wivenhoe Pipeline to enable increased use by irrigators along the pipeline route.
Hydrological benefits and how they will be realised	This option would provide an extra volume of water to Blackbutt irrigators, located along the existing route of the Wivenhoe Pipeline.
Customer benefits and how they will be realised	The customer benefits for this option are additional water at improved reliability for high value irrigators located in Blackbutt.
The problem(s) this option seeks to address	This option will directly address two key problems in South Burnett: 1. Existing agricultural supplemented water allocations are highly unreliable resulting in reduced agricultural output, jobs & investment 2. Large areas of fertile land have no access to a reliable source of water hindering crop yields, value and diversity due to dependence on unreliable seasonal rains
Strategic Considerations	
SIP Classification	Classified as Better Use under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option aligns closely with the State Government objective to efficiently use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure. This option would utilize existing water resources and infrastructure to better achieve the water balance and requirements of South Burnett. Furthermore, this option is lower cost than alternatives that require the construction of new water infrastructure and is suitable in the current fiscal environment. Government policy and objectives in relation to power generation priorities the safety and security of power generating facilities, and this includes that water security is maintained and protected. This option will need to be reviewed and considered by the Energy Division of the Department of National Resources, Mines and Energy, and Stanwell, to determine whether this option poses a risk to water security and power generation at the Tarong Power Stations Government policy in relation to opening up Wivenhoe Dam to additional users from South Burnett would need to be reviewed and considered, especially if it were to impact the water security for South East Queensland. *Sources: Queensland bulk water opportunities statement, 2019.*
Feasibility assessment against strategic considerations	This option has been assessed as having medium feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option will require no legislative changes and only minimal regulatory changes that are needed to reflect the changes in water allocations in the Boyne River & Tarong Water Supply Scheme. Specific water accounting arrangements are likely to be required to track the volumes of water

	transferred via the pipeline to customers in the Burnett to maintain separation from water supplied under existing entitlements. *Sources: Boyne River & Tarong Water Supply Scheme*
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having medium feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders impacted by the option include: **(a) Seqwater** Seqwater own and manage Wivenhoe Dam and would be a party to any commercial arrangement to purchase water from Wivenhoe Dam. **(b) Irrigators in Blackbutt** These irrigators would be the primary beneficiaries of this option. Through consultations they have indicated a willingness to pay for a reliable source of water for irrigation. **(c) Stanwell** Stanwell own and operate the Wivenhoe Pipeline and will be concerned that the additional usage of the pipeline does not impact their water security. They will need to be compensated for any costs associated with the use of the pipeline.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raising Boondooma Dam (see Option 12). This will need to be considered further if this option progresses.
Timeframe considerations	This timeframe for implementing this option would be short, although undertaking the necessary negotiations could take some time.
Social and economic considerations	Agriculture is an important part of the South Burnett regional economy, with large areas of suitable soils providing a wide range of agricultural activities including animal production, broadacre cropping (such as peanuts, navy beans and soybeans), fodder crops, horticulture, macadamia nuts and sugarcane. The Blackbutt area would potentially experience increased investment as a result of additional water and improved water reliability that would lead to increased production capacity, employment and benefits to the region. Irrigators that access water from Wivenhoe Dam would have an increased reliability for their water products, which would facilitate greater investment, growth and potential employment in the region. The Tarong Power Stations have a critical role in the social and economic environment of South Burnett, as the largest employer and supporter of public institutions and private businesses. If this option undermines or risks the security and integrity of the Tarong Power Stations then that could have a significant social and economic impact across the region. *Source: Kingaroy Regional Water Security Assessment, 2020 [NB: confirmation from SBRC is required prior to publishing the reference to this study]; Irrigation from the Boyne River: The Value of Improved Water Security, 2019*
Access to water	This option would not require access to unallocated reserves or have any implications for the Water Plan's objectives.
Proximity to demand	There is significant demand for increased water and water reliability from irrigators in Blackbutt. This option would deliver additional water to an area of high demand and high productivity. The soil in the Blackbutt area is high quality and suitable for a range of crops, including high value crops.

	This option would potentially open up for irrigation larger parcels of land that are considered suitable for a broad range of agriculture, including tree and vine crops. *Sources: Irrigation from the Boyne River: The Value of Improved Water Security, 2019; Soils and Agricultural Suitability of the South Burnett Agricultural Lands, 2001*
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Suitability of the pipeline* Stanwell own and operate the Wivenhoe Pipeline. A review will be required to assess the suitability of the pipeline to transport additional water, and what additional costs that may involve (those additional costs would be borne by the water users). *Availability of the pipeline* The Wivenhoe Pipeline is used by the Tarong Power Stations and may not be available for use by the Blackbutt irrigators for significant periods because it is being fully utilised by the power stations. This may mean that a scheduling and risk management solution is required, including the use of substantial on-farm storages to mitigate against extended periods when the pipeline cannot be accessed. *Accessing water from Wivenhoe Dam* It is essential that additional supply from Wivenhoe Dam does not impact on Seqwater ability to meet its water security objectives for South East Queensland.
Feasibility assessment against risk considerations	This option has been assessed as having medium feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.3.5 Option 16: Private water harvesting

Water harvesting	
Background to this option	
Description	The option proposes harvesting wet—season floodwaters for off-stream storage and later use to irrigate riparian and near riparian lands. It could be expected that this type of development would be replicated in multiple locations across lands that have previously been identified noting static lift and distance from watercourse. This option generally has fewer environmental regulations to satisfy as in-stream infrastructure is limited and there is very little additional inundation. Suitable sites need to be available adjacent to areas of water demand.
Costs of this option	The costs of this option are unknown at this stage of assessment.
Hydrological benefits and how they will be realised	This option has not been modelled to determine the potential volumes, locations and impacts on existing water allocation reliabilities or environmental flows from allowing additional water harvesting opportunities. The upper limits to the potential volume of new water harvesting allocations in each area would be equivalent to the unallocated reserve volumes as set out in various locations in the water plan. Depending on their location, water harvesting allocations generally enjoy of significantly less reliability (e.g. with annual reliabilities typically around 60% but as low as 23% according to the

	values of unsupplemented water allocation security objectives set out in the water plan) than medium priority supplemented water allocations.
Customer benefits and how they will be realised	The potential beneficiaries of this option includes irrigators and medium priority allocation holders across North and South Burnett.
The problem(s) this option seeks to address	This option would seek to address two problems identified in the Strategic Business Case: • There are large areas of fertile land in North Burnett that do not have access to a reliable source of water. The current lack of a reliable water source substantively hinders crop yields, value and diversity due to dependence on unreliable seasonal rains. • The agricultural sector needs a more reliable water source in order to grow. This option will address this problem by providing reliable water directly to irrigators for expanded agricultural production.
Strategic Considerations	
SIP Classification	Classified as Reform under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option proposes to increase the efficiency of water in North and South Burnett without the need for expenditure on public water infrastructure. This option is well suited to the current fiscal environment. This option generally aligns with the Government objective to maximize the efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure *Source: Queensland bulk water opportunities statement*
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	This option would potentially require amendments to the water plan and the water management protocol to enable the release of unallocated water reserves in the form of unsupplemented water allocations.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	The key stakeholders for this option would be irrigators across North and South Burnett who may be able to access additional water for irrigation.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raining Boondooma Dam (see Option 5). This will need to be considered further if this option progresses.
Timeframe considerations	This timeframe for implementing this option would be short, although obtaining the necessary Government support could take time.
Social and economic considerations	The potential social and economic benefits of this option are linked to the ability to generate additional water that can facilitate irrigated farming in the region, which can potentially lead to increased production, growth and employment.

Access to water	This option would require a portion of the water plan's strategic water infrastructure reserves to be issued by DNRME as unsupplemented water allocations. However, this may prove difficult as water harvesting might not be considered by government as "strategic infrastructure".
Proximity to demand	Consultations have identified significant demand from irrigators across North and South Burnett for increased water supply and improved reliability. This option should focus on improvements to existing rules that would provide the highest benefit to the areas with the greatest potential for increased production.
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	*Lack of tangible benefit* There is a risk that the proposed rule changes do not result in a significant increase in benefit for irrigators in North and South Burnett. Further investigation and analysis is required to determine the achievable improvements from this option.
Feasibility assessment against risk considerations	This option has been assessed as having high feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

B.3.6 Option 17: Agricultural supply chain improvements

Option 17: Agricultural supply chain improvements	
Background to this option	
Description	The option proposes developing a supply value chain for the region and addressing supply chain gaps and constraints. This review to understand the opportunities for local value add, local jobs and opportunities for processing to occur within the region (e.g. for peanuts, blueberries and pecans). Understand the impediments, particularly regarding economies of scales and reliability that could be addressed through additional / more reliable water sources.
Costs of this option	Costs of this option are unknown at this stage.
Hydrological benefits and how they will be realised	Nil.
Customer benefits and how they will be realised	Unknown at this stage.
The problem(s) this option seeks to address	This option seeks to address problems with supply chain inefficiencies.
Strategic Considerations	
SIP Classification	Classified as Reform under the State Infrastructure Plan Hierarchy.
Alignment with Government policy and objectives	This option proposes to increase the efficiency of water in North and South Burnett without the need for expenditure on water infrastructure. This option is well suited to the current fiscal environment. This option generally aligns with the Government objective to maximize the efficient

	use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure *Source: Queensland bulk water opportunities statement*
Feasibility assessment against strategic considerations	This option has been assessed as having high feasibility against the strategic considerations.
Legal and Regulatory Considerations	
Legislative and regulatory issues	Nil.
Feasibility assessment against legal and regulatory considerations	This option has been assessed as having high feasibility against the legal and regulatory considerations.
Public Interest Considerations	
Impact on stakeholders	Unknown at this stage.
Environmental impact	This option is likely to have minimal negative environmental impact as it proposes to use existing water resources more efficiently without the interdiction of any new construction projects in the region. There may be considerable environmental benefit of this option if it provides a viable alternative to the construction of new water infrastructure, such as raining Boondooma Dam (see Option 5). This will need to be considered further if this option progresses.
Timeframe considerations	Unknown at this stage.
Social and economic considerations	Unknown at this stage.
Access to water	Unknown at this stage.
Proximity to demand	No applicable to this option.
Assessment against public interest consideration	This option has been assessed as having medium feasibility against the public interest considerations.
Risk Considerations	
Risks	No specific risk can be identified at this stage because of the need for greater specificity in the intended outcomes for this option.
Feasibility assessment against risk considerations	This option has been assessed as having high feasibility against the risk considerations.
Outcome of High-Level Assessment	
Outcome	This option has been assessed as feasible and will proceed to the Shortlisting through Multi-Criteria Analysis

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Water supply requirements in the North and South Burnett

Appendix C

Options Analysis

N499

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Feasibility Study of water supply requirements in North Burnett and South Burnett: Strategic water advice

28 May 2020

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Key points

Badu Advisory was engaged by Jacobs to provide strategic advice to Jacobs in relation to:

- the water planning requirements, provisions, constraints and opportunities relating to the feasibility study of water supply requirements and water security options in the North Burnett and the South Burnett
- the potential water products (e.g. hydrologic performance) for the areas.

The water plan for the Burnett Basin provides for unallocated water reserves as follows:

- a total of 25,845ML of nominal volumes of supplemented water available in the strategic water infrastructure reserve made up of:
  - up to 4,250 ML for water infrastructure on Barker Barambah Creek within the Barker Barambah Water Supply Scheme
  - up to 15,295 ML for water infrastructure on the Burnett River within the Bundaberg water supply scheme
  - up to 6,300 ML for water infrastructure on the Burnett River within the Upper Burnett water supply scheme.
- A total of 2,000ML of nominal entitlement as a strategic reserve made up of:
  - 1,000 ML of water licences for projects of State significance
  - 1,000 ML of water licences for an indigenous purpose.
- A total of 2,000 ML of nominal entitlement as a general reserve for any purpose made up of:
  - 1,000 ML of water licences in the Gregory River sub-catchment
  - 1,000 ML of water licences in the Isis River sub-catchment.

In addition, there are approximately 10,469 ML of medium priority water allocation (held by Burnett Water) in the Upper Burnett Water Supply Scheme are currently unused and not able to access, or be supplied from, the water announced as being available in the scheme. This relates to the loss of storage volumes arising from the decommissioning of the fabridam at Claude Wharton Weir. Should the storage volume in the system be reinstated in the future (through, for example, the construction of a new gated structure to replace the decommissioned fabridam), it is expected that these water allocations would be reinstated again.

A further potential opportunity for the north and south Burnett may arise from unutilised and/or un-utilisable water allocations becoming available from Paradise Dam as a result of the lowering of the dam wall as an outcome of the ongoing Paradise Dam Improvement Program.

Water users appear to be justified in their concerns that monthly reliabilities of medium priority water allocations in the north and south Burnett are not adequate for the types of crops that are increasingly being grown there. For example, using water allocation security objectives as a measure, the monthly reliabilities for Barker-Barambah, Boyne River / Tarong and Three Moon Creek water supply schemes are reportedly just 75%, 70% and 65% respectively.

Improving water supply security to support the expansion of irrigated agriculture in the Burnett Basin might be achieved by a combination of improving the monthly reliabilities of groups of existing medium priority water allocations plus creating volumes of additional (new) water allocations. The report lists a number of ways that this might be achieved including constructing new (or augmenting existing) water infrastructure, reforming existing water sharing rules, as well as facilitating the movement and reconfiguring of unsupplemented water allocations and/or existing supplemented water allocation into new supplemented water allocations for new or augmented water supply schemes.

Table of Contents

1 Introduction

1.1 Context

Jacobs was engaged by the Department of Natural Resources, Mines and Energy (DNRME) to undertake a feasibility study of water supply requirements and water security options in the North Burnett and the South Burnett. The purpose of the study was to identify a range of water supply options which may be able to increase water supply security to support expansion of irrigated agriculture and deliver strong economic benefits, while protecting the environment[1].

1.2 Purpose of this report

Badu Advisory was engaged by Jacobs to provide strategic advice (in the form of this report) to Jacobs in relation to:

- the water planning requirements, provisions, constraints and opportunities relating to the feasibility study
- the potential water products (e.g. hydrologic performance) for the study areas.

1.3 Methodology

This report has been prepared based on:

- Badu Advisory's evaluation of the current water planning arrangements including a review of water planning documents and other historical information (from a water plan and water product/hydrologic performance perspective) and
- discussions with DNRME officers at the commencement of the project
- discussions with stakeholders during a field trip in November 2019
- ongoing liaison and collaboration with members of the Jacobs team.

2 Water planning provisions

2.1 Queensland's water planning framework

An overview of water planning framework is presented in Appendix A including about:

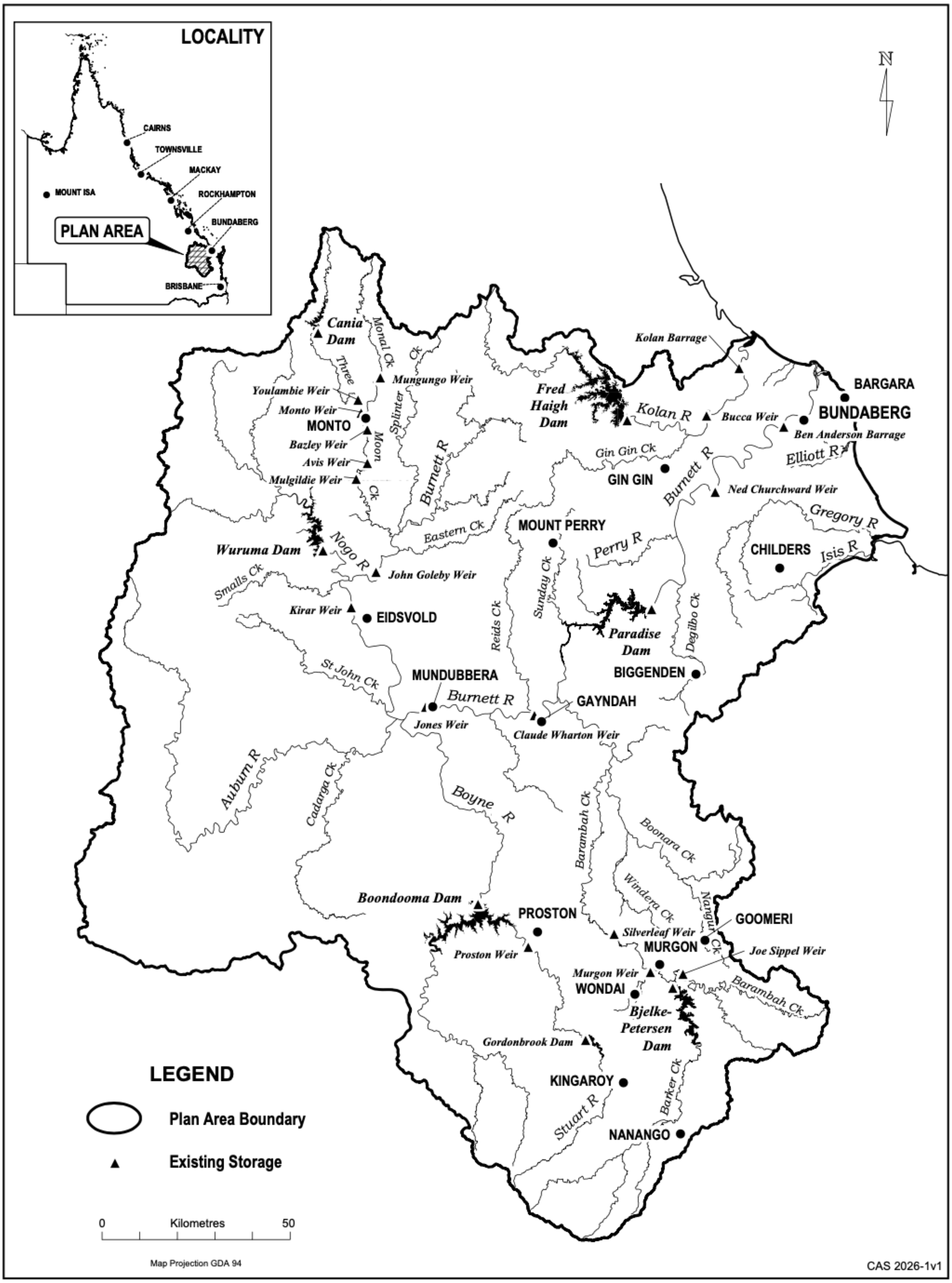
- Queensland's Water Act 2000 ('the Act')
- water allocations
- water plans
- water management protocols and operations manuals
- operations licences.

[1] From *Statement of Work Request (SOWR): DNRME19025 for the procurement of Consultant for Feasibility Study of water supply requirements in North Burnett and South Burnett*, Department of Natural Resources, Mines and Energy, 2019

2.2 The Burnett Basin water plan

Water in the Burnett River basin is allocated and managed under the Water Plan (Burnett Basin) 2014 (the 'water plan'). Figure 1 shows the plan area for the water plan.

Figure 1 – Water plan area



Replicated from the water plan area map presented on Business Queensland website

The plan was last replaced in 2014 and is due to expire on 1 September 2024. A five-year assessment of the water plan was completed in 2019 which identified a number of emerging issues[2] including:

- the interest in accommodating potential new water infrastructure developments within the plan area to address agricultural water demands and water security including Cooranga weir, Claude Wharton Weir (where a bag was decommissioned) as well as NWIDF projects including Gayndah regional infrastructure development (GRID)
- the implications of progressing the Paradise Dam Improvement Program with Building Queensland commencing an expedited assessment of options and reporting back to Government early in 2020. It is understood that Sunwater are also preparing to commence lowering the spillway as soon as the 2019/2020 wet season is over.
- the implications of long-term climate change projections for 2030 which predict an increase in evaporation across the plan area as well as a small decrease in rainfall mainly during the spring months and a small increase in rainfall mainly during the autumn months.

2.3 Existing water entitlements

Existing water entitlements in the plan area consist of supplemented water allocations, supplemented interim water allocations, unsupplemented water allocations and water licences. A summary of the total existing water entitlements within plan area is presented in Table 1.

Table 1 - Summary of existing water entitlements in the Burnett Basin

Entitlement Type	Entitlement numbers				Entitlement	
	All	Volumetric	Area	Other[T]	Volume (ML)	Area (ha)
Surface Water Licences*	775	184	352	239*	25467	5098
Underground water Licences	270	259	0	11^	35274	0
Supplemented Surface Water Allocations	4633	4633	0	0	493848	0
Unsupplemented Surface Water Allocations	439	439	0	0	48344	0
Unsupplemented Underground Water Allocations	758	758	0	0	62326	0
Interim Water Allocation	127	127	0	0	14586	0

[T] Entitlement is not stated, *Includes all licences to interfere, ^Dewatering licences.

Replicated from Appendix B, Table 7 of Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014

Figure 2 presents a map of the sub-catchment areas and water supply schemes in the Burnett Basin water plan area. The supplemented water allocations in the table above are located in water supply schemes within the Burnett River, Boyne River and Barambah Creek, and Bundaberg water supply schemes whilst the supplemented interim water allocations are located in the Three Moon Creek water supply scheme[3].

[2] *Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014*, Water Policy and Water Services (South Region), DNRME, 2019

[3] The Thee Moon creek water supply scheme currently operates under an Interim Resource Operations Licence (IROL). A water plan amendment is required to convert the interim water allocations to tradable water allocations.

Figure 2 - Sub-catchment areas and water supply schemes in the Burnett Basin

Adapted from Figure 1 of Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014 (Nov 19)

2.4 Announced allocations

Announced allocation provisions apply to water allocations in all of the supplemented water supply schemes in the plan area.

Medium priority and high priority announced allocations can vary from year to year and from scheme to scheme and are generally based on the volumes of water held in storages (dams and weirs) within each scheme.

Announced allocations for all high priority water has been set at 100 per cent in all schemes at the commencement of each water year since the plan was updated in 2014.

The Three Moon Creek water supply scheme is primarily an underground water recharge scheme where releases are made from Cania Dam to recharge the surrounding benefitted alluvial aquifer via a series of weirs along Three Moon Creek. The announced allocations for surface water and underground water are determined based on storage levels in Cania Dam and water levels in monitoring bores within the scheme area. Surface water (water flowing or ponded in Three Moon Creek) is available from time to time. Surface water customers can take their allocation when water is available in the creek[4].

2.5 Unallocated water

Section 36 of the water plan provides for strategic water infrastructure reserves, strategic reserves and general unallocated water reserves in the Burnett Basin as follows:

- There is 25,845ML of nominal volumes of supplemented water available in the strategic water infrastructure reserve made up of:
    - up to 4,250 ML for water infrastructure on Barker Barambah Creek within the boundaries of the Barker Barambah water supply scheme
    - up to 15,295 ML for water infrastructure on the Burnett River within the boundaries of the Bundaberg water supply scheme
    - up to 6,300 ML for water infrastructure on the Burnett River within the boundaries of the Upper Burnett water supply scheme.
- The plan also reserves 2,000ML of nominal entitlement as a strategic reserve made up of:
    - 1,000 ML of water licences for projects of State significance
    - 1,000 ML of water licences for an indigenous purpose.
- The plan makes available 2,000 ML of nominal entitlement as a general reserve for any purpose made up of:
    - 1,000 ML of water licences in the Gregory River sub-catchment
    - 1,000 ML of water licences in the Isis River sub-catchment.

The total volume of water that may be allocated in the Burnett Basin is effectively capped. This means that apart from the additional volumes of unallocated water reserves above or reconfiguring and/or trading existing water entitlements, the plan prohibits any decisions relating to surface water or groundwater entitlements that would have the effect of increasing the total average volume of water available to be taken in the plan area.

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[4] See *Water Supply Arrangements and Service Targets: Three Moon Creek Water Supply Scheme*, Sunwater https://www.sunwater.com.au/wp-content/uploads/Home/Schemes/Three-Moon-Creek/Three_Moon_Creek_Rules_Targets.pdf

2.6 Process for granting unallocated water

The water plan states that the process for releasing unallocated water in the plan area must be as prescribed in the part 2, division 2, subdivision 2 of the Water Regulation 2016, i.e. by:

- public auction
- tender
- fixed price sale
- grant for a particular purpose.

The Minister's November 2019 review report affirmed that the water plan outcomes, together with the Water Regulation, aim to provide a framework for the fair and transparent release of the reserved water.

2.7 Claude Wharton Weir

Section 63 of the water plan provided for specific volumes of medium priority water allocations that are held by Burnett Water Pty Ltd to be changed to low priority water allocations if and when the water sharing rules in the ROP for the Upper Burnett Water Supply Scheme ROP were amended post the commencement of the water plan. This was as a result of Sunwater's decision to deflate and decommission the Claude Wharton fabridam in November 2008 following the failure of a similar inflatable structure at Bedford Weir.

The water sharing rules for the Upper Burnett Water Supply Scheme were originally set out in an appendix to the water plan rather than the ROP. This meant that the ROP was never actually amended to include water sharing rules for the Upper Burnett Water Supply Scheme resulting in Section 63 of the water plan never being triggered. Recently, these water sharing rules have been incorporated into the Operations Manual for the scheme, again not triggering Section 63.

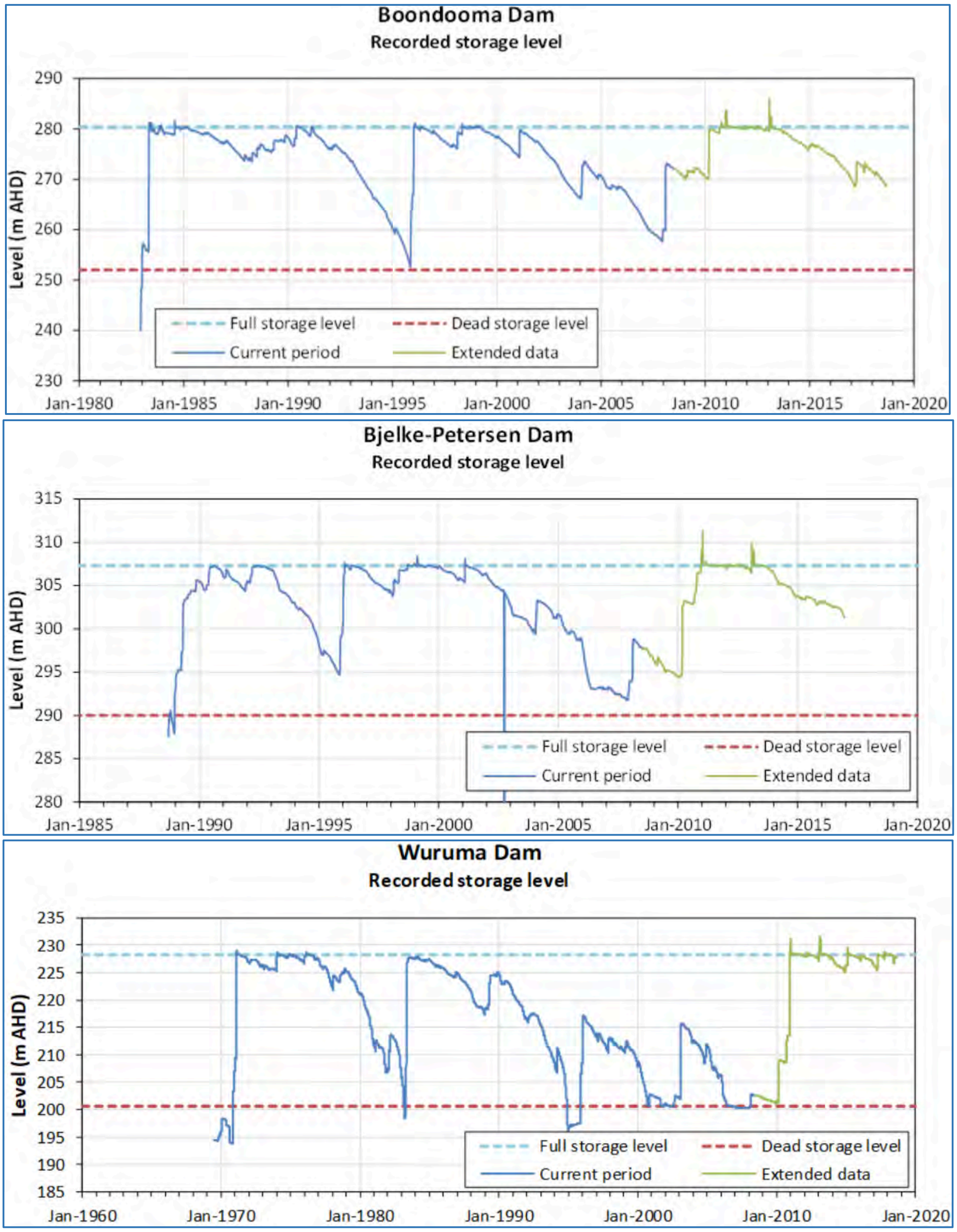
The water sharing rules have been designed to exclude 10,469 ML of medium priority water allocations. In effect, this means that 10,469 ML of medium priority water (held by Burnett Water) in the Upper Burnett Water Supply Scheme are unused and not able to access, or be supplied from, the water announced as being available in the scheme. Should the storage volume in the system be reinstated (through, for example, the construction of a new gated structure to replace the decommissioned fabridam), it is expected that these water allocations would be reinstated again.

3 Water product considerations

3.1 Historical dam storage performance

Water level data for Boondooma Dam, Bjelke-Petersen Dam and Wuruma Dam are presented in Figure 3 below.

Figure 3 - Dam storage levels



From Minister's Performance Assessment Report of the Water Plan (Burnett Basin) 2014 (Nov 19)

These illustrate that there have been significant periods over history that storage levels have been at or near dead storage level and that the timing of these periods tend to be correlated (e.g. 1996, 2009).

In the Boyne River and Tarong water supply scheme, releases are made from Boondooma Dam to meet demands for medium priority water allocation holders downstream of the dam only if the storage level is above 268.67m Australian Height Datum (AHD) which equates to approximately 70,000ML in storage capacity. No releases may be made below this to protect high priority water allocations for town water supplies and power generation. This rule has been in place since Boondooma Dam was built and was enacted in 2017-18 and 2018-19 water years.

3.2 Water allocation security objectives

The water plan specifies water allocation security objectives (WASOs) for high, medium and low priority groups of supplemented water allocations.

Section 21 of the water plan states that the WASO performance indicator for taking supplemented surface water is the monthly supplemented water sharing index. This is defined by the water plan to be the percentage of months in the IQQM simulation period in which a particular group of supplemented water allocations are fully supplied.

Table 2 presents the volumes and WASOs for each priority group of supplemented water allocations in the Burnett Basin.

Table 2 - Supplemented water allocations and associated performance objectives

Scheme	Major scheme storage	High priority nominal volume (ML)	Medium priority nominal volume (ML)	Medium priority nominal volume excluded from water sharing rules (ML)	High priority WASO	Medium priority WASO	Medium priority WASO (groundwater)	Comments
Boyne River and Tarong	Boondooma Dam	33920	9485		95%	70%		HP volume may become available if/when Tarong PSS closes in ~2039. Cut-off rule impacts MP performance
Barker Barambah	Bjelke-Petersen Dam	2236	32079		99%	75%		
Bundaberg - Burnett Water	**Burnett**: Paradise Dam, Ned Churchward Weir, Ben Anderson Barrage, **Kolan**: Fred Haigh Dam, Bucca Weir and Kolan Barrage	20000	124000		99%	90%		Lowering of Paradise Dam may lead to additional unallocated water being available for reassignment elsewhere in the Burnett Basin (to underpin new development)
Bundaberg - SunWater		24372	211957					
Upper Burnett - Burnett Water	Wuruma Dam, Kirar Weir, Jones Weir and Claude Wharton Weir	0	9531	10469	99%	85%		10,469 ML of medium priority water allcoations in the Upper Burnett Water Supply Scheme are unused and not able to access, or be supplied from, the water announced as being available in the scheme.
Upper Burnett - SunWater		1530	25460					
Three Moon Creek	Cania Dam	380	14961		95%	65%	80%	Includes supplemented groundwater

Using WASOs as a measure of hydrologic performance, the table illustrates that the monthly reliabilities of medium priority water allocations in the Barker-Barambah, Boyne River / Tarong and Three Moon Creek water supply schemes are just 75%, 70% and 65% respectively. By state standards, this might be considered to be relatively low for medium priority water products particularly where alternative water supply sources (e.g. groundwater) are limited.

3.3 Headworks utilisation

Headworks Utilisation Factors (HUFs) describe the percentage of a WSS's storage headworks volumetric capacity that is effectively utilised by each priority group of water entitlements in that scheme during critically low periods. This factor is a key consideration in, and input to, the allocation of the relevant capital costs (i.e. asset value and renewal costs) associated with a scheme's bulk water assets. It is also a useful descriptor of the extent to which headworks storage supports the performance of medium priority water allocations relative to high priority water allocations.

Table 3 presents the HUFs[5], water allocation volumes[6] and other parameters for the water supply schemes in the north and south areas of the Burnett Basin.

Table 3 - Headworks utilisation factors

Scheme	Major scheme storage	Useable volume (ML)	High priority nominal volume (ML)	Medium priority nominal volume (ML)	Proportion of total nominal volume that is medium priority (%)	Medium priority HUF (%)
Boyne River and Tarong	Boondooma Dam	195840	33920	9485	22%	4%
Barker Barambah	Bjelke-Petersen Dam	135068	2236	32079	93%	72%
Upper Burnett - Burnett Water	Wuruma Dam, Kirar Weir, Jones Weir and Claude Wharton Weir	184159	0	9531	48%	100%
Upper Burnett - SunWater			1530	25460	94%	64%
Three Moon Creek	Cania Dam	87850	380	14961	98%	61%

The table particularly illustrates that in the Boyne River and Tarong water supply scheme, the proportion of headworks storage being utilised by medium priority water allocations in critically low periods is very low (just 4%) even though medium priority water allocations represent 22% of the total nominal volume in that scheme. This is due to the operation of the announced allocation coupled with the cut-off rule in that system (as described in Section 3.1).

3.4 Opportunities for improvement

Improving water supply security to support expansion of irrigated agriculture in the Burnett Basin might be achieved by a combination of:

A. Improving product performance: Improving the monthly reliabilities of groups of existing medium priority water allocations in the basin by, for example:

   1. Reforming the water sharing rules in Boondooma Dam to remove, or mitigate, the effects from the cut-off rule
   2. Reinstating Claude Wharton Weir's full water storage volume and restoring access to the full volume of medium priority water allocations
   3. Reforming schemes' water sharing rules (e.g. by moving from announced allocations to continuous sharing) to allow greater flexibility and choice in allowing water users to select their desired long-term reliability

[5] Refer to Irrigation Price Review Submission, Appendix J: Headworks Utilisation Factors Technical Paper, Sunwater, 6 November 2018, accessed from QCA website: (https://www.qca.org.au/project/rural-water/irrigation-price-investigations/)

[6] Note that the medium priority nominal volume used to calculate the HUFs in the Upper Burnett Water Supply Scheme excludes the 10,469ML of medium priority water that is excluded from the water sharing rules.

4. Facilitating the movement and reconfiguring of unsupplemented water allocations and/or existing supplemented water allocation into new supplemented water allocations for new or augmented water supply schemes
5. Optimising in-scheme unsupplemented access rules to cater for greater use of projected water levels when making water harvesting announcements
6. Constructing re-regulating weirs downstream of existing headworks storages
7. Raising headworks storages

B. Creating additional water product: Increasing the volume of water allocations available for water users within the basin by, for example:

1. Constructing new, or raising existing, weirs
2. Constructing new, or raising existing, headworks storages
3. Freeing up high priority water allocations from Boondooma Dam through greater utilization of the Wivenhoe to Tarong Pipeline for power generation purposes
4. Constructing pipelines to enable unutilized water allocations to be accessed by existing and new water users in the north and south Burnett

Appendix A – Overview of Queensland's water planning framework

The Water Act 2000

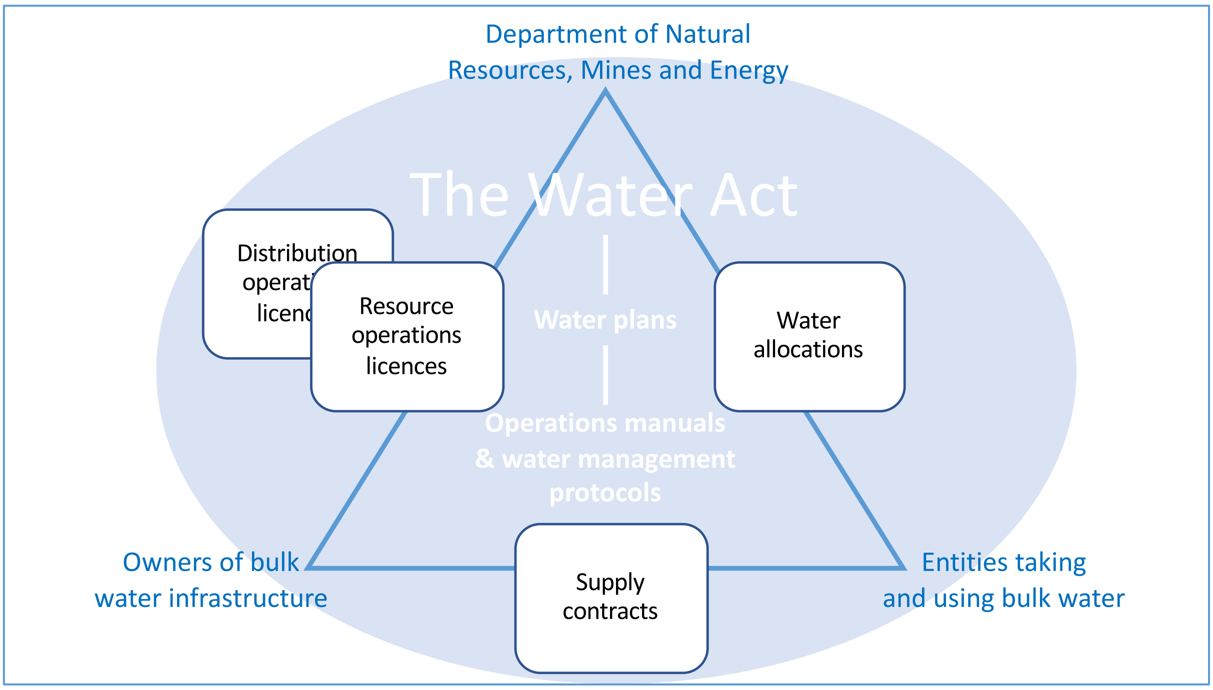
The Water Act 2000 ('the Water Act') establishes the legislative framework for planning the sustainable allocation and management of Queensland's water resources. The framework consists of:

- water plans (formerly referred to as water resource plans)
- water management protocols and operations manuals (which are progressively replacing resource operations plans)
- resource operations licences and distribution operations licences

The Water Act requires that all decisions about water allocation and management are consistent with this framework.

Figure 1 illustrates the relationships between key components of the framework that are described below.

Figure 4: Queensland's bulk water allocation framework



Water allocations

The framework establishes water allocations which grant holders authorities to take water. Water allocations are separate from land, tradeable, perpetual in tenure and subject to the requirements of the above framework.

"Supplemented water" refers to water that is supplied under a resource operations licence. A resource operations licence is required to allow the owner of water infrastructure to interfere with the flow of water in a watercourse. Supplemented water allocations are specified in terms of:

- a nominal volume
- the location from which water may be taken (generally described in terms of zones)

- the purpose for which water may be taken
- the water plan and operations manual under which it is managed
- the priority group to which it belongs
- other conditions or matters

Unsupplemented water allocations are not supplied under a resource operations licence (and generally not associated with major instream water infrastructure located in a watercourse). Examples include overland flow, water harvesting (i.e. which allow the taking of water during periods of high flow) and other opportunistic entitlements (e.g. that allow taking of water from natural instream water holes).

Water plans

Water plans define the long-term availability of water for different purposes including environmental and consumptive water uses. Water plans include:

- outcomes or aspirational targets that represent what government and the community want to achieve over time
- strategies and requirements to guide the management of environmental flows
- environmental flow objectives, water allocation security objectives and associated performance indicators to be considered when making water allocation and management decisions
- strategies that specify the groups, types and volumes of water allocations (authorities to take water) that may exist within the plan area
- strategic, general and indigenous water reserves that establish volumes, locations and allowable uses of unallocated water available in the plan area and which may be issued as new water allocations.

Water management protocols and operations manuals

Water management protocols generally includes specific rules and requirements in order to achieve the outcomes stated in the water plan. A protocol is developed by DNRME and approved by its chief executive.

Key matters included within a water management protocol include:

- (where applicable) the processes for releasing specified water volumes of unallocated unsupplemented water for stated purposes and locations
- water sharing rules for unsupplemented water in order to provide equitable sharing of water between water users
- permanent water trading rules and seasonal (temporary) water assignment rules for unsupplemented water allocations
- permanent water trading rules water assignment rules for supplemented water allocations
- other water dealing rules.

An operations manual is prepared under the Water Act where required as a condition of a resource operations licence or distribution operations licence. A manual is developed by the operator of a scheme in consultation with stakeholders but must be approved by the chief executive of DNRME. It includes the day to day operation rules for supplemented water schemes such as:

- water releases from dams to ensure that infrastructure is operated efficiently providing flows for industry, agriculture and town water supply
- water sharing rules for supplemented water in order to provide equitable sharing of water between water users supplied by the scheme
- seasonal (temporary) water assignment rules for supplemented water allocations.

Operations licences

A distribution operations licence or a resource operations licence allows a holder to take, or interfere with the flow of, water to distribute it to water allocation holders (typically through systems of channels or pipelines)[7]. The owner of an instream dam or weir is therefore likely to require a resource operations licence[8]. Depending on the institutional, operational and supply arrangements that are adopted, there may also be a requirement for a distribution operations licence[9].

An operations licence typically includes conditions related to operating arrangements and water supply requirements. A licence holder is also required to comply with the provisions of the relevant water plan and operations manual.

In the case of a supplemented water allocation (i.e. one managed under a resource operations licence), the Water Act 2000 requires there to be a water supply contract between the resource operations licence holder and the holder of the water allocation. A supply contract sets out the arrangements by which water is to be stored and supplied as well as the financial obligations.

[7] A resource operations licence also allows a holder to interfere with the flow of water to construct and operate water infrastructure (typically dams and weirs).

[8] A resource operations licence may only be held by owner of the water infrastructure (to which the licence relates) or the owner's parent company. A distribution operations licence, however, may be held by owner of the water infrastructure (to which the licence relates), the owner's parent company or by an entity nominated by the owner.

[9] If the owner of a distribution network (e.g. pipeline or channel) was a different entity to (and not a subsidiary of) the owner of the dam, and water allocations were to be supplied via that distribution network, then the distribution network owner would also need to separately hold a distribution operations licence.

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Appendix D

Options Analysis

Appendix D. Risk register

Risk description	Trigger	Impact	Likelihood	Consequence	Rating	Control strategy
Process risks						
COVID-19 Restrictions	Caused by the Coronavirus disease.	State and National restrictions on travel, public and social gatherings	High (occurring)	Major	High	• Utilising remote working tools such as Microsoft teams, SharePoint and Dropbox to allow the team to work seamlessly and keep up to date. • Teleconference and video calling programs including Zoom, Skype for Business and Microsoft teams to allow regular virtual face to face meetings internally and with DNRME. Continued use of online project management and organisational tools – MS Project.
Risk of not correctly evaluating the base case in regard to net benefits	Caused by poor information or inaccurate assumptions	The benefits derived from each option are smaller than estimated.	Possible	Moderate	Medium	Undertake a detailed demand assessment and investigation into current cropping practices for the Detailed Business Case,
There is a risk of change of government or mayor/councillors	caused by Council election (March 2020) State election (October 2020) Federal election (due 2022)	Resulting in changes in support for the study, and Mayor/council changes impacting acceptance of Options Analysis direction or conclusions	Possible	Moderate	Medium	Comply with good business case practices through an unbiased assessment. If change of regional government occurs during study, consultants to actively and directly engage with new government

Risk description	Trigger	Impact	Likelihood	Consequence	Rating	Control strategy
						members to provide information and opportunities to contribute.
There is a risk that the Councils do not support project outcomes	Caused by the Options Analysis resulting in recommendations of fewer or different investments than anticipated by the Council	Resulting in the PBC not being approved by the project steering committee, resulting in rework, delays or loss of project funding	Possible	Moderate	Medium	Comply with good business case practices through an unbiased assessment
There is a risk of changes to the Building Queensland Framework	caused by the release of a new framework during the study period	resulting in delays or the production of a business case that does not comply with the new framework	Possible	Moderate	Medium	Consultants to conduct an assessment if/when the new framework is released and identify a strategy to prepare a business case that complies with the new framework within the project time frames
There is a risk of ineffective, duplicated or conflicting communications	caused by concurrent, related and overlapping Burnett feasibility (NWIDF), BQ and Sunwater processes and studies	resulting in frustrated, disengaged or confused stakeholders leading to project delays, potential loss of project funding and/or reputational damage to the council, state and consultants	Likely	Moderate	High	Consolidate stakeholder lists and outline timelines for stakeholder engagement—to be coordinated with other studies Streamline engagement activities across the NWIDF, BQ and Sunwater Blueprint processes
There is a risk of incomplete review of existing studies	caused by an inability to source previous reports	resulting incomplete and potentially inaccurate information	Possible	Moderate	Medium	Regularly consult with DNRME and Sunwater to obtain previous reports in a timely manner to allow them to be considered in the study
There is a risk of delays to concurrent dependent	caused by decisions and delays in the Paradise Dam	resulting in uncertainty regarding project option viability	Possible	Major	High	Seek regular briefings on direction and likely outcomes of

Risk description	Trigger	Impact	Likelihood	Consequence	Rating	Control strategy
strategic plans and studies	study, Sunwater Regional Blueprint, SEQ WSP, and Kingaroy Regional Water Supply Security Assessment	and performance precludes development of project conclusions and recommendations resulting in project delays and potential loss of project funding				concurrent planning and studies
There is a risk that there is limited additional demand and/or low willingness to pay.	caused by completion of a demand assessment	Resulting in the project recommending little or no public investment and does not proceed	Possible	Moderate	Medium	Engage an experienced party with an understanding of irrigation to forecast demand and willingness to pay
There is a risk of a lack of Seqwater, DNRME or Sunwater support	caused by a lack of support for options affecting and/or requiring approval by Seqwater, DNRME or Sunwater	resulting in many options being difficult or impossible to progress, resulting in rework, delays or loss of project funding	Unlikely	Major	Medium	Close and continual engagement
There is a risk of unexpected events impacting the study	caused by an unpredictable event (such as a natural disaster in the study area)	resulting in process delays or inability to perform effective investigations and engagement	Unlikely	Major	Medium	Consultants prepare strategy for the use of alternative communication methods and project management techniques
There is a risk that the water study loses momentum and community support	caused by other distractions (such as Covid-19, drought or high rainfall)	resulting in delays and lessening demand from prospective customers	Likely	Moderate	High	Consultants providing regular project updates and maintaining active stakeholder engagement
There is a risk that there will be a perception that the economic benefits of the shortlisted options are overstated	caused by misunderstandings and lack of information about the basis for the economic analysis	resulting in reduced State and Commonwealth Government support for the project	Rare	Moderate	Low	Share the basis for the economic estimates and modelling with State and Commonwealth Governments.
There is a risk that timelines for the Options Analysis will be missed	Caused by restrictions on public gathering due to Covid-19	resulting in substantive delays to the completion of the detailed business case	Likely	Insignificant	Low	Continued monitoring of restrictions on gatherings and planning meetings to maximise both

Risk description	Trigger	Impact	Likelihood	Consequence	Rating	Control strategy
						safety and efficiency.
There is a risk that there will be a lack of engagement by the Project Steering Committee	caused by poor communication with and by the group	resulting in loss of progress and momentum for the Reference Project	Rare	Moderate	Low	The Project Steering Committee has been highly engaged and will be encouraged to continue working in the same way going forward
Proposal risks						
There is a risk of climate change impacts	Caused by a change in temperature, rainfall and number and severity of extreme events beyond what is already anticipated	resulting in lower than expected water security and reduced agricultural production	Possible	Major	High	Ensure resilience to climate change is a key consideration in filtering and evaluating project options
There is a risk that the industry is government-led rather than market-led	Caused by unexpected changes to policy, regulation or legislation	Resulting in markets signal that is affected, and inefficient decision-making	Unlikely	Moderate	Medium	Ensure the business case clearly communicates to government the risks that excessive market intervention can have on benefits realisation
There is a risk that the project analysis overestimates demand	caused by poor information or inaccurate assumptions informing demand assessment caused by market demand satisfied by increased production and investment in other regions	resulting in underutilised water allocations and reduced agricultural investment and value-add	Unlikely	Major	Medium	Apply best practice forecasting methodology Engage an experienced party with an understanding of irrigation to forecast demand Ensure that potential infrastructure investments in other regions inform project demand assessment
There is a risk of unexpected outcomes from related and overlapping BQ and Sunwater	caused by water infrastructure investment decisions made prior to decisions regarding the	resulting in benefits that are not fully realised due to the selection of a	Possible	Major	High	Seek regular briefings on direction and likely outcomes of concurrent

Risk description	Trigger	Impact	Likelihood	Consequence	Rating	Control strategy
processes and studies	long-term future of Paradise Dam and other related assets and policies	suboptimal project option				planning and studies Ensure business case investment recommendations are conditional on outcomes of related studies
There is a risk that the identified demand for water is uncertain and unreliable	caused by potential customer overstating their future demand	resulting in increased requirement for public funding and threatening the viability of and reference project	Possible	Moderate	Medium	The consultants should conduct multiple consultations with prospective customer to identify, assess and confirm demand
There is a risk that the options included in the shortlist will exclude prospective customers	caused by the high cost of reaching customers a significant distance from the nearest mainline	resulting in reduced stakeholder support	Possible	Insignificant	Low	Consult widely and regularly in order to capture the largest possible number of potential customers.
There is a risk that the study will underestimate the impacts of certain options on Stanwell	caused multiple information sources and different views	resulting in increased risk to any reference project and to Stanwell.	Possible	Moderate	Medium	Direct engagement with Stanwell and the Energy division of DNRME to understand and test information and proposals
There is a risk that a commercial arrangement will not be able to be reached for sharing infrastructure assets in South Burnett	caused by unchangeable operational or contractual limitations	resulting in assets being unavailable for new water solutions	Possible	Major	High	Recommend that the first steps for the relevant option(s) include detailed and direct negotiation with Stanwell
There is a risk the study will overstate the likelihood of commercial transactions required to progress certain options	caused by misinformation of misunderstanding the commercial (and other) drivers for interested parties	resulting in increased risk to any affected reference project	Possible	Moderate	Medium	Directly engage with potential commercial parties to understanding needs and risks
There is a risk that there will be a weakening of export demand for agricultural produce	caused by reduced demand and protectionist actions in export destinations	resulting in reduced revenue for project customers threatening their ability to pay	Unlikely	Minor	Low	Engage with irrigators to encourage diversification in export customer profiles to hedge against demand

Risk description	Trigger	Impact	Likelihood	Consequence	Rating	Control strategy
		contracted water prices				fluctuation and considering insuring against business failures

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Appendix E

Options Analysis

Appendix E. Stakeholder engagement plan and register

The project requires significant stakeholder engagement in order to achieve its objective of identifying one or more reference projects that will meet the needs of the region. In this Options Analysis, where the viability and comparative value of each option is under consideration, it is critical to undertake strong stakeholder management, engaging appropriately with the relevant people at the right time.

Stakeholders will provide:

- assistance in understanding relative strengths and weaknesses of each option under consideration;
- collaboration in the review and assessment of each option;
- a source of primary data and lived experience of assessing the potential public interest impact of each option;
- refinement of selection criteria relevant to commercial irrigators, the environment, the community, Sunwater, industry, government and regulators;
- collaboration in the assessment of the feasibility of each option and the scoring against selection criteria; and
- support for the solution.

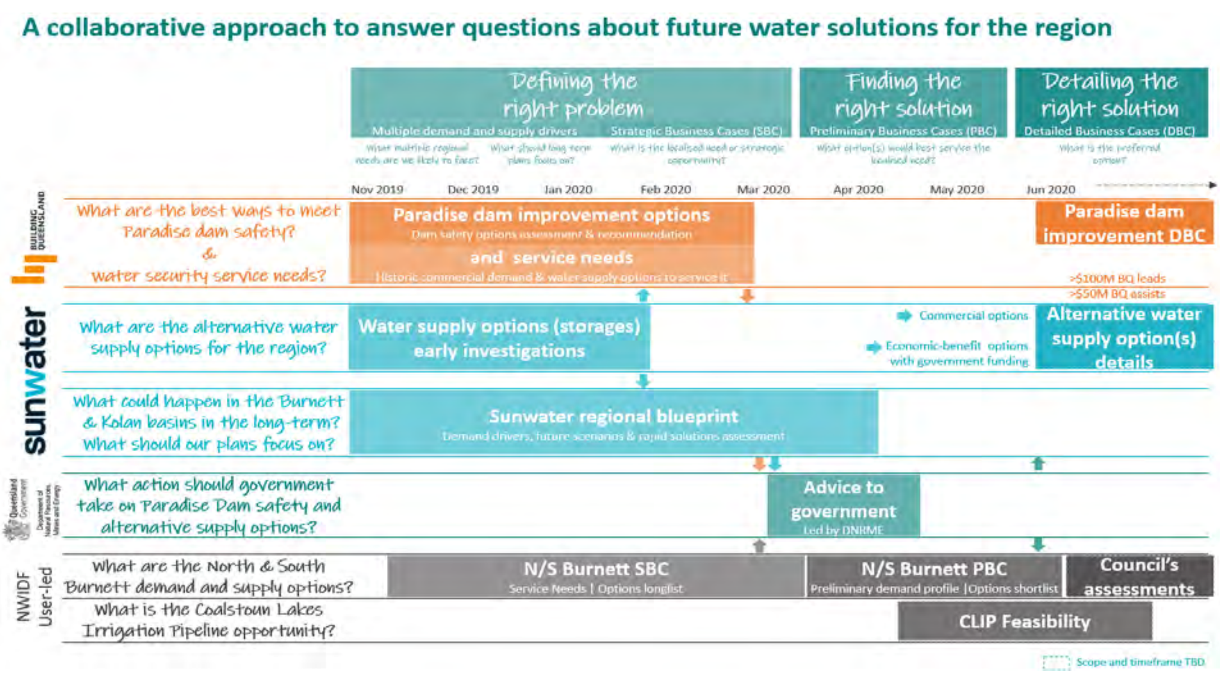
Stakeholders are essential to the success of the project.

This Stakeholder Engagement Plan (SEP) adopts an open and exploratory perspective of water demand and supply in the study region and demonstrates the commitment to engagement and learning from those with not only a detailed knowledge of water supply and demand issues, but also the region. It seeks to balance the objectives and outcomes of the project with the expectations of its stakeholders.

This is another concurrent study being undertaken exploring water options in the region. Building Queensland, with Sunwater, are further exploring and investigating long-term options related to Paradise Dam during 2020. As this study will engage key stakeholders, coordination between the project teams will be crucial to minimise project confusion and engagement fatigue, as well as share learnings of mutual interest.

A graphical depiction of the various processes is shown below.

Figure E.1: Stakeholder Engagement Process for project



This Stakeholder Engagement Plan (SEP) is a living document and will be adjusted throughout the project.

Approval by DRNME and the appropriate council will be obtained for all stakeholder engagement activities before any activities are implemented.

E.1 Purpose and objectives of stakeholder engagements

E.1.1 Purpose

Engagement with stakeholders will contribute to determining the range of potential initiatives to be explored, test the soundness and size of the opportunity in the final reference project and to influence the success of its outcome. Specifically, the engagement will assist with identification of the service need, options longlist, selection criteria, options shortlist and risk mitigation measures – all key elements of the project.

E.1.2 Objectives

The goal of this SEP is to guide consultation with stakeholders that will allow us to:

- gain an understanding of the benefits and disbenefits of options under consideration,
- identify irrigators and how their needs can be considered in the final project recommendation,
- provide clear communication pathways throughout the project – gathering information and providing consistent, frequent communications
- to ensure stakeholders are fully informed, understand the purpose of an options analysis and associated timeframes, and understand how they can provide meaningful input to the assessment process.
- ensure outcomes of the feasibility study have a high level of confidence that they are supported by stakeholders and meeting a direct need

This SEP demonstrates that:

- all relevant stakeholders have or will be identified with their opinions reviewed and documented
- a hierarchy of stakeholders has been developed, taking into account stakeholders' ability to influence the project and the extent to which the project will affect them
- an assessment of acceptance of the outcomes is undertaken with alternative views addressed

E.2 Stakeholders

Stakeholders of the project are those affected by current and future water supply in the Burnett region and well placed to assist the project, as well as those who can influence the outcomes of any proposed initiative.

E.2.1 Key project stakeholders

The below table provides a summary of identified stakeholders and their interests in the project.

Table E-1: Key project stakeholders

Stakeholder category	Stakeholder	Interest/s
Internal stakeholders		
Project partners	Department of Natural Resources, Mines and Energy	• Administrative facilitator for the feasibility study
	North and South Burnett Regional Councils	• Recipients of the NWIDF funding
	Jacobs	• Lead consultant for feasibility study
Australian Government		
Departmental Ministers	Minister for Agriculture and Water Resources	• Alignment with federal objectives and plans • Infrastructure that is properly planned and timed • Investment decision/approval of any further investigations and any resulting project outcomes • Environmental approvals/ requirements
	Minister for the Environment and Energy	
	Minister for Infrastructure and Transport	
Elected representatives	Queensland Senators and Federal Members representing study areas – Maranoa, Flynn and Wide Bay.	• Alignment with federal objectives and plans • Infrastructure that is properly planned and timed • State, regional and local economic, social and environmental impacts
Australian Government departments and authorities	Department of Infrastructure, Transport, Cities and Regional Development	• Administration of the NWIDF • Administration of funding for renewable energy projects • Review of business cases • Alignment with federal objectives and plans
	Department of the Environment and Energy	
	Infrastructure Australia	
Queensland Government		
Premier and Departmental Ministers	Premier and Minister for Trade	• Investment decision/approval • Alignment with other Queensland Government department objectives and plans • Infrastructure investment that is properly planned and timed
	Queensland Treasurer	
	Minister for Natural Resources, Mines and Energy	
	Minister for State Development, Manufacturing, Infrastructure and Planning	
	Minister for Agricultural Industry Development and Fisheries	
	Minister for Environment and the Great Barrier Reef	
Elected representatives	State Members for Callide and Nanango	• Alignment with state objectives and plans • Infrastructure that is properly planned and timed • Local economic, social and environmental impacts
Queensland Government departments, authorities and corporations	Queensland Treasury	• Alignment with other Queensland Government department objectives and plans • Infrastructure investment that is properly planned and timed • Review, input and feedback on the SBC and PBC • Alignment of parallel water studies in the region
	Department of Natural Resources, Mines and Energy	
	Department of State Development, Manufacturing, Infrastructure and	

	Planning (including the Office of the Coordinator-General)	• Ongoing management and delivery activities – in particular, coordination of overlapping project stakeholder management activities
	Department of Agriculture and Fisheries	
	Department of Environment and Science	
	Building Queensland	
	Sunwater	
Local government		
Councils	North Burnett Regional Council + South Burnett Regional Council	• Feasibility Study proponents • Urban water supply security • Agricultural and industrial water supply security • Job creation in the region • Impact on environment • Advancing the area's status as an attractive place to invest • Infrastructure location and planning • Increasing agricultural and related industry production
Community and business		
Community groups	TBC	• Local regional advocates for water supply security
Landholders	TBC	• Impact on existing water supply and environment • Access to property
Potential customers	Parties that could receive water from the project	• Solutions to water supply issues • Access to secure water • Business growth and profitability
Environmental groups	TBC	• Minimisation and/or mitigation of environmental impacts • Monitoring and reporting activities
Traditional owners/Aboriginal cultural heritage	TBC	• Any Native Title or cultural implications
Business	Coalstoun Lakes Development Group Kingaroy Chamber of Commerce and Industry Mundubbera Enterprise Association Gayndah Chamber of Commerce Burnett Inland Economic Development Organisation Barker Barambah IAC Boyne River and Tarong IAC Three Moon Creek IAC Upper Burnett IAC	• Removing impediments to business growth and regional economic prosperity • Improved conditions for local residents, industry and other sectors • Advancing growth • Job creation in the region
	Large agricultural and industrial water users - TBC	
Other irrigators	Owners and operators of farming operations that will not directly benefit from the study	• Ensure that potential projects do not adversely impact on their business operations and availability to water

Industry peak bodies	TBC	• Improved conditions for industry sectors • Advancing the region's status as an attractive place to invest
Potential suppliers	TBC	• Scope of proposed initiatives as potential business generation
Media	TBC	• TBC

E.3 Methodology

Consistent with the guidance provided by BQ's Options Analysis Framework, the following specific information and has been identified in the Stakeholder Engagement Plan.

- Stakeholder name & description
- Extent of stakeholder interest and influence in service need/potential initiative
- Stakeholder score
- Proposed mechanism for stakeholder engagement (inform, consult, active participation)
- Risk of engaging (or not) with stakeholder
- Proposed strategies of managing stakeholder risks.

This SEP follows the Building Queensland framework for stakeholder engagement, balancing the benefits of better outcomes through improved articulation of the service need with the risks of engagement in the process. Stakeholder expectations will be clearly managed throughout.

Stakeholders will continue to be identified throughout the preparation of the PBC, as the proposal progresses, with activities designed to meet their unique needs.

E.4 Council messaging

Each of the councils are responsible for communication with the broader public in their respective council areas. The councils intend to take a different approach to seeking input from the community. However, some messages may be in common. Some core messages include:

> South and North Burnett Regional Councils have together secured National Water Infrastructure Development Fund (NWIDF) funding to identify the long-term water needs of the region and assess options for meeting those needs.
>
> The project aims to identify and progress projects to improve water reliability of existing supplies for towns, business and irrigated agriculture in the Burnett, to boost the economic dynamics in the region and to underpin future investment. The program will directly focus on identifying ways to create more water for our region and also on key projects that improve the reliability of existing allocations.
>
> This phase of the study – the strategic and options analysis – will by mid-2020 generate a short list of the most promising water infrastructure and related options to meet the region's key water needs. From there the preferred option for each council area will be designed and costed in a late 2020 detailed business case.
>
> The NWIDF Burnett water feasibility study will be coordinated in partnership between South Burnett Regional Council, North Burnett Regional Council, Department of Natural Resources, Mines and Energy, and Sunwater. We were recently pleased to announce that Jacobs have been appointed as our lead consultant for the program and have extensive experience across this field.

> We are excited that the water agenda has become prominent at all levels of government, and the NWIDF Burnett Feasibility Study is one of three critical and concurrent pieces of information that will shape our future water strategies.

It is up to council how they chose to communicate with their stakeholders.

E.5 Stakeholder Scoring

Each stakeholder is provided a score based on their interest in (impact) and influence on the project.

The scoring matrix used in this process in outlined below.

Figure E-2: Scoring matrix used in stakeholder consultation

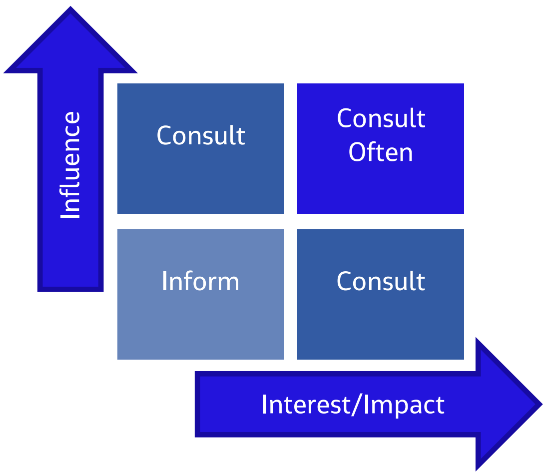
Interest/Impact Level

Influence Level		Low	Medium	High
	Low	2	4	6
	Medium	3	6	9
	High	4	8	12

The scoring matrix uses a standard multiplier to develop a total score which combines the overall influence and interest the stakeholder has in regard to the project. For example, a stakeholder with a low influence and interest level would receive a score of 2.

The higher the score the more importance and rank that was associated with the particular stakeholder for the project.

E.5.1 Stakeholder Strategy



Jacobs will undertake stakeholder engagement through its tried and tested methodologies with its distinctive authentic, commercial and engaging style.

Stakeholder engagement will be undertaken as a tailored, multi-channel and phased approach, applied variously according to the stakeholder and the needs of the project stage. Reflecting the importance of stakeholder input to the success of the project outcomes, the project team will focus its attention on a small group of representative stakeholders with a high degree of interest in water supply and influence over the outcome.

It will engage these stakeholders over the life of the project, from identification of the problem and creation of a longlist of solutions to selection criteria and ultimately endorsement of the outcomes.

E.5.2 Key messaging

Specific messages will be developed for the various activities within the plan, tailored for the stakeholder and the outcomes required from the activity. Foundational messages for stakeholders as they are engaged will be:

- Stakeholders are being engaged from the very beginning of the project and throughout the development the feasibility study of water supply options for the region, ensuring the solution is developed with deep consideration of a broad range of perspectives.
- Stakeholder input has been recognized as critical to the development of an optimal water supply solution for the Burnett region, ensuring the outcome of the study for North Burnett and South Burnett Regional

Councils is the identification of a reference project which best meets the needs of the entire region and those affected by it.

- This is an important opportunity for those impacted by water issues in the Burnett to provide substantial input at its earliest exploratory stages, influencing the future of water management and contributing to the region's sustained prosperity.
- We will work with you to ensure your concerns and aspirations are directly reflected in the options explored and identification of the preferred solution.

E.6 Stakeholder Engagement Plan

Stakeholders will be engaged at different levels according to the needs of the stage of the development of the study and the needs of the stakeholder. In the earliest phases we will predominantly employ one-to-one communications, with formal group discussions to be commenced mid-way through the development of the Options Analysis. This approach recognizes the other concurrent water supply investigations being conducted for Building Queensland. Coordination with both concurrent studies is required, to avoid multiple approaches to the same individuals, to be achieved with the assistance of DRNME.

Through the Stakeholder Engagement Plan developed and implemented by Jacobs during the preparation of the SBC, Jacobs engaged with large and diverse group of stakeholders.

In the Options Analysis, Jacobs will continue and reinforce its engagements with key stakeholders and build on the understanding gained during the SBC process. Jacobs will regularly engage with each of the proponent Councils to obtain feedback on information and assessments of each of the options under consideration.

Jacobs will meet with stakeholder groups in one-on-one meetings, and group gatherings, to gain deeper understanding of the details of prospective options and the critical issues that may impact the success, or failure, of a particular option.

The PSC will meet to review the High-Level Assessment and develop the criteria for the Multi-Criteria Analysis, including categories, descriptions and weightings for the criteria.

Jacobs will present and share the High-Level Assessment, Multi-Criteria Analysis and detailed analysis throughout the process in order to keep stakeholders informed and to gain immediate feedback and improvements on the analysis as it relates to specific stakeholders.

E.6.1 Impact of Covid-19

The Stakeholder Engagement Plan was substantively impacted by the onset of Covid-19 the travel restrictions that prevented in-person and onsite meetings with stakeholders for the majority of the period of the Options Analysis. At or around the time of the commencement of the Options Analysis there was a restriction on travel to, and around, the study area.

In response to these changed circumstances, Jacobs amended the Stakeholder Engagement Plan in consultation with the PSC. The changes to the Stakeholder Engagement Plan included:

- Planned and scheduled one-on-one meetings with stakeholders in South Burnett were changed to video-conferences coordinated through the South Burnett Regional Council.
- All known attendees for scheduled public forum events were personally and directly contacted by Jacobs and provided the opportunity for a one-on-one discussion. Most scheduled engagements with stakeholders proceeded remotely.
- All engagements with key stakeholders during April and May were undertaken by teleconference or videoconferencing, including PSC meetings, stakeholder consultations with the energy division of DNRME and Stanwell, engagements with industry, discussions with potential customers and meetings with other stakeholders.

Table E-3: Stakeholder Engagement Plan (SEP)

Rank	Stakeholder entity	Contact Name	Interest level	Influence level	Score	Proposed mechanism and actions	Engagement Plan (frequency and timing)	Risk of not consulting (or risk of consulting)	Risk management strategies
=1	Department of Natural Resources, Mines and Energy		H	H	12	• Formal updates and presentations at monthly meeting Regular direct communication • Invites to public meetings and other key discussions	• Formal monthly updates Ad hoc discussions on key matters	• Disruption to project delivery • Rework and delays to milestones • Misinformation about the project • Misalignment of project expectations	• Ongoing constructive communication • Share initial findings and seek feedback
=1	Councils	North Burnett Regional Council South Burnett Regional Council	H	H	12	• Represented on Project Steering Committee • Regular communication and meetings with senior executives and Councillors • Offer of project briefings	• Monthly or more frequent if required on particular matters	• Disruption to project delivery • Unable to receive Council support for project • Misinformation about the project • Misalignment of competing interests and project expectations	• Regular contact with senior executives and Councillors • Promote the community benefits and positive impact to the region of the project
=1	Project Steering Committee (TBC)		H	H	12	• Weekly telephone update • Provision of draft chapters • Invited to stakeholder workshops	• Weekly updates • Draft chapters as per project plan	• Disruption to project delivery • Rework and delays to milestones • Misinformation about the project • Misalignment of project expectations	• Ongoing constructive communication • Share initial findings and seek feedback on draft options analysis by chapter
=1	Potential customers	Parties that could receive water from proposed solution	H	H	12	• Regular communication through face-to-face meetings and phone conversations	• Direct communications throughout project • On an as-needs basis for specific matters	• Lack of project support • Not delivering a project meeting customer requirement	• Regular engagement on the opportunities identified through the project • Continuous engagement to gather

Rank	Stakeholder entity	Contact Name	Interest level	Influence level	Score	Proposed mechanism and actions	Engagement Plan (frequency and timing)	Risk of not consulting (or risk of consulting)	Risk management strategies
						• Invited to stakeholder workshops, including ILM		• Misinformation about the project	input and response to proposed initiatives
=5	Federal departments and authorities	• Department of the Environment and Energy • Infrastructure Australia	H/M	H	10	• Regular updates on project status via Queensland departments • Specific and direct engagement on matters of interest and/or areas requiring feedback and guidance	• Regular project updates • On an as-needs basis for specific matters	• Disruption to project delivery • Rework and delays to milestones • Misinformation about the project • Misalignment of project expectations	• Providing regular updates and presenting an understanding of the opportunities and challenges of the project
=5	State departments, authorities and corporations	• Queensland Treasury • Department of Natural Resources, Mines and Energy • Department of State Development, Manufacturing, Infrastructure and Planning (including the Office of the Coordinator-General) • Department of Agriculture and Fisheries • Department of Environment and Science	H/M	H	10	• Regular updates on project status through DNRME • Specific and direct engagement on matters of interest and/or areas requiring feedback and guidance	• Regular project updates • On an as-needs basis for specific matters	• Disruption to project delivery • Rework and delays to milestones • Misinformation about the project • Misalignment of project expectations	• Providing regular updates and presenting an understanding of the opportunities and challenges of the project

Rank	Stakeholder entity	Contact Name	Interest level	Influence level	Score	Proposed mechanism and actions	Engagement Plan (frequency and timing)	Risk of not consulting (or risk of consulting)	Risk management strategies
		• Sunwater							
=7	Business	• Kingaroy Chamber of Commerce and Industry • Gayndah Chamber of Commerce • Burnett Inland Economic Development Organisation • Coalstoun Lakes Development Group ▪ Barker Barambah IAC ▪ Boyne River and Tarong IAC ▪ Three Moon Creek IAC • Upper Burnett IAC	M	L	8	• Specific and direct engagement on matters of interest and/or areas requiring feedback and guidance • Invitation to participate in workshops	• On an as-needs basis on specific matters	• Disruption to project delivery • Lack of interest or readiness for project • Misinformation about the project	• Engagement at specific stages of the project • Providing a clear understanding of the relevant expectations and opportunities with the project
=8	Media		M	M	8	• Regular updates on project status • Specific updates on project milestones and matters of interest		• Misinformation about the project Misalignment of project expectations	• Providing regular updates and presenting an understanding of the opportunities and challenges of the project
=8	Community groups		M	M	6	• Specific and direct engagement on matters of interest and/or areas requiring	• On an as-needs basis on specific matters	• Misinformation about the project • Misalignment of project expectations	• Engagement at specific stages of the project

Rank	Stakeholder entity	Contact Name	Interest level	Influence level	Score	Proposed mechanism and actions	Engagement Plan (frequency and timing)	Risk of not consulting (or risk of consulting)	Risk management strategies
						feedback and guidance			
=8	Other irrigators	• Parties that are unlikely to purchase water from any solution, though with an interest in the overall impact of proposed solutions.	M	M	6	• Specific and direct engagement on matters of interest and/or areas requiring feedback and guidance	• On an as-needs basis on specific matters	• Lack of interest or readiness for project • Misinformation about the project	• Direct engagement on issues of particular interest or relevance • Clear and honest engagement
=10	Environmental groups		M	L	4	• Specific and direct engagement on matters of interest and/or areas requiring feedback and guidance	• On an as-needs basis on specific matters	• Misinformation about the project Misalignment of project expectations	• Engagement at specific stages of the project
=17	Potential contractors	• Parties that could tender for any resulting project	M	M	4	• Specific and direct engagement on matters of interest and/or areas requiring feedback and guidance	• On an as-needs basis on specific matters	• Lack of interest or readiness for project • Misinformation about the project	• Engagement at specific stages of the project • Providing a clear understanding of the relevant expectations and opportunities with the project
=17	Landholders		H	H	4	• Invitation to participate in workshops • Regular contact with updates of the project and potential impacts to property	• Regular bi-monthly contact or more frequent when required	• Disruption to project delivery • Potential to be obstructive towards any future initiatives • Misinformation about the project	• Regular and honest engagement • Involvement in the process

Rank	Stakeholder entity	Contact Name	Interest level	Influence level	Score	Proposed mechanism and actions	Engagement Plan (frequency and timing)	Risk of not consulting (or risk of consulting)	Risk management strategies
=17	Traditional owners / Aboriginal cultural heritage					•	•	•	•
=17	Industry peak bodies		M	L	4	• Specific and direct engagement on matters of interest and/or areas requiring feedback	• On an as-needs basis on specific matters	• Misinformation about the project • Misalignment of project expectations	• Engagement at specific stages of the project

E.7 Stakeholder engagement register

The following Stakeholder Engagement Register (SER) table has been developed to provide a summary of key findings arising from engagement with key stakeholders in the project region. The method of documentation for this project is in accordance with the stakeholder engagement plan and Building Queensland guidelines.

It contains record of all stakeholders, contacts, dates of engagement with comments or summarised key findings

Table E.2: Stakeholder Engagement Register (SER)

Stakeholder entity	Key contacts	Score	Activity	Date	Summary of Key Findings (some confidential)
Internal Stakeholders					
Project Steering Committee	▪ Trevor Harvey ▪ Ged Brennan ▪ Kristy Frahm	12	▪ Project inception meetings ▪ Stakeholder List and Focus Group ▪ ILM Workshops – North and South Burnett ▪ Reviewing project documentation ▪ Development of assessment criteria ▪ Project oversight	▪ 25-27 November 2019 ▪ 6 &12 February 2020 ▪ 5 March 2020 ▪ 5 May 2020 ▪ 11 May 2020 ▪ 15 May 2020 ▪ Ongoing communications	▪ Project manager (in conjunction with DNRME) and primary reviewer of the SBC. ▪ Provided key guidelines surrounding the writing of the report. Including relevant feedback on drafts, document style, formatting and document properties. ▪ Established the importance of providing a report that is based on evidence and economic data to support the need to for improvement. It also requires a document to communicate with the community it serves. ▪ Key role in the engagement of key stakeholders, including the Australian, Queensland and local governments. ▪ Noted the importance of maintaining an extensive options list to allow for the best decisions to be made. ▪ The North and South Burnett must both benefit out of the study. ▪ Ongoing updates on assessment of options ▪ Reporting on outcome of initial assessment and shortlisting ▪ Consulting regarding criteria ▪ Consulting regarding impact of governmental changes and briefing new councillors
Australian Government					
Department of the Environment and Energy		10	▪ Project update and progress report via Queensland Government Department	▪ Ongoing	▪ Update on the project and progress to date, including support of the project going forward. ▪ Will continue to consult throughout the business case process.

Infrastructure Australia		10	▪ Project update and progress report via Queensland Government Department	▪ Ongoing	▪ Update on the project and progress to date, including support of the project going forward. ▪ Will continue to consult throughout the business case process.
Queensland Government					
Queensland Treasury		10	▪ Project update and progress report via DNRME	▪ Ongoing	▪ Update on the project and progress to date, including support of the project going forward. ▪ Will continue to consult throughout the business case process.
Department of Natural Resources, Mines and Energy (DNRME)	▪ Paul Hope ▪ Grant Horton ▪ Ubong Ntuk ▪ Other officers	12	▪ Project Inception meeting ▪ Sunwater Scenario Planning Workshop ▪ ILM Workshops – North and South Burnett ▪ Reviewing project documentation ▪ Development of assessment criteria ▪ Project oversight	▪ 31 October 2019 ▪ 4-5 December 2019 ▪ 6 &12 February 2020 ▪ 5 March 2020 ▪ 3 April 2020 ▪ 5 May 2020 ▪ Ongoing	▪ Update on progress of the project. Including the progression of parallel studies. ▪ Update and discussion on the water plan and unallocated water in region. ▪ Discussion on the seeking support for the unallocated water allocation required for the project. ▪ Project management arrangements and scope requirements ▪ Expectation that the business case is comprehensive, and the process is collaborative Ongoing updates on assessment of options ▪ Reporting on outcome of initial assessment and shortlisting ▪ Consulting regarding criteria ▪ Consulting regarding governmental stakeholders
Energy Division, Department of Natural Resources, Mines and Energy (DNRME)	▪ Allan Weatherley	12	▪ Energy policy ▪ Energy generation risk management ▪ Stanwell Corporation	▪ 16 April 2020 ▪ Other communications	▪ Consultation on energy policy issues and management of energy related risks
Regional Urban Water Supply Planning, Energy Division, Department of	▪ Craig Gordon	12	▪ Urban water modelling for Kingaroy	▪ 13 May 2020 ▪ Other communications	▪ Consultation on modelling for urban water failures in Kingaroy ▪ Consultation on Gordonbrook Dam modelling and usage

Natural Resources, Mines and Energy (DNRME					
Department of State Development, Tourism and Innovation	▪ Principal Economist ▪ Fiona Bowden (Bundaberg) ▪ Simon Parnell (Bundaberg) ▪ Gary Cooper	10	▪ Project update and progress report. ▪ Sunwater Scenario Planning Workshop ▪ Meeting post draft options analysis to discuss regional economic development opportunities	▪ Ongoing ▪ 4-5 December 2019 ▪ 2 July 2020	▪ Update on the project and progress to date, including support of the project going forward. ▪ Will continue to consult throughout the business case process. ▪ Department provided some additional information on economic and investment opportunities in the region that Jacobs will incorporate.
Infrastructure and Planning (including the Office of the Coordinator-General)	▪ Scott Taylor ▪ Karen Oatley ▪ Steven Tarte Maxine Hunter	10	▪ Project update and progress report.	▪ Ongoing	▪ Update on the project and progress to date, including support of the project going forward. ▪ Will continue to consult throughout the business case process.
Department of Agriculture and Fisheries	▪ Bernadette Ditchfield – Deputy Director General ▪ Elton Miller – Executive Director ▪ Michelle Hinkfuss	10	▪ Project update and progress report. ▪ Meeting via teleconference to discuss agricultural land mapping	▪ Ongoing ▪ 2 July 2020	• Update on the project and progress to date, including support of the project going forward. • Discussed the new agricultural land mapping tool which Jacobs will be able to incorporate some of the data into the Options Analysis report. •
Department of Environment and Science	▪ Richard Routley – Regional Director ▪ Kelly Bryant	10	▪ Project update and progress report. ▪ Meeting via teleconference to discuss agricultural land mapping	▪ Ongoing ▪ 2 July 2020	▪ Update on the project and progress to date, including support of the project going forward. ▪ Will continue to consult throughout the business case process. ▪ Discussed the new agricultural land mapping tool which Jacobs will be able to incorporate some of the data into the Options Analysis report.

Sunwater	▪ Gloria Vega ▪ Lisa Welsh ▪ Peter MacTaggart	10	▪ Sunwater Scenario Planning Workshop	▪ 4-5 December 2019 ▪ 5 May 2020 ▪ 16 June 2020 ▪ Ongoing	▪ 2-day workshop in Bundaberg with Sunwater and key stakeholders to discuss scenario planning and opportunities for the Wide Bay Burnett and respective Sunwater schemes. ▪ The process for Sunwater's regional blueprint framework is as follows: 1) Diagnostic Scenarios 2) Solution & identification 3) Rapid economic and financial assessment 4) Solutions by scenario and region ▪ Introduction and discussion on future global trends that will affect the water sector (now until 2040) ▪ Discussion occurred around on how these trends will affect the region in the future. ▪ Persistent drought will have and is currently having an impact on the regions production. There is a need for an integrated water resource management plan. ▪ High youth unemployment and aging population in the region. Education levels are one of the lowest in QLD. Many community members are currently disengaged. Bundaberg has signed up for the cashless card trials. ▪ Climate adaptation and usage efficiencies will be very important for the region moving forward. ▪ Diversification – urban mining and agriculture and smart investment in infrastructure in the region ▪ Local employment - Health Retail and Education largest employers followed closely by agriculture. ▪ Boyne region – MP customers have been cut off for over 9 months. Tarong Power Station has a HP allocation of 30,000ML. ▪ The Wide Bay Burnett (ABS region) one of QLD's largest producers of Mandarins, Avocados and 3rd largest sugar producer ▪ There were group discussions about what makes the Burnett region unique: - Fertilised soils – great for growing HV produce - Access to a port from a variety of areas - Closeness to major market hubs (SEQ and also Sydney/Melbourne - Diversity of produce you can grow - Cyclone risk is minimal - One of the few regions that creates more power than it uses.

					- Technology advances – region has been quite proactive and committed to the uptake of new technology - Stable economic area – not boom or bust. Does not rely predominately on one specific industry for success. ▪ Water is still available in the region as opposed to other areas that are struggling to have any water for production. ▪ DNRME 62 options report 2001 was mentioned as original source of the Sunwater long list of options for region ▪ Sunwater Introduced process to arrive at short list of 14 options. This included new infrastructure and upgrades/raising of existing infrastructure. These options were as follows: 1) Bucca Weir Raising (Bundaberg) 2) Ned Churchward Offstream Storage 3) Ned Churchward Weir – 2m Raising 4) Gregory River Dam 5) Reids Creek Dam 6) Degilbo Creek Dam 7) Mt Lawless Offstream Storage 8) Jones Weir Raising (1.4m) 9) Claude Wharton weir (2m raising) 10) Boonara Dam 11) Auburn River Weir 12) Cooranga Weir 13) Barlil Weir 14) Calibar Dam (mega dam inundates Paradise Dam) • Meeting post draft submission of Options Analysis report to review and incorporate suggestions.
Stanwell Corporation	Mitch McCrystal Liz Beavis Kirk McNaughton Jayden Flint	12	▪ Tarong Power Station – site visit and discussion with stakeholders: ▪ Teleconference regarding Tarong Power Stations and Stanwell	▪ 13 February 2020 ▪ 16 April 2020 ▪ 28 May 2020 ▪ Other communications	▪ Face to face meeting to discuss Tarong power stations water usage ▪ Established lines of communication moving forward through study. ▪ Provided update and brief background on the project and progress to date ▪ Cooling water dam on site (storage 3,000ML). Receives water from Wivenhoe to Tarong Pipeline. ▪ Boondooma Pipeline goes straight into plant for usage. 29,270 ML allocation (80ML/day). ▪ Can almost use Wivenhoe water twice as many times water sourced from Boondooma Dam based on the release limits.

			▪ Video conference regarding preliminary findings of operation analysis		▪ Meandu Creek Dam (storage also 3,000ML). Receives blowdown form Stations (When EC limit is reached) Release downstream from this dam. Like to keep storage above 70% at all times. Currently releasing 5ML/day but have the ability to go up to 45ML/day in extreme circumstances. ▪ Downstream irrigators would like 20 ML/day so to get water down to Glenmore Gauging station. Rarely makes it to BP Dam. ▪ Estimated 17 years left of operation at this site (2037). ▪ Stanwell have a bulk water supply agreement from Seqwater (Not an allocation). Wivenhoe pipeline commissioned in 1998. 2007 Tarong reduced capacity due to water availability. Damaged Pipeline and pump station which took pipeline offline in 2012. ▪ Stanwell will not take water below 8 per cent (storage) in Boondooma dam. The current dead storage level is at 4 per cent. ▪ Current investigations into how to further reduce water use on site and during operation.
Local government					
North Burnett Regional Council	▪ Rachel Chambers, Mayor ▪ Rachel Cooper CEO ▪ Councillor Faye Whelan ▪ Justin Kronk, General Manager Strategy, Innovation & Assets ▪ Trevor Harvey Project Manager for NBRC	12	▪ North Burnett Immersion Workshop	▪ 27 November 2019 ▪ 5 March 2020 ▪ 5 May 2020 ▪ 11 May 2020 ▪ Ongoing communications	**Overview** ▪ The goal is to deliver a feasibility study with integrity that gets the right answer. On the two preferred projects the aim is clarity, that is, either elevate and construct (one or both) OR put to bed for ever one or both (i.e. provide clarity on the feasibility or lack of feasibility). The language on the two major projects is: ▪ Coalstoun Lakes – The Mayor says this is an opportunity. ▪ Boyne "Water reliability solution" – The Mayor said this is addresses a problem (but acknowledges it is also an opportunity for expansion). The goal is to increase reliability in the Boyne River Scheme. For example, and very importantly – despite popular misconceptions – the solution may not be a single Cooranga Weir / regulating weir. Rather, it may be two weirs. Either way a re-write of the WRP and the ROP is required. ▪ Problem – The Boyne is looking at 900 jobs lost. The Smart Berries 500 people. The other crops (citrus and nuts) may shed 400 jobs. BIEDO engaged ARUP wrote a report on the problem. ▪ Opportunity – Excitingly, the citrus, nuts and blueberries can massively expand in the Boyne scheme. This could get us to critical levels of higher production that leads to a processing plant locally. **Supply Notes – Options Long List** ▪ Water for Coalstoun Lakes could come from Paradise or the Barker Barambah (or Wivenhoe).

					▪ A discussion with John revealed the following long-list options for storing up to 100,000 ML including: ▪ Barker Creek – upstream of Ban Ban Springs (3km upstream) and this weir site could also supply Coalstoun Lakes via a 5 km pipeline. Very worthy of long list. ▪ Boyne River – one or two sites for weirs (Trevor knows) ▪ Burnett River (upstream of Paradise Dam) – and both Barker and Boyne flow into Burnett River. There is a site 100 meters downstream of where the Barker Creek flows into the Burnett River that is known as the Aroona Weir site (e.g. 7-meter wall). It would flood some farming country but it is a very good weir site. ▪ Reids Creek – Flows to the Burnett River (between Barker and Boyne entering Burnett River). There was a very promising weir site 35km upstream from the Burnett River confluence. Reids Creek Weir (35kmk upstream from Burnett River on Reids Creek. ▪ Water Resources Commission report on all the major dams in the area. **Agricultural notes** ▪ Perfect soil for blueberries ▪ The region has proven that it can provide, house, attract and sustain international workers (backpackers) ▪ Access to markets including Wellcamp Airport (24 hours to Asian breakfast tables) and Brisbane ▪ Rainfall is average 700mm (28 inches). ▪ Need more infrastructure on the Boyne system (water infrastructure is a problem – we need more) ▪ Mismanagement of water by Sunwater (operating rules are a problem / releases that undermine North Burnett water security) ▪ Claude Warton Weir – has been good for three years (held at 80% full) – but one month ago they started releasing water from Claude Warton (it has fallen to 60%) – so this jeopardises water reliability for a number of irrigators as they have to excavate the impounded area for their pumps to reach water. ▪ The combined water security for citrus farmers (scheme plus on-farm storages and investment) used to give 3-5 years water security. However, revised security is now 2.5 years (2-3) which causes genuine stress in the farming community. It also prevents planting of new trees from the nursery / so the opportunity cost is forgone expansion of citrus or other crops. ▪ This was a cotton area – used to grow cotton on Councillor Whelan's farm.

					Urban notes ▪ Biggenden is dire but a separate report is addressing. It could link into this project. ▪ Burnett system supplies Gayndah and Munduberra and the high priority is ok. But the Munduberra supply is on the limit. The high priority water in Gayndah could assist. ▪ Gayndah had 1,000 ML of HP water and then NBRC sold 150ML to an orchard. Leaving 850ML. The price was about $2,000/ML for a permanent sale. ▪ Council also sold 150ML of MP water for – $835/ML.
South Burnett Regional Council	▪ Keith Campbell, Mayor of SBRC ▪ Mark Pitt CEO ▪ Aaron Meehan ▪ Kristy Champney ▪ Ged Brennan	12	▪ South Burnett Immersion Workshop ▪	▪ 25 November 2019	Summary of the need for water in SBRC: 1) Irrigated agriculture 2) Industrial water (e.g. bacon or other processing) 3) Urban growth. ▪ SBRC needs greater volumes of water allocations. The dry time is threatening these three opportunities. ▪ SBRC is geographically close to Wellcamp Airport, Brisbane Port, Bundaberg and the Sunshine Coast so it is good for market access. **Supply notes / all sectors** ▪ Tarong Power station's future is key, but 2039 is the date at which it could close. If it closes 600-700 jobs could be lost. Action is needed to create jobs. Water and agriculture is a key opportunity for jobs. The Mayor worked for Bean Growers Australia for 40 years. There is a pipeline from Boondoomba Dam to Tarong Power Station. ▪ Opportunities include the spare water from a lowered Paradise Dam. The 100,000 ML from Paradise lowering, could be stored in a second stage of Boondoomba Dam. This would be an excellent option according to the Mayor – noting that all options are on the table for rational analysis. ▪ The Barlil Weir – was a study that went nowhere – it showed promise. ▪ The Barambah system is zero allocation at the moment. The ground water extraction in the Barambah system is being halved by Sunwater and charges will still apply. ▪ Widebay Burnet Regional Organisation of Councils (SBRC is a member) – support additional water for the whole region. ▪ In the past the Murgon-South Burnett Meatworks at Murgon was operational and used large volumes of water. The meat works has closed– it does not and will not operate. There is spare capacity in Murgon for industrial expansion.

					▪ Gordonbrook Dam is owned by council but controlled by Sunwater. Council prefer to use Gordonbrook Dam rather than the low water quality of Boondoomba dam. ▪ Is the WCRW plant another possible source – noting the recycled water has limitations for green leafy vegetables and would be more suitable for tree crops. **Agricultural** ▪ The soil types in South Burnett includes fertile and productive soils. ▪ Most irrigate from groundwater bores, and some have small allocations from schemes. None (or very few) farmers have substantial water in a reliable scheme. ▪ Water is needed to enable productivity in the agricultural sector. ▪ The Mayor got a group of farmers together to ask do you need more water? A resounding yes. ▪ The opportunities that exist are based on strong interest from agriculture. Likely to be a change in cropping practices (depending on the prices of water). So primarily the opportunity is in irrigated agriculture. ▪ The Mayor is aware of a lot of irrigators who do not pay much or anything for water. So, the attitude and response of irrigators from the region will need to be challenged. ▪ On the flipside, there are a large number of cotton growers on Barker Barambah – Byee Flats and Mondure. This is a flood plain so the risk is unacceptable for a tree crop rather than annual. ▪ The lack of demonstrated payment for water relates to a poor reliability product to date. ▪ Impacts of increased high-reliability water (new water) would be to see older farmers retire and the changing of hands of farms to younger and corporate farmers. ▪ The future must be water-efficient water use (e.g. drip irrigation orchards in the Kumbia District) – these large yielding farms achieve a great deal with very limited groundwater supplies only. **Industrial notes** ▪ Then secondarily, another industry would be helpful. However, 300-500ML is probably not available. ▪ The Swickers Kingaroy Bacon Factory Pty Ltd at Kingaroy Barkers Creek Road is the largest urban water user by an order of magnitude. In recharge seasons, their bores work. Currently, they are short of water or it is somewhat insecure. Swickers wants to expand which will increase demand for pig production and therefore grain. ▪ Kingaroy could not accommodate another Swickers. This is a concerning constraint on industrial growth. ▪ In the past, a 10ML request was concerning in the Kingaroy system and the industrial development was denied partly due to a lack of water. **Urban notes**

					▪ Thirdly, Council is interested in urban growth. There was a recent MIP project – Maturing the Infrastructure Pipeline – that investigated the issues of urban water supply and there is a problem / risk of poor water security. ▪ Kingaroy cannot spare raw water for Nanango. As a result, Nanango is looking for a new raw water supply. **Stakeholders** ▪ **The key stakeholders in the region include:** ▪ Kingaroy Chamber of Commerce were strongly supportive and the network of such business development groups including in Murgon and Nanango are active. ▪ HQ Plantations – Own 70-80 properties for forestry. This is possibly the largest land owner in South Burnett. ▪ Crumpton Company – peanuts and duboisia production and are now trialling Macadamia – Have likely got the second largest number of properties in South Burnett. Sonie Crumpton, better known for peanuts and duboisia, is hoping this … are the most popular varieties currently being grown in the Bundaberg area. … have the potential of producing a greater kernel-to-shell ratio which … from Lismore, has been working with Sonie on the macadamia trial. ▪ Bega cheese who own the Peanut Company ▪ Costa Group – Avocadoes and Mangoes (large operations here and in Bundaberg) ▪ Swickers Sun Pork ▪ Proteco – manufacture of cold pressed seeds / oils (Sunflower and other oils) ▪ Wine industry locally ▪ Brett Hedding, McCullough Robertson Lawyers is a large investor in wines and olives in South Burnett ▪ Gina Rinehart has invested mainly beef (and could invest further in dairy) ▪ AAM - Coolabunia Sale yards will be operated by AAM Investment Group after the South Burnett Regional Council accepted the company's tender to take over. The 15-year-old company owns sale yards in NSW, Victoria and Queensland, and operates the Murgon sale yards (now known as the South Burnett Livestock Exchange). Mayor Keith Campbell said: "We have the facilities here and are happy to see them used, but we think it's likely that people who have a commercial interest in the livestock industry will do a better job operating them." ▪ There are many small stakeholders: ▪ Boehringer Ingelheim, a German pharmaceutical company, owns and operates duboisia farms in the South Burnett. Global head of chemical operations, Manfred Psiorz, said the chemists extracted scopolamine, an alkaloid, from the duboisia leaves.

					▪ Piggeries and feedlots (large one near Proston) **Options** ▪ Ongoing updates on assessment of options ▪ Reporting on outcome of initial assessment and shortlisting ▪ Consulting regarding criteria ▪ Consulting regarding impact of governmental changes and briefing new councillors
South Burnett Regional Council	▪ Allen Christensen ▪ Tim Low ▪ Aaron Meehan ▪ Kristy Champney ▪ Ged Brennan	10	▪ Meeting with SBRC to discuss urban water demand	▪ 12 February 2020	**Current Scenario (base case)** ▪ There are 3 major sources of urban water. Bjelke Peterson Dam, Boondooma Dam (Boyne Tarong supply scheme) ▪ From and urban supply situation SBRC are most worried about Wondai, Murgon. This supply is sourced from Bjelke Peterson Dam (currently at 20%) ▪ The supply for Proston, Kingaroy and Blackbutt is also very stretched. ▪ Council has discussed releasing water to Ficks Crossing and then building a small pipeline form Murgon to Wondai. This would increase the urban supply by 4 months. The cost of this pipeline is expected to be $1 million dollars. ▪ Kingaroy has Gordonbrook dam to fall back on when the pipeline is offline. However, once Gordonbrook falls below 50% storage capacity in becomes almost unusable due to containments in the water. ▪ Council discussed the alternative of creating a 100-200ML storage that would be lined near Gordonbrook and top it up using the Boondooma pipeline. ▪ Council last year alone had to provided carted water to residents in Blackbutt 3-4 times. ▪ The supply of Gordonbrook between 100-50% can usually supply Kingaroy for up to 18 months. It is a council owned asset and is primarily used just for urban water. ▪ The existing bores surrounding Kingaroy are an option for emergency water supply, but there is issue with quality. Boondooma water is still the most important to urban supply. ▪ Approx. 3360 ML of dead storage in Boondooma Dam. Unsure who is entitled to that in emergency situations. In other regions this has been provided to urban water users (Macquarie Valley). ▪ Swickers (Industrial processing) sources its water from council. It is waiting to expand its operation in the region.
South Burnett Regional Council	▪ Brett Otto, Mayor of SBRC	10	▪ Consultations regarding options analysis and criteria	▪ 5 May 2020 ▪ 15 May 2020 ▪ Ongoing	**Options** ▪ Ongoing updates on assessment of options ▪ Reporting on outcome of initial assessment and shortlisting

	▪ Kirstie Schumacher, Councillor of SBRC ▪ Scott Henschen, Councillor of SBRC ▪ Ged Brennan				▪ Consulting regarding criteria ▪ Consulting regarding impact of governmental changes and briefing new councilors ▪ Gordonbrook Dam and options to improve the dam or make it redundant
Businesses					
Kingaroy Chamber of Commerce and Industry	▪ Rob Fitz-Herbert ▪ Paula Greenwood, Secretary	8	▪ Stakeholder meeting	▪ 12 February 2020	▪ Update on the project and progress to date, including support of the project going forward. ▪ Plenty of interested in greater water access. The Chamber of Commerce i has lots of contacts and information that they would be willing to provide for the study. ▪ Strongly supportive and the network of such business development groups including in Murgon and Nanango are active ▪ Will continue to consult throughout the business case process.
Burnett Inland Economic Development Organisation	▪ Kristy Frahm CEO	8	▪ South Burnett Immersion Workshop ▪ Stakeholder List and Focus Group ▪ ILM Workshops – North and South Burnett	▪ 25 -27 November 2019 ▪ 6 &12 February 2020	▪ Face to Face meetings to introduce project team. Provided an overview and background of the project, including discussion around the objectives of the study. ▪ BIEDO have provided local content and on ground knowledge to support the business case. This knowledge has been incorporated throughout the register. ▪ They have an extensive network that has been critical to successful stakeholder engagement in the region. ▪ Will continue to consult throughout the business case process.
Coalstoun Lakes Development Group	▪ Don Roberton ▪ Steve Marshall (President)	8	▪ Coalstoun Lakes Meetings, visit and workshops	▪ 5-6 February – Coalstoun Lakes ▪ 14 May 2020 ▪ Ongoing communications	▪ Face to Face meetings to introduce project team. Provided an overview and background of the project, including discussion around the objectives of the study. ▪ Eleven local farmers- both irrigators and potential irrigators attended the meetings and discussions. (The individual conversations and key findings are provided in the Potential customers section) ▪ Further face to face conversations have occurred. ▪ Will continue to consult throughout the business case process.
Swickers Kingaroy Bacon Factory	▪ Lincoln Hawks (General Manager)		▪ Stakeholder meeting (1on1 conversation)	▪ 11 & 17 March ▪ Ongoing communications	▪ Jacobs provided a summary of the progress to date on the Options Analysis. ▪ Swickers introduction – estimated that they currently only have 12 months' supply until being potentially cut off.

	▪ Dave Williamson (Service Support & Environmental Manager)				▪ Coronavirus has had a serious impact on production and throughput. Currently down on our forecasted position. Markets are down – grain prices are up. ▪ Looking to upgrade the water treatment plant to allow greater generation of recycled water on site. Business case has been prepared for government consideration. ▪ Discussion around current sources and total volumes of water used on site. ▪ Dave advised that Swickers had received a proposal from the company that would undertake the recycling project. A copy of the proposal has been provided to Jacobs. ▪ Confirmed that Swickers would be presenting on the recycling project to the Council on 18 March. Attending for the Council will be the Mayor, CEO and Aaron Meehan.
Potential Customers, Landholders and Other Irrigators					
Moffatdale irrigators	Brett Heading Dane Kapernick Brett Sanders Greg Sippel Paul Sippel Dennis Walter	6	▪ 1 on 1 telephone calls	▪ 25 May to 31 May 2020	▪ Collectively, the group owns approximately 2,000 to 4,000 ML of medium priority on the Barker Barambah WSS. ▪ It is considered to be unreliable and is a major constraint on current irrigation activities and expansion. Water is a costly constraint. ▪ This has been addressed by very significant investment in on farm storages and efficient irrigation application and equipment, such as overhead laterals and drip irrigation. ▪ Current enterprises are moderate to very high value such as lucerne hay, peanuts, mungbeans, wine grapes, beef cattle and any other profitable crop depending on water availability. ▪ With additional water, or more reliable existing water, collectively the group would expand production by 50% to 100%, growing more of the aforementioned crops with significant increases in peanuts, table grapes, garlic and other high value horticulture. ▪ To address the water constraint, a West Barambah Creek Dam, and Barlil Weir. ▪ They understand that the significant constraints of the West Barambah dam including the high capex, availability of water in the Plan and potential flooding of the highway. ▪ They support Barlil Weir and would like to be involved in discussion during the detailed business case to understand how it would benefit Moffatdale irrigators. ▪ A version of Barlil that makes water available across the entire WSS may be welcomed by some. ▪ The group may also be interested in a general improvement of reliability for all existing customers.
Quebec Farms and Committee Member of the Boyne River and Tarong IAC	Troy Emmerton	12	▪ Stakeholder meeting (1 on1 conversation)	▪ 27 November 2019	▪ Troy uses about 900ML per annum of 200 ha of citrus. Could expand up to 250ha on existing farm.

					▪ Citrus – mandarins (90%), 5 percent lemons and 5 percent mangoes. 70 percent export of the mandarins and 30 percent domestic. Transitioning to 90 percent export and 10 percent domestic. Mainly to China and Thailand. ▪ Export $48 dollars per box of mercots for 18kg or 2.66 per kg from the Chinese. The profit is double that of the Australian supermarkets. The Thailand market wants small mandarins. The middle east market buy very small mandarins. The big ones go to the Chinese. The really big ones go to Taiwan. ▪ Supermarkets $24 dollars per box 9kg box of Imperial. The domestic market mandarin profit is 50% of the export market. Only mid-size. ▪ On farm storages give us up to 2 years of on farm water. ▪ Grows citrus. Large operations with huge potential to expand. Has 2,000ML of on-farm storage. Quebec Dam is on-farm storage and filled with unused allocated water and water harvesting. We used to buy water from sleepers.
Ken Darrow (Irrigator and Chairperson Boyne River and Tarong's Irrigator Advisory Committee)	Ken Darrow	8	▪ 1 on 1 telephone call	▪ 18 June 2020	▪ Update on project progress specifically relating to the Boyne River Infrastructure options. ▪ Ken highlighted the growth in Table Grapes, Pecans and Avocados in the area – Jacobs adjusted crop mix to account for this. ▪ The region has proven that it can provide, house, attract and sustain international workers (backpackers). It also has access to markets including Wellcamp Airport (24 hours to Asian breakfast tables) and Brisbane. ▪ Knows of 2 Pecan farms expanding. Citrus (Mandarins) is still the largest perennial crop in area (over 5 farms producing) ▪ Jacobs provided Ken with proposed crop mix and this was adjusted based on the information above and his local knowledge of the region.
Lionel Wreck	• Lionel Wreck – Peanut grower and sources for Bega-PCA	10	▪ 1 on 1 telephone calls	▪ 18 June 2020	▪ Update on project and our assessment of crops and margins to date. ▪ Provided guidance and reviewed yields and water use for peanuts in the region. ▪ Confirmed the upfront cost per ha of $5,000 for irrigated peanuts (60 ha minimum) ▪ Provided guidance on yield and water use for corn grown in Coalstoun Lakes.
Kerry Dove – Irrigator Coalstoun Lakes	▪ Kerry Dove – Irrigator Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ Started farming in 1976 but is going backwards. We are looking for a solution. Getting water for Coalstoun Lakes is a necessity. ▪ Peanuts are a stable price and should provide a solid economic base
Kerry Dove – Irrigator	▪ Kerry Dove – Irrigator	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ Has limited bores and is a dryland farmer. This is a small district with very good potential for irrigated agriculture. We are using drip tape and growing seedless melons. Also, pumpkin on plastic. Row crops such as peanuts. There is a driver to take the water downstream (Burnett

Coalstoun Lakes	Coalstoun Lakes				River). But would like to see some equity in the region. It would be fair if this water was to be shared. ▪ This great soil warrants some irrigation water. Traditionally, being peanut farmers (wheat and sorghum) and have branched into melons. ▪ The one thing that is important is your marketing. This area has the ability to manage risk and create money in lean conditions. There is skilled management here and that is critical to the success of the region.
Gary Hunter Coalstoun Lakes	▪ Gary Hunter Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ This scheme is the future of the district. Grows dryland peanuts and corn.
Gary Hunter Coalstoun Lakes	▪ Gary Hunter Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ We want 30-60GL piped to here. We started in the 1990s due to the huge potential of the region. We believe the water in Paradise Dam is just sitting there wasted. ▪ We want to use the water to create economic activity in the region. Even if we doubled our yield, we could sell it all at premium prices. The peanut price is very resilient. The kids want to come home but if there is no water, then it is not viable enough to support young families. It is a tough life financially and we need to get water to bring home our kids to farm. ▪ We have changed our farming practices to be more and more water efficient. If the young people – our children come home the energy drives production and change.
Darrin Rackemann	▪ Darrin Rackemann - Coalstoun Lakes irrigator		▪ Stakeholder meeting (1 on 1 conversation)	▪ 27 November 2019	▪ Has limited bores and is a dryland farmer. This is a small district with very good potential for irrigated agriculture. We are using drip tape and growing seedless melons. Also, pumpkin on plastic. Row crops such as peanuts. ▪ There is a driver to take the water downstream (Burnett River). But would like to see some equity in the region. It would be fair if this water was to be shared. This great soil warrants some irrigation water. ▪ Traditionally, being peanut farmers (wheat and sorghum) and have branched into melons. The one thing that is important is your marketing. This area has the ability to manage risk and create money in lean conditions. There is skilled management here and that is critical to the success of the region.
Garry Seabrook - Irrigator Coalstoun Lakes	▪ Garry Seabrook - Irrigator Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation) ▪ 1 on 1 telephone call	▪ 27 November 2019 ▪ 18 June 2020	▪ Generational farmers since 1946. Recognise that when Paradise Dam was built, we had wanted to bring water up to the area. We build our own 100ML on-farm storage and irrigate 126 ha but it is not reliable. But this has proven what we can do. ▪ The crop responds very well from a rainfall event – so the growing area is resilient. We apply 1.6ML per ha pa gives 8 tons per ha yield of peanuts. Key message – the yield average for peanuts would be 7 tons per ha with irrigation – the price paid is about $1,200 per ton. This

					means $8,400 revenue per ha of peanuts, using 3 ML per ha. Perfect soil and climate for peanuts. ▪ We are set up to grow peanuts. The struggle is succession planning and the water would help. ▪ Outlined what is currently grown in the region – Peanuts are the main rotation with a summer crop (Corn, Maize, Sorghum). Cover crops are also used (Wheat, Barley and Oats). Corn grown in region is used for chips and as corn flakes. ▪ Discussed future crop mix under the proposed short-listed options. Indicated that they would predominately undertake irrigated peanut cropping in the first one to three years before a gradual conversion to more capital intensive and larger downside risk perennial and high value tree crops. Outlined that in order to afford the water there would have to be shift in the region towards this higher value cropping. ▪ Tree crops, Avocados, Macadamias, Citrus and Melons have all been known to grow in the area and would be with a new water source. Green Vegetables have not been tested yet, but the soil is highly suitable. ▪ Jacobs outlined proposed crop mix used to assess economic benefits. There was a minor adjustment to the water use and yield of the peanut and corn net margins.
Rob Radel - Irrigator Coalstoun Lakes	▪ Rob Radel - Irrigator Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ This area is on top of the catchment, so it is expensive to get water up here. But a massive advantage is that the soil is so good – and has such great drainage – that even in a cyclone (18 inches in one day) we are back farming four days later. Pick your least favourite child and leave them the farm. Dairy farmer – fifth generation in Coalstoun Lakes – keeps good rainfall records and the seasons have become more and more erratic. ▪ We just need stable water. The three issues / needs are water security and we are only 26 km from Paradise Dam. We also create jobs in this area and 9,000 ha would create massive jobs – and though it is seasonal we would have jobs 12 months of the year. The State is growing in population and we have increasing export opportunities, and this is the perfect location for market access. Has 250 acres (100 ha) and we would invest in this project. The land is tightly held and locals will buy it and not agents needed.
Don Roberton Irrigator Coalstoun Lakes	▪ Don Roberton Irrigator Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ Late comers to the district – 20 years ago. Is grazing country at the top of the valley and is frost free – it lends itself to tree crops. We currently grow leukena, which doubles the production on country. Would like to grow 200 acres of fruit tree crops
Terry Staib Irrigator Coalstoun Lakes	▪ Terry Staib Irrigator Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ We really need water because we only get rain every 3 to 5 years. Then we can value add to crops with intensive livestock.

Bill: Staib Irrigator Coalstoun Lakes	▪ Bill: Staib Irrigator Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ There is loss of farming families due to drought over 20-30 years. ▪ The water would help reverse that trend and bring young people to the area. It would liven up Gayndah and Biggenden. Bill runs an earthmoving business because just farming peanuts for 31 years, but only made money a handful of years. The inputs costs are higher (diesel, tractor tyres, seed and fertiliser has tripled in cost), so the only way to combat that is water, which would double the yield to increase the revenue. ▪ The climate change is leading to erratic rain – all the water at once – then nothing for extended periods.
Cameron Rackemann Irrigator Coalstoun Lakes	▪ Cameron Rackemann Irrigator Coalstoun Lakes	12	▪ Stakeholder meeting (1on1 conversation)	▪ 27 November 2019	▪ Crumpton's and Bega- PCA are both crying out for more supply. One of the reasons we get along is that we are not really competing. ▪ The prices for peanuts are resistant to increased production. In low production seasons the prices rise to compensate for lower production levels. The machinery and on farm drying and other equipment is all here. We have all been growing peanuts dryland for years. Only a couple of farmers have irrigation from bores. We are much better placed to grow larger levels of peanuts than Bundaberg farmers. A lot of farms have invested a lot of money in contour banks / water coursing to prevent erosion and to withstand intense storms. So, the water management has seen a lot of investment. There is the greatest amount of potential here. We have very little water and huge capability and great soils. ▪ The fairness argument is that others have got water (and want more). We have no water. Our concern is for our parents and how hard it is.
Tom Dunn (irrigator; farming persimmons and macadamias)	▪ Tom Dunn		▪ Stakeholder one-on-one meetings	▪ 17 March 2020	▪ Jacobs provided a summary of the progress to date on the Options Analysis. ▪ Tom farms persimmons and macadamias at his farm at 155 Crows Nest Road, Blackbutt. ▪ He currently has no access to external water. He uses bore water, which has worked well for persimmons. He has not had enough water from bores for the past 12 months and it resulted in his persimmon crop being low (8-9 tonnes) and the effective loss of his macadamia crop (30 tonnes at $100k). ▪ He would like to get 20-30ML of reliable water to allow his to invest and grow his crops. ▪ He irrigates from August to October. He currently grows 8-9 tonnes of persimmons on 6ML/ha of bore water. He believes that with 20-30ML of reliable water he would grow and sell: 30-40 tonnes of persimmons, 30 tonnes of macadamias and employ 6 staff (he currently has 2 staff).
Googa Farms	▪ Anthony Buetel ▪ David Buetel	12	▪ Stakeholder one-on-one meetings (site visits to property to view operation) ▪ 1 on 1 telephone calls	▪ 19 March 2020 ▪ 14 -15 May 2020 ▪ 18 June 2020	▪ Jacobs provided a summary of the progress to date on the Options Analysis. ▪ Anthony indicated that he would gather together the water demand figures for the irrigators and farmers in the Blackbutt area. ▪ Provided strong demand for water during Blackbutt demand assessment. Open to paying for reliable water

				▪ Ongoing communications	▪ Significant areas of high value horticulture under production – main crop is Avocados. ▪ New water would be used to expand and also for security of existing perennial crops. Large amounts of cleared land ready for expansion but lack of water restricting this opportunity. ▪ Provided local content on yield, water use, and fixed and variable costs associated with growing Avocados in the Blackbutt area.
Terry Clark	▪ Terry Clark – Blackbutt irrigator (Avocados)		▪ Stakeholder one-on-one meetings (site visits to property to view operation) ▪ Blackbutt demand assessment participant	▪ 19 March 2020 ▪ 14-15 May 2020	▪ One on One Consultation in Blackbutt – Visited property and operation. Large area of avocados being grown. ▪ Provided information on the Blackbutt pipeline and how the water is sourced. Significant on farm storages on properties. ▪ Indicated he would be able to expand with greater water allocation. Avocados have been a very profitable venture on farm current prices are relatively stable. ▪ Provided a non-binding expression of interest for a likely water demand of 288 ML.
Troy Prenner	▪ Troy Prenner – Blackbutt irrigator		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 188 ML.
Drew Reiser	▪ Drew Reiser Blackbutt irrigator		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 163 ML.
Russel Page	▪ Russel Page - Blackbutt irrigator (Avocados)		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 115 ML.
Dennis Rowe	▪ Dennis Rowe - - Blackbutt irrigator (Avocados)		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 75 ML.
James McKinnon	▪ James McKinnon – Blackbutt irrigator (Vegetables)		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 60 ML.
Andrew (Andy) Veal	▪ Andrew (Andy) Veal		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 58 ML.

Ryan Petersen	▪ Ryan Petersen – Blackbutt irrigator		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 50 ML.
Allan Vere - Bambara	▪ Allan Vere – Blackbutt irrigator Macadamias and Lychees		▪ Blackbutt demand assessment participant	▪ 14-15 May 2020	▪ Provided a non-binding expression of interest for a likely water demand of 13 ML.
Barry Trousdale – Mt Binga Orchards	▪ Barry Trousdale – Blackbutt Irrigator (Avocados)		▪ Stakeholder one-on-one meeting in Blackbutt ▪ Blackbutt demand assessment participant	▪ 19 March 2020 ▪ 14-15 May 2020	▪ Mt Binga has 40-metre-deep red soil excellent growing conditions for Avocados. Has about 180 ha and over 13,000 trees. Could expand further with more water. ▪ Provided a non-binding expression of interest for a likely water demand of 200 ML.
Adrian Bettwieser	▪ Adrian Bettwieser		▪ Stakeholder one-on-one meetings	▪ 1 May 2020 ▪ 14 -15 May 2020	▪ Avocado farm in Blackbutt ▪ Strong demand for additional reliable water ▪ Open to paying for reliable water ▪ Provided demand information for demand assessment
Tony Beresford (irrigator and farmer)	▪ Tony Beresford		▪ Stakeholder one-on-one meetings	▪ 19 March 2020	▪ Farmer at Barkers Creek and shift superintendent at Tarong Power Station (TPS). ▪ His farm is 100 acres and grows loosen. ▪ He currently draws water from Meandu Creek that is blowdown from TPS. This water is free and is highly reliable, although the volume can vary considerably (if 7ML is less is released, the he does not receive any water). ▪ He holds a 7-day p/w water licence for 10ha. There is an informal arrangement between the irrigators on Meandu Creek regarding the volume and timing for extraction. ▪ He also uses bores, which are closely linked to the level of Meandu Creek. He has an ability to use 25ML/day, although he is currently taking 10ML/day.
Sharon and Mark Young (irrigator and farmer)	▪ Sharon and Mark Young		▪ Stakeholder one-on-one meetings	▪ 19 March 2020	▪ Jacobs provided a summary of the progress to date on the Options Analysis document. ▪ Have a diverse farming mix: peanuts, silage, hay, cattle (3,000) and pigs (6,500). ▪ Property is 400ha, with 323ha used for irrigation and the reminder used for livestock, operations and storage. ▪ Annual water usage is between 200ML and 1,000ML. Currently drawing around 17ML/day from Gordonbrook but can draw a maximum of 26ML/day. Purchase 200ML/year via temporary transfer.

					▪ Employ 4-5 permanent staff, having peaked at 17 staff. ▪ With greater water supply and security, they would look to generate greater security in their operations, including for succession planning in their business. Would be willing to pay up to $2,500ML for high reliability water. ▪ Generally supportive of Gordonbrook Dam being converted into irrigation only, although are concerned that if the water is sold by tender process that they may be priced out of the market. ▪ Advised that water harvesting is limited in the area. The Youngs have started some water harvesting.
Crumptons	▪ Sonie Crumpton		▪ Stakeholder one-on-one meetings	▪ 19 March 2020	▪ Jacobs provided a summary of the progress to date on the Options Analysis document. ▪ Operation processes peanuts. The target is to process 10,000 tonnes of peanuts per annum. This year is well down due to a lack of water to secure the crop. ▪ Source the majority of peanuts from other farms in and around Kingaroy. Also grow 1,000 acres/year, all dryland growing. Dryland growing allows for 1 tonne/acre, and wetland allows for 2 tonnes/acre. Generally, it is $1,000-$2,000 per tonne. ▪ Of the 1,000 acres actively used for cropping only 200-300 acres is irrigated. Open to paying around $750ML, although price was given without much context of knowledge. ▪ Currently employs 85 people and has previously employed over 100 people. Output: 20% raw cereals; 80% blanched and roasted; small quantity of shell and grade nuts; bi-product of operations goes into feedstock. ▪ Supportive of changing Gordonbrook Dam to irrigators only, very supportive of Coalstoun Lakes having a water infrastructure project.
Chris Tunstall (irrigator and farmer)	▪ Chris Tunstall		▪ Stakeholder one-on-one meetings	▪ 19 March 2020	▪ Jacobs provided a summary of the progress to date on the Options Analysis document. ▪ Hay product. Currently, 110 acres is being used for hay product. This could go up to 180 acres with an additional 150ML of reliable water. ▪ Takes around 6ML/year from Stewart Creek, plus has bores (the reliability of the bores is falling). He has a licence to take 120ML/year. ▪ Suggested a document for review by Jacobs.
Noni and Stuart Richardson	▪ Noni and Stuart Richardson		▪ Stakeholder one-on-one meetings	▪ 17 March 2020	▪ Jacobs provided a summary of the progress to date on the Options Analysis document. ▪ Moved to Murgon township in November 2019 ▪ Have found the urban water supply to be poor quality and unreliable. They are concerned to drink the water because they expect to become unwell. ▪ Only use the water for bathing and washing clothes.

Glenn Steinhardt	▪ Glenn Steinhardt		▪ Stakeholder one-on-one meetings	▪ 17 March 2020	▪ Jacobs provided a summary of the progress to date on the Options Analysis document. ▪ Former irrigator and farmer in the Murgon area, and former Murgon councillor. ▪ Concerned regarding the over focus on environmental impacts. ▪ Concerned that Gordonbrook Dam needs to be carefully managed because if too much water is removed it will have problems.
Brett Hedding	▪ Brett Hedding		▪ 1 on 1 telephone calls	▪	▪ Jacobs provided a summary of the business case process and the work that had been done to date. ▪ Outlined crops grown including wine grapes and olives. Indicated some interest in purchasing new water for small expansion. ▪ Would like to grow table grapes in the future.
Peter Enkelmann	▪ Peter Enkelmann		▪ Stakeholder one-on-one meetings	▪ 25 November 2019	▪ Planted 225ha in a 10% year. Maximum is 900 acres or 350ha. Double crop wheat. ▪ Would still be growing cotton in rotation with other crops. Skip row cotton this year (two rows in and one out) after long fallow. Dalby is the cotton gin. Last year 5.25 bales to the acre. ▪ Average yield is 11.5-12 bales and average application 6-6.5 ML per ha. Good operators are 2 bales per ML maybe the average is 1.7-1.9 bales per ML of irrigation water applied.
Boyne River Pecans – Boyd Paton	▪ Boyd Paton		▪ Stakeholder meeting	▪ 25 February 2020	▪ Expansion is based on getting more water. Outlined that if was to get more yield that has sufficient volume, then he can process on site. This will generate more jobs and on-site value adding. ▪ Stahmann Farms in Toowoomba are likely to do the processing. Some food products also done on the Sunshine Coast.
Smart Berries	▪ Stewart Blade MacKenzie – Farm Manager		▪ Stakeholder meeting	▪ 25 February 2020	▪ Farm Manager of Smart Berries. Plans for expansion if water was available. Huge employers approximately 520 people last week - pick 10 months of the year. Needs to be picked ten times per annum to harvest whole crop. ▪ Smart Berries could conservatively expand between 50-100ha which would result in an increase in usage of 250-500 ML.
Christopher Tapsall	• Christopher Tapsall		▪ South Burnett Regional Council EOI	▪ 12 February 2020	▪ Stated demand of 150 ML of water through South Burnett Regional Council EOI
Tony Dugdell (Kumbia)	• Tony Dugdell (Kumbia)		▪ South Burnett Regional Council EOI	▪ 12 February 2020	▪ Stated demand of 400 ML of water through South Burnett Regional Council EOI
Andrew Mayne (Byee)	• Andrew Mayne (Byee)		▪ South Burnett Regional Council EOI	▪ 12 February 2020	▪ Stated demand of 100 ML of water through South Burnett Regional Council

Community groups					
Barker Barambah IAC	▪ Stuart Nicholson	6	▪ Stakeholder meeting ▪ One on one meeting	▪ 9 December 2019 ▪ 17 March 2020	▪ Update on the project and progress to date, including support of the project going forward. ▪ Plenty of interested in greater water access. Especially around Barlil Weir. ▪ Will continue to consult throughout the business case process. ▪ Suggested that the study look to put storage onto Barambah Creek, although the Barambah Gorge is not viable due to environmental concerns. ▪ He has a number of previous studies that he would like to provide to contribute to the project. ▪ Suggested that the project should look at multiple different storages.
Public Consultation – South Burnett	▪ Keith Campbell, Mayor of SBRC ▪ Aaron Meehan ▪ Kristy Champney ▪ Ged Brennan	6	▪ Public Consultation Meeting Kingaroy	▪ 12 February 2020	**Mayoral Introduction** ▪ Introduction and Welcome- outlined the further consultation dates in March and provided location details. ▪ The feasibility study will provide recommendations on how we can progress the projects/initiatives forward. ▪ Emphasised this is an excellent opportunity for the region. This is not just about water it is bigger than that. ▪ There is a primary focus on agriculture and businesses. Swickers, processing and Stanwell. They will all be consulted with and involved in the project. New industries could also arise through the security and supply of water. There is also an urban component to this study in the South Burnett, so everyone is impacted. It is important to get involved. **Jacobs Presentation** Jacobs ran through the slides and discussed the project. This was facilitated by Matt Bradbury and Chris Hewitt. **Audience member questions (Q&A)** ▪ At the blackbutt end there are also irrigators that sit in the Toowoomba Regional Council area. Should they still come to meetings in March? ▪ To what extent is the ROP considered in regard to the potential changes with Paradise dam? ▪ Water quality in the region is starting to have an impact on the businesses and is determinantal to the quality of the pipes. If this is improved it allows for further investment. ▪ Claude Wharton Weir was raised. Community members outlined when levels get low the rock formation causes issues with water quality. ▪ Don't forget sustainability of the community as a whole. Maintaining the current workforce is really important. Diversity is the key.

					▪ Amenities (football fields – all these things get impacted by drought and low water availability. We are watching people leaving. No one wants to live in a dry dead barren town. ▪ Has there been discussion around the extra allocation that may be available at Paradise Dam? ▪ What is the conversation around stage 2 of the Boondooma Dam? The land has already been acquired. This should be on the short list' ▪ We are currently having rain and the urgency of this in the community will lower. However, this shouldn't die we need to keep pushing forward regardless. ▪ There is always a big push when there is no water around. We as a community need to remain on the front foot with this opportunity. ▪ What stage of the business case process does international market demand and access come into consideration? I know in the Rookwood weir business case this was considered. ▪ For example: currently not many producers are growing peanuts as chickpeas are going through the roof in the export market. When does this analysis start? ▪ You should be looking for people/producers who don't use water currently but would if it was available. ▪ Plenty of interested in greater water access. The Chamber of Commerce in Kingaroy has lots of contacts and information that they would be willing to provide for the study. ▪ Any consideration on the Bundaberg area and how that has changed from Sugarcane to tree crops. This should mean that they don't need the same amount of water moving forward (in regard to the potential lowering of paradise dam and who gets the water) ▪ Blackbutt – There is a lot of opportunity. Wivenhoe and other pipeline run past area. Lots of High value agriculture (avocados, beans).
Public Consultation – South Burnett	▪	6	▪ Public Consultation	▪ 15 July 2020 (In person in South Burnett) ▪ 16 July (remotely)	• Update on Options Analysis and business case process to date. • Outlined proposal for South Burnett 25-year economic blueprint

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Appendix F

Options Analysis

Appendix F. Multi-criteria analysis

This report sets out the criteria and findings of the Multi-Criteria Analysis. The Multi-Criteria Analysis reviewed twenty-eight options against a standard set of criteria determined by the Steering Committee based on the guidance and recommendations of the consultants.

Part 2 of this report includes the descriptions and scoring for each criterion in the Multi-Criteria Analysis.

Part 3 of this report provides the detailed analysis, scoring, weighted score and rank for each option reviewed in the Multi-Criteria Analysis. The unweighted (raw) score is provided for each option, which corresponds with the scores in Part 2. The results of the assessment of each option is also provided, including the final unweighted score and the outcome of the option analysis.

F.1 Criteria – descriptions and scoring

The tables below set out the scores and score descriptions determined by the Steering Committee for each of the seven criteria in the Multi-Criteria Analysis.

Table F.1: Service Need

Service Need	Score
Does not address any of the problems	0
Partially addresses one of the problems	1
Partially addresses two or more of the problems on its own	2
Fully addresses one of the problems or mostly addresses two or more of the problems	3
Fully addresses two of the problems	4
Fully addresses all of the problems	5

Table F.2: Benefits Sought

Benefits Sought	Score
Does not deliver the benefits sought (or reduces a benefit sought)	0
Partially delivers one of the benefits sought	1
Partially delivers two or more of the benefits sought on its own	2
Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	3
Fully delivers two of the benefits sought	4
Fully delivers all of the benefits sought	5

Table F.3: Support from Stakeholders

Support from Stakeholders	Score
All stakeholders strongly oppose	0
Stakeholders oppose	1
Indifference / mix of support and opposition	2
Support from most stakeholders	3
High support from all relevant stakeholders	4
Very high support from all relevant stakeholders	5

Table F.4: Public Interest Considerations

Public interest Considerations	Score
performs poorly against all the public interest categories	0
performs moderately against some of the public interest categories and poorly against other public interest categories	1
performs moderately against all the public interest categories	2
performs well against some public interest categories and poorly against other public interest categories	3
performs well against some public interest categories and moderately against other public interest categories	4
performs well against all the public interest categories	5

Table F.5: Risks

Risks	Score
Intolerable risk	0
Very high risk	1
High risk	2
Moderate risk	3
low residual risks	4
Very low residual risks	5

Table F.6: Legal and Regulatory Issues

Legal and Regulatory issues	Score
requires significant legislative changes at multiple levels of Government that will be difficult to achieve	0
requires some legislative changes at a single level of Government that will be difficult to achieve	1
requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	2
requires substantive operational changes, and no legislative changes	3
requires minimal operational changes, and mostly aligns with current legislation and regulations	4
requires no operational changes, and fully aligns with current legislation and regulations	5

Table F.7: Strategic Policy Alignment

Strategic Policy Alignment	Score
does not support the delivery of other government initiatives and is not aligned with the timing of other government initiatives.	0
partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	1
N/A	2
partially supports the delivery of other government initiatives and is partially aligned with the timing of other government initiatives.	3
fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, or is fully aligned with the timing of other government initiatives	4
fully supports the delivery of other government initiatives and is consistent with a whole-of government approach and is fully aligned with the timing of other government initiatives.	5

F.2 Results of the Multi Criteria Analysis

Option 4B: Build a pipeline from Paradise Dam to Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 4 Score Description: Fully delivers two of the benefits sought	This option facilitates the delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	This option has strong support, although this is expected to be some resistance from water users in the Bundaberg Water Scheme if water is taken from Paradise Dam.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	Strong performance in relation to socio-economic, environmental and timeframe considerations. Some stakeholder concerns in relation to access to water from Paradise Dam.
Risks	Score: 3 Score Description: Moderate risk	Some risk related to potential route requiring lift which would increase operational costs, and access to water from Paradise Dam.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to existing legislation, regulations and legislative instruments, including the Burnett Water Plan, operations manuals, water management protocols and bulk water service contracts.
Strategic and policy alignment	Score: 5 Score Description: Fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, and is fully aligned with the timing of other government initiatives.	Provides high potential area with reliable water without high capital expenditure and aligns closely with North Burnett Regional Council economic strategies.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.80	
Rank:	1^{st} (equal)	
Outcome:	This option has been included in the Short-list	

Option 4I: Raise Jones Weir, Raise Claude Wharton Weir. build a weir on the Burnett River downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 4 Score Description: Fully delivers two of the benefits sought	This option facilitates the delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	Irrigators and Council have expressed initial support. There may be some resistance from other parts of North Burnett that are in closer proximity to the two raised weirs.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	Option performs well against most public interest measures, although there is some uncertainty regarding the environmental and other impacts of the proposed weir.
Risks	Score: 3 Score Description: Moderate risk	This option involves multiple minor to moderate construction projects that each have some associated risk. The proposed new weir requires further engineering and environmental review.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option may require changes to the Burnett Water Plan and will require amendments to the operations manual and water management protocol.
Strategic and policy alignment	Score: 5 Score Description: Fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, and is fully aligned with the timing of other government initiatives.	Provides high potential area with reliable water without high capital expenditure and aligns closely with North Burnett Regional Council economic strategies. Government alignment may be reduced if a cost recovery plan is not achievable.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	3.80
Rank:	1st (equal)
Outcome:	This option has been included in the Short-list

Option 5: Construct a re-regulating weir on the Barambah Creek		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 3 Score Description: Fully addresses one of the problems or mostly addresses two or more of the problems	Fully addresses unreliability with specific existing agricultural supplemented water allocations.
Benefits	Score: 4 Score Description: Fully delivers two of the benefits sought	This option facilitates the delivery of two benefits for irrigators in South Burnett: • Sustained increases in agricultural production and employment • Improved economic (agricultural) resilience
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	Most stakeholders have indicated support for this option, provided that a suitable funding plan can be developed.
Public interest considerations	Score: 5 Score Description: performs well against all the public interest categories	This option performs well against all public interest considerations, particularly environmental considerations where a review was previously completed and approved by Commonwealth regulators.
Risks	Score: 3 Score Description: Moderate risks	The risks of this project have been considered and successfully mitigated previously. Some planning and approval are dated and will require updating. Environmental assessments and approvals may need to be conducted again to accommodate changes.
Legal and regulatory issues	Score: 4 Score Description: requires minimal operational changes, and mostly aligns with current legislation and regulations	Some changes to the Operations Manual and Water Management Protocol may be required. The legal and regulatory considerations will require updating and reconsideration.
Strategic and policy alignment	Score: 5 Score Description: fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, and is fully aligned with the timing of other government initiatives.	This is highly aligned with State and Local Government policies and objectives, and has previously received approval and support from the Commonweal Government.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.70	
Rank:	3rd (equal)	
Outcome:	This option has been included in the Short-list	

Option 1: Construct a re-regulating weir on the Boyne River		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 3 Score Description: Fully addresses one of the problems or mostly addresses two or more of the problems	Fully addresses unreliability with specific existing agricultural supplemented water allocations.
Benefits	Score: 4 Score Description: Fully delivers two of the benefits sought	This option facilitates the delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Boyne River Irrigators.
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	Most stakeholders have indicated support for this option. Sunwater have expressed reservations regarding cost recovery for this option.
Public interest considerations	Score: 5 Score Description: Performs well against all the public interest categories	This option provides broad public interest benefits without significant identified detriments. Further enquiries on environmental impacts and the affected on adjacent landholders will be required.
Risks	Score: 3 Score Description: Moderate risks	There are some risks relating to environmental assessments and requirements, and other approvals, that require management and potentially additional cost.
Legal issues	Score: 4 Score Description: requires minimal operational changes, and mostly aligns with current legislation and regulations	Some changes may be required to the Operations Manual and Water Management Protocol.
Strategic and policy alignment	Score: 5 Score Description: fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, and is fully aligned with the timing of other government initiatives.	There is close alignment with State and Local Government policies (provided a suitable cost recovery or management plan can be developed during the detailed business case).

Multi-Criteria Analysis outcome for this option

Overall weighted score:	3.70
Rank:	3rd (equal)
Outcome:	This option has been included in the Short-list

Option 8: Construct water recycling plant at Swickers facility in Kingaroy		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 3 Score Description: Fully addresses one of the problems or mostly addresses two or more of the problems	Improves water supply in Kingaroy, and provides for expanded industrial expansion with additional supply of reliable water.
Benefits	Score: 1 Score Description: Partially delivers one of the benefits sought	Partially delivers improved community (urban) resilience.
Support from stakeholders	Score: 4 Score Description: High support from all relevant stakeholders	All stakeholders support this option as providing cost recoverable benefits.
Public interest considerations	Score: 5 Score Description: performs well against all the public interest categories	This option performs broadly, and especially highly against environmental and socio-economic considerations.
Risks	Score: 5 Score Description: Very low residual risks	The risks are highly limited and can be easily mitigated.
Legal issues	Score: 5 Score Description: requires no operational changes, and fully aligns with current legislation and regulations	There are no impacts on any legislation or regulations.
Strategic and policy alignment	Score: 5 Score Description: Fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, and is fully aligned with the timing of other government initiatives.	This option performs very highly against government policies and plans at all levels of government.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.65	
Rank:	5th	
Outcome:	This option has been included in the Short-list	

Option 15: Greater utilisation of the Wivenhoe to Tarong pipeline (for Blackbutt irrigators)		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 4 Score Description: Fully addresses two of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 4 Score Description: Fully delivers two of the benefits sought	This option facilitates the delivery of: • Sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	There may be some resistance to this option from other users of the pipeline or user that rely on water from Wivenhoe Dam.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option performs well against measures such as environmental and socio-economic impact. The performance is less against measures related to stakeholder impacts.
Risks	Score: 3 Score Description: Moderate risk	There is some risk relating to the potential impact on energy security and water security in South East Queensland.
Legal issues	Score: 4 Score Description: Requires substantive operational changes, and no legislative changes	Specific water accounting arrangements are likely to be required to track the volumes of water transferred via the pipeline to customers in the Burnett to maintain separation from water supplied under existing entitlements.
Strategic and policy alignment	Score: 3 Score Description: Partially supports the delivery of other government initiatives, and is partially aligned with the timing of other government initiatives.	This option closely aligns with water and economic policy at State and Local Government levels. The option may be less aligned with some energy and water security initiatives in South East Queensland.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	3.60
Rank:	6th
Outcome:	This option has been included in the Short-list

Option 9B: Tarong Power Station to source more of its water from Wivenhoe Dam (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	Option addresses all of the issues in South Burnett, including urban water security, unreliability for existing allocation holders, and lack of reliable water for fertile areas.
Benefits	Score: 5 Score Description: Fully delivers all of the benefits sought	Option delivers benefits for agricultural production, urban resilience, agricultural resilience and growth opportunities for agricultural processing industries.
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	This option has support from Council, although there may be opposition if this option impacts energy or water security in South East Queensland.
Public interest considerations	Score: 3 Score Description: performs well against some public interest categories and poorly against other public interest categories	This option performs well against measures such as environmental and socio-economic impact. The performance is lower against measures related to stakeholder impacts.
Risks	Score: 2 Score Description: High risk	There is high risks relating to the potential impact on energy security and water security in South East Queensland, and the limitations of existing commercial arrangements.
Legal issues	Score: 3 Score Description: Requires substantive operational changes, and no legislative changes	This option will require no legislative changes. It will require some changes in water allocations in the Boyne River & Tarong Water Supply Scheme.
Strategic and policy alignment	Score: 1 Score Description: partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	This option may not align with State Government policy in relation to energy security and water security in South East Queensland.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.30	
Rank:	7th (equal)	
Outcome:	This option has been included in the Short-list	

Option 10B: Tarong Power Station to source more of its water from manufactured water products (Convert Gordonbrook to irrigation use and supplement urban supply with additional water allocation from Tarong Power Station)		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	Option addresses all of the issues in South Burnett, including urban water security, unreliability for existing allocation holders, and lack of reliable water for fertile areas.
Benefits	Score: 5 Score Description: Fully delivers all of the benefits sought	Option delivers benefits for agricultural production, urban resilience, agricultural resilience and growth opportunities for agricultural processing industries.
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	This option has strong support from Council, although there will be opposition if this option impacts energy or water security in South East Queensland.
Public interest considerations	Score: 3 Score Description: performs well against some public interest categories and poorly against other public interest categories	This option performs well against measures such as environmental and socio-economic impact. The performance is less against measures related to stakeholder impacts.
Risks	Score: 2 Score Description: High risk	There is high risks relating to the potential impact on energy security and water security in South East Queensland, and the limitations of existing commercial arrangements.
Legal issues	Score: 3 Score Description: Requires substantive operational changes, and no legislative changes	This option will require no legislative changes. It will require some changes in water allocations in the Boyne River & Tarong Water Supply Scheme.
Strategic and policy alignment	Score: 1 Score Description: partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	This option may not align with State Government policy in relation to energy security and water security in South East Queensland
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.30	
Rank:	7th (equal)	
Outcome:	This option has been included in the Short-list	

Option 14: Optimise in-scheme unsupplemented access rules		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 2 Score Description: Partially addresses two or more of the problems on its own	Partially addresses problems with highly unreliable existing was allocations and highly fertile land with no access to reliable water
Benefits	Score: 2 Score Description: Partially delivers two or more of the benefits sought on its own	This option has the potential to partially address agricultural resilience and sustained increases in agricultural production and employment
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	Most stakeholders have support for this option, although the support is not strong.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option is strong on most public interest considerations, although its performance and level of impact is questionable.
Risks	Score: 5 Score Description: Very low residual risks	Only risk is that this option will not have a high benefit or positive impact.
Legal issues	Score: 4 Score Description: requires minimal operational changes, and mostly aligns with current legislation and regulations	There are unlikely to be any water planning issues associated with this option. Some changes to operational mechanisms will be required.
Strategic and policy alignment	Score: 5 Score Description: Fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, and is fully aligned with the timing of other government initiatives.	Option is designed to improve the administration and efficiency of water harvesting entitlements.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.30	
Rank:	7th	
Outcome:	This option has been not included in the short-list	

Option 9A: Tarong Power Station to source more of its water from Wivenhoe Dam (Keep Gordonbrook Dam)		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 3 Score Description: Fully addresses one of the problems or mostly addresses two or more of the problems	This option will fully address the urban water security issue in Kingaroy
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option facilitates the delivery of improved community (urban) resilience
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	Most stakeholders support this option, although there may be opposition if it impacts on energy security.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option performs moderately on its socio-economic benefits on the basis that it does not resolve the water quality concerns in Kingaroy.
Risks	Score: 2 Score Description: High risk	There are high risks relating to the potential impact on energy security and water security in South East Queensland, the limitations of existing commercial arrangements, and the continued use of Gordonbrook Dam.
Legal issues	Score: 4 Score Description: requires minimal operational changes, and mostly aligns with current legislation and regulations	This option will require no legislative changes. It will require some changes in water allocations in the Boyne River & Tarong Water Supply Scheme.
Strategic and policy alignment	Score: 4 Score Description: fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, or is fully aligned with the timing of other government initiatives	This option aligns with Government initiatives to build urban water security across the state.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.15	
Rank:	10th	
Outcome:	This option has been not included in the short-list	

Option 4A: Up to 65,000 ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 3 Score Description: Partially delivers two of the benefits sought	This option facilitates the partial delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	While there is some support for this option the higher cost than other alternatives and environmental assessments on the final site may result in substantive opposition.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option will require further environmental assessment, and there may be some stakeholder concerns in relation to access to water from Paradise Dam. It performs very well in relation to socio-economic benefits and proximity to demand.
Risks	Score: 2 Score Description: High risk	There are high risks in relation to determining the final location for the dam, the resulting uncertainty regarding costs and approvals, and significant costs and affordability.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.
Strategic and policy alignment	Score: 3 Score Description: partially supports the delivery of other government initiatives, and is partially aligned with the timing of other government initiatives.	The barriers to the recovery of the high capital costs for this option will result in some misalignment with Government policies and objectives.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	3.10	
Rank:	11th	
Outcome:	This option has been included in the Short-list	

Option 4D: Barambah Creek Dam at 39.3 km and irrigation network primarily for Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option facilitates the partial delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	There has been some support for this option, although the high cost of the dam is likely to reduce stakeholder support.
Public interest considerations	Score: 4 Score Description: Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option will require further environmental assessment, and there may be some stakeholder concerns in relation to access to water from Paradise Dam. It performs very well in relation to socio-economic benefits and proximity to demand.
Risks	Score: 2 Score Description: High risk	This option has a high risk of unknown costs and failure to recover the costs of the project from water users or other sources of funding.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.
Strategic and policy alignment	Score: 1 Score Description: Partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	While this option may align with some government policies, the option is highly likely to fail to meet Government objectives for cost recovery.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.90	
Rank:	12th (equal)	
Outcome:	This option has been not included in the short-list	

Option 4E: Barambah Creek Dam at 41.6 km and irrigation network primarily for Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option facilitates the partial delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	There has been some support for this option, although the high cost of the dam is likely to reduce stakeholder support.
Public interest considerations	Score: 4 Score Description: Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option will require further environmental assessment, and there may be some stakeholder concerns in relation to access to water from Paradise Dam. It performs very well in relation to socio-economic benefits and proximity to demand.
Risks	Score: 2 Score Description: High risk	This option has a high risk of unknown costs and failure to recover the costs of the project from water users or other sources of funding.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.
Strategic and policy alignment	Score: 1 Score Description: Partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	While this option may align with some government policies, the option is highly likely to fail to meet Government objectives for cost recovery.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.90	
Rank:	12th (equal)	
Outcome:	This option has been not included in the short-list	

Option 4F: Barambah Creek Dam at 43.0 km and irrigation network primarily for Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option facilitates the partial delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	There has been some support for this option, although the high cost of the dam is likely to reduce stakeholder support.
Public interest considerations	Score: 4 Score Description: Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option will require further environmental assessment, and there may be some stakeholder concerns in relation to access to water from Paradise Dam. It performs very well in relation to socio-economic benefits and proximity to demand.
Risks	Score: 2 Score Description: High risk	This option has a high risk of unknown costs and failure to recover the costs of the project from water users or other sources of funding.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.
Strategic and policy alignment	Score: 1 Score Description: Partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	While this option may align with some government policies, the option is highly likely to fail to meet Government objectives for cost recovery.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	2.90
Rank:	12th (equal)
Outcome:	This option has been not included in the short-list

Option 4C: 100,000 ML dam on Barambah Creek and irrigation network primarily for Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option addresses the problems of: • highly unreliable existing agricultural water allocations; and • fertile area without reliable source of water.
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option facilitates the partial delivery of: • sustained increases in agricultural production and employment; and • Improved economic (agricultural) resilience for the Coalstoun Lakes irrigators
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	There has been some support for this option, although the high cost of the dam is likely to reduce stakeholder support.
Public interest considerations	Score: 4 Score Description: Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option will require further environmental assessment, and there may be some stakeholder concerns in relation to access to water from Paradise Dam. It performs very well in relation to socio-economic benefits and proximity to demand.
Risks	Score: 2 Score Description: High risk	This option has a high risk of unknown costs and failure to recover the costs of the project from water users or other sources of funding.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to regulations and legislative instruments, including the Burnett Water Plan, operations manual and water management protocol. Testing against compliance with the water plan's environmental flow objectives and water allocation security objectives is required.
Strategic and policy alignment	Score: 1 Score Description: Partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	While this option may align with some government policies, the option is highly likely to fail to meet Government objectives for cost recovery.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.90	
Rank:	12th (equal)	
Outcome:	This option has not been included in the short-list	

Option 3A: Raise Claude Wharton Weir		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 2 Score Description: Partially addresses two or more of the problems on its own	This option would provide partially address the problems of insufficient water being available for fertile lands, and providing increased reliability for existing allocations.
Benefits	Score: 2 Score Description: Partially delivers two or more of the benefits sought on its own	This option partially facilitates the delivery of: • sustained increases in agricultural production and employment; and • improved economic (agricultural) resilience.
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	Most stakeholders support this option although there would be some opposition from other agricultural areas with higher water demand.
Public interest considerations	Score: 3 Score Description: Performs well against some public interest categories and poorly against other public interest categories	There is limited demand for the additional water this option provides in the immediate area that would benefit. This option does not perform as well as options that deliver water to area of high demand.
Risks	Score: 4 Score Description: Low residual risks	The risks for this option have been considered and assessed, and mitigation strategies have been developed.
Legal issues	Score: 3 Score Description: Requires substantive operational changes, and no legislative changes	This option will require amendments to the water management protocol and operations manual.
Strategic and policy alignment	Score: 4 Score Description: Fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, or is fully aligned with the timing of other government initiatives	This project supports the delivery of other government initiatives, although it performs better when considered in combination with other options.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	2.85
Rank:	16th (equal)
Outcome:	This option has not been included in the short-list

Option 17: Agricultural supply chain improvements		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 1 Score Description: Partially addresses one of the problems	This option could partially contribute to agricultural output, jobs & investment in the study area.
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option will facilitate the emergence of efficient local supply chain industries
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	This option requires concreate programs in order to gain stakeholder support.
Public interest considerations	Score: 2 Score Description: performs moderately against all the public interest categories	This option provides limited benefit at this stage, although it may be developed further and show increased public interest performance.
Risks	Score: 5 Score Description: Very low residual risks	There are little or no risks associated with this option at this stage.
Legal issues	Score: 5 Score Description: Requires no operational changes, and fully aligns with current legislation and regulations	No changes will be required at this stage.
Strategic and policy alignment	Score: 3 Score Description: partially supports the delivery of other government initiatives, and is partially aligned with the timing of other government initiatives.	As programs and initiatives are developed for this option, it will be necessary to measure them against the State and Local Government policies.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	2.85
Rank:	16th (equal)
Outcome:	This option has not been included in the short-list

Option 4F: Build a pipeline from Paradise Dam to Boondooma Dam via Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 4 Score Description: Fully addresses two of the problems	This option will address: • Existing water allocations with poor reliability; and • large fertile areas without a reliable water source.
Benefits	Score: 4 Score Description: Fully delivers two of the benefits sought	This option will facilitate the delivery of: • sustained increases in agricultural production and employment; and • improved agricultural resilience
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	This option has some opposition due to the high cost and the complexity in completing the project.
Public interest considerations	Score: 3 Score Description: Performs well against some public interest categories and poorly against other public interest categories	This option has a high cost and it is highly unlikely that it will be affordable for water users or governments.
Risks	Score: 2 Score Description: High risk	This option has high risk associated with its complexity, cost and affordability.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option impacts on multiple water schemes and water plans, and would require amendments to the operations manual and water protocols.
Strategic and policy alignment	Score: 1 Score Description: partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	This option does provide some of the outcomes sought by governments, although it does not meet government objectives for water projects in Queensland.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	2.80
Rank:	18th
Outcome:	This option has not been included in the short-list

Option 2A: Raise Jones Weir		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 1 Score Description: Partially addresses one of the problems	This option would provide some additional water to fertile areas for agricultural production, although without an irrigation network the water is unlikely to reach areas of highest demand and production potential.
Benefits	Score: 2 Score Description: Partially delivers two or more of the benefits sought on its own	This option partially facilitates the delivery of: • sustained increases in agricultural production and employment; and • improved economic (agricultural) resilience.
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	Most stakeholders support this option although there would be some opposition from other agricultural areas with higher water demand.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option does not perform as well as other options that direct new water to areas of high demand and production potential.
Risks	Score: 4 Score Description: Low residual risks	The risks for this option have been considered and assessed, although some reconsideration will be required for assessments conducted 20+ years ago.
Legal issues	Score: 3 Score Description: Requires substantive operational changes, and no legislative changes	This option will require amendments to the water management protocol and operations manual.
Strategic and policy alignment	Score: 4 Score Description: fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, or is fully aligned with the timing of other government initiatives	This project supports the delivery of other government initiatives, although it performs better when considered in combination with other options.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.75	
Rank:	19th (equal)	
Outcome:	This option has not been included in the short-list	

Option 4H: Build a pipeline from Paradise Dam to Tarong – Boondooma pipeline via Coalstoun Lakes		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 5 Score Description: Fully addresses all of the problems	This option will address: • poor water security for urban areas; and large fertile areas without a reliable water source.
Benefits	Score: 5 Score Description: Fully delivers all of the benefits sought	This option will facilitate the delivery of: • sustained increases in agricultural production and employment; and improved community (urban) resilience
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	This option has some opposition due to the high cost and the cost and complexity in completing the project.
Public interest considerations	Score: 1 Score Description: Performs moderately against some of the public interest categories and poorly against other public interest categories	This option has a high cost and it is highly unlikely that it will be affordable for water users or governments.
Risks	Score: 1 Score Description: Very high risk	This option has high risk associated with its complexity, cost and affordability.
Legal issues	Score: 1 Score Description: Requires some legislative changes at a single level of Government that will be difficult to achieve	This option impacts on multiple water schemes and water plans, and would require amendments to the operations manual and water protocols.
Strategic and policy alignment	Score: 1 Score Description: Partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	This option does provide some of the outcomes sought by governments, although it does not meet government objectives for water projects in Queensland.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.75	
Rank:	19th (equal)	
Outcome:	This option has not been included in the short-list	

Option 10A: Tarong Power Station to source more of its water from manufactured water products (Keep Gordonbrook Dam)		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 3 Score Description: Fully addresses one of the problems or mostly addresses two or more of the problems	This option will fully address the urban water security issue in Kingaroy
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option facilitates the delivery of improved community (urban) resilience
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	This option has support from Councils, although there may be opposition in relation to the use of recycled water at the power stations and other impacts this option could have to energy and water security.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	The public interest concerns with this option relation to potential impacts to energy and water security, and possibly to energy prices.
Risks	Score: 2 Score Description: High risk	There is high risks relating to the potential impact on energy security and water security in South East Queensland, and the limitations of existing commercial arrangements.
Legal issues	Score: 4 Score Description: Requires minimal operational changes, and mostly aligns with current legislation and regulations	Minor changes may be required in relation to the transfer of water and water allocations.
Strategic and policy alignment	Score: 1 Score Description: partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	Good alignment with State Government policy, although the use of manufactured water in this way may not align fully with existing government schedules.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.70	
Rank:	21^{st} (equal)	
Outcome:	This option has been not included in the short-list	

Option 16: Private Water harvesting		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 2 Score Description: Partially addresses two or more of the problems on its own	This option could partially address problems with: • existing allocations with poor reliability; and • fertile areas without a reliable water source.
Benefits	Score: 2 Score Description: Partially delivers two or more of the benefits sought on its own	This option will facilitate the particle delivery of: • sustained increases in agricultural production and employment; • improved economic (agricultural) resilience
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	This option would be supported by most stakeholders although there is uncertainty around the significance of the benefits it would deliver.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option has limitations on its performance and resulting limitation son its public interest value.
Risks	Score: 3 Score Description: Moderate risk	There is some risk with this option, and there are unknowns with how this option would be delivered.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option would potentially require amendments to the water plan and the water management protocol to enable the release of unallocated water reserves in the form of unsupplemented water allocations.
Strategic and policy alignment	Score: 4 Score Description: Fully supports the delivery of other government initiatives and is consistent with a whole-of government approach, or is fully aligned with the timing of other government initiatives	This option generally aligns with the Government objective to maximize the efficient use of existing water resources and infrastructure without the need for additional expenditure on new water infrastructure
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.70	
Rank:	22nd	
Outcome:	This option has not been included in the short-list	

Option 3B: Raise Claude Wharton Weir and build a pipeline to area of urban or irrigation demand		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 2 Score Description: Partially addresses two or more of the problems on its own	This option would partially address the problems of insufficient water being available for fertile lands, and providing increased reliability for existing allocations.
Benefits	Score: 3 Score Description: Fully delivers one of the benefits sought or mostly addresses two or more of the benefits sought	This option mostly facilitates the delivery of: • sustained increases in agricultural production and employment; and • improved economic (agricultural) resilience.
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	There is some stakeholder support for this option, although that support is limited because the option does not provide sufficient benefits on its own.
Public interest considerations	Score: 3 Score Description: Performs well against some public interest categories and poorly against other public interest categories	This option does not provide sufficient water to the areas of demand to provide public interest benefits across all categories.
Risks	Score: 3 Score Description: Moderate risk	The risks relating to this option relate to the high cost and ability to pay for the project.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to the water management protocol and operations manual.
Strategic and policy alignment	Score: 3 Score Description: Partially supports the delivery of other government initiatives, and is partially aligned with the timing of other government initiatives.	This option includes broadly aligns with Government objectives.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	2.55
Rank:	23rd
Outcome:	This option has not been included in the short-list

Option 6: Flood harvesting from Barambah Creek into Bjelke-Petersen Dam		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 1 Score Description: Partially addresses one of the problems	This option will partially address the problem of large areas of fertile land not having reliable water source.
Benefits	Score: 1 Score Description: Partially delivers one of the benefits sought	This option would partially facilitate increases in agricultural production and employment.
Support from stakeholders	Score: 3 Score Description: Support from most stakeholders	This option would receive support from most stakeholders, although some stakeholders have indicated that it has less support than alternative options.
Public interest considerations	Score: 4 Score Description: Performs well against some public interest categories and moderately against other public interest categories	This option would provide public interest benefits, although there is limited reliability and certainty around the delivery of those benefits.
Risks	Score: 4 Score Description: Low residual risks	The risks of this option are low, although the design of the project could result in increased risk
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option would require operational changes and amendments to the water management protocol.
Strategic and policy alignment	Score: 3 Score Description: Partially supports the delivery of other government initiatives, and is partially aligned with the timing of other government initiatives.	If this option could be executed successfully it would partially align with the Government objectives in the region.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	2.35
Rank:	24th
Outcome:	This option has not been included in the short-list

Option 2B: Raise Jones Weir and build a pipeline to area of urban or irrigation demand		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 1 Score Description: Partially addresses one of the problems	This option would partially address the problems of insufficient water being available for fertile lands.
Benefits	Score: 2 Score Description: Partially delivers two or more of the benefits sought on its own	This option partially facilitates the delivery of: • sustained increases in agricultural production and employment; and • improved economic (agricultural) resilience.
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	There is some stakeholder support for this option, although that support is limited because the option does not provide sufficient benefits on its own.
Public interest considerations	Score: 3 Score Description: Performs well against some public interest categories and poorly against other public interest categories	This option does not provide sufficient water to the areas of demand to provide public interest benefits across all categories.
Risks	Score: 3 Score Description: Moderate risk	The risks relating to this option relate to the ability to pay for the project by water users.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option will require amendments to the water management protocol and operations manual.
Strategic and policy alignment	Score: 3 Score Description: Partially supports the delivery of other government initiatives, and is partially aligned with the timing of other government initiatives.	This option includes broadly aligns with Government objectives.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	2.15	
Rank:	25th	
Outcome:	This option has not been included in the short-list	

Option 12: Raise Boondooma Dam		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 3 Score Description: Fully addresses one of the problems or mostly addresses two or more of the problems	This option could fully address problems of poor reliability for existing agricultural water allocations by increasing up to 90.1%
Benefits	Score: 1 Score Description: Partially delivers one of the benefits sought	This option could partially facilitate improved economic agricultural resilience.
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	Some support for this option has been expressed in South Burnett, although the lack of tangible benefit has reduced active support.
Public interest considerations	Score: 1 Score Description: Performs moderately against some of the public interest categories and poorly against other public interest categories	This option would have limited benefits that would impact areas of high need and there would be considerable potential for negative impact, including environmental impact and high costs.
Risks	Score: 1 Score Description: Very high risk	This option has a high cost and little tangible benefit in relation to new water. It is unlikely this project could recover capital or operational costs.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option would require changes to the operations manual and water management protocol
Strategic and policy alignment	Score: 1 Score Description: Partially supports the delivery of other government initiatives, or is partially aligned with the timing of other government initiative	This option has limited benefit and limited alignment with Government objectives

Multi-Criteria Analysis outcome for this option

Overall weighted score:	1.65
Rank:	26th
Outcome:	This option has not been included in the short-list

Option 11: Remove the 70,000 ML cut-off rule in Boondooma dam		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 0 Score Description: Does not address any of the problems	This option would not address any of the identified problems
Benefits	Score: 0 Score Description: Does not deliver the benefits sought (or reduces a benefit sought)	This option would potentially reduce community (urban) resilience by removing a risk mitigation mechanism
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	While there is some community support for the removal of the cut-off rule, multiple stakeholders are opposed due to the potential for increased risk
Public interest considerations	Score: 1 Score Description: Performs moderately against some of the public interest categories and poorly against other public interest categories	This option could create potential detriments to urban water security, commercial water security and power generation security.
Risks	Score: 2 Score Description: High risk	There are multiple risks in relation to this option including to urban water security, commercial water security and power generation security
Legal issues	Score: 3 Score Description: Requires substantive operational changes, and no legislative changes	This option would require amendment to the water management protocol and potentially the operations manual.
Strategic and policy alignment	Score: 0 Score Description: Does not support the delivery of other government initiatives, and is not aligned with the timing of other government initiatives.	This option does not align with Government priorities for urban water, energy generation and water security for the region.
Multi-Criteria Analysis outcome for this option		
Overall weighted score:	1.00	
Rank:	27th	
Outcome:	This option has not been included in the Short-list	

Option 7: Convert Gordonbrook Dam to irrigation use		
Criteria	**Unweighted Scoring and Description**	**Reasons of this score**
Service need	Score: 1 Score Description: Partially addresses one of the problems	This option would seek to address water quality issues, although this would also involve reducing water security.
Benefits	Score: 0 Score Description: Does not deliver the benefits sought (or reduces a benefit sought)	This option would potentially reduce community (urban) resilience by reducing urban water security.
Support from stakeholders	Score: 2 Score Description: Indifference / mix of support and opposition	This option has some limited support, although it has stronger support when it is combined with other measures to improve water security.
Public interest considerations	Score: 1 Score Description: Performs moderately against some of the public interest categories and poorly against other public interest categories	This option could create potential detriments to urban water security and commercial water security.
Risks	Score: 1 Score Description:	There are multiple risks in relation to this option including to urban water security and commercial water security.
Legal issues	Score: 2 Score Description: Requires minimal legislative changes at a single level of Government and substantive operational and administrative changes	This option would require regulatory changes relating to 'purpose of use' and operations of the dam.
Strategic and policy alignment	Score: 0 Score Description: Score Description: Does not support the delivery of other government initiatives, and is not aligned with the timing of other government initiatives.	This option does not align with Government priorities for urban water security.

Multi-Criteria Analysis outcome for this option

Overall weighted score:	0.95
Rank:	28th
Outcome:	This option has not been included in the short-list

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Water supply requirements in the North and South Burnett

Appendix G

Options Analysis

Appendix G. Determination of crop mix

For each potential irrigation area, a possible crop mix has been determined. This has been based on three key factors – stakeholder interviews, soil suitability and export and domestic markets.

In each area, we held discussions with the key irrigators and their local representatives. This consultation included discussion of what could be grown and what would likely be grown. In some cases, stakeholders suggested that there would be an increase in existing crops and/or a diversification into other crops. Our approach has been to conservatively estimate growth based on what we know can occur. While there may be opportunity for expansion into untired crops, our assessment is based on crops that already have a history of good performance.

While stakeholders take into account a range of factors, we also confirmed the soil suitability is sufficient for expansion. This soil suitability analysis is based on detailed surveys. However, an on-ground assessment would be needed to confirm suitability. In most cases, stakeholder interviews confirmed the data.

Table G.1: Crop suitability classes

Class	Suitability	Limitations	Description
1	Suitable	Negligible	Highly productive land requiring only simple management practices to maintain economic production.
2	Suitable	Minor	Land with limitations that either constrain production, or require more than the simple management practices of class 1 land to maintain economic production.
3	Suitable	Moderate	Land with limitations that either further constrain production, or require more than those management practices of class 2 land to maintain economic production.
4	Unsuitable	Severe	Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics or technology.
5	Unsuitable	Extreme	Land with extreme limitations that preclude any possibility of successful sustained use of the land in the proposed manner.

The first three classes of land (classes 1 to 3) are considered suitable for the specified land use, as the benefits obtained from that land use in the long term should outweigh the inputs required to initiate and maintain production. Class 3 land may be as productive as class 1 or 2 land; however, increased inputs (e.g. fertiliser, land preparation and maintenance operations) would generally be required.

It is not uncommon to find in a land resource survey that there is no land assessed as suitability class 1 for a particular land use. Class 4 land is considered currently unsuitable for the specified land use, due to the severity of one or a number of limitations. It is implied that the inputs required to achieve and maintain production outweigh the benefits of production in the long term. This land may be upgraded to a suitable class if future agronomic, edaphic or engineering studies show it to be economically viable and environmentally sustainable.

Changes in climate, economic conditions or technology may alter the level of management inputs required to achieve satisfactory long-term productivity. Class 5 land is considered unsuitable for the specified land use, as it has limitations that singly or in aggregate are so severe that the benefits would not justify the inputs required to initiate and maintain sustainable production in the long term. Such land is unlikely to ever be suitable for the specified land use.

We have also selected a crop mix that will not create an oversupply in any single commodity market. In some cases, there are strong export opportunities which can be utilised to ensure that prices are not materially impacted in the domestic market. Also, there are some instances where the domestic market is currently undersupplied (for example, peanuts) and additional domestic supply would displace imports. For other crops, the additional crops are not sufficient to materially impact domestic prices, compared with the existing domestic supply. For the below analysis, we have focussed on crops that make up 15 per cent or more of the forecast crop mix.

G.1 Coalstoun Lakes crop mix

G.1.1 Stakeholder interviews

Jacobs conducted multiple visits to Coalstoun Lakes for in person discussions and workshops with 12 of the largest irrigators in the region. Jacobs also spoke with three representatives from the Coalstoun Lakes Development Group. This consultation allowed us to gain insight into what is currently grown, what can be grown and what would be grown with greater water availability.

These conversations allowed us to determine and also check our assumptions on crop mix percentages and net margin parameters.

One of the key findings from the local consultation was the desire for the region to transition into an irrigation area focusing on high-value crops (including irrigated peanuts, green vegetables and Macadamias). Currently rainfed broadacre cropping is the primary land use.

The stakeholder engagement register and willingness and capacity to pay assessment have detailed documentation of the consultation undertaken. A summary of this justification for the crop mix percentages used for Coalstoun Lakes is documented in the table below.

Table G.2: Coalstoun Lakes crop mix percentages and justification

Crop	Percentage of mix (%)	Justification
Peanuts	30	Broadacre cropping is prevalent in region with dryland peanuts being the main rotation. Consultation revealed producers would likely shift to irrigated peanuts under the shortlisted option. We spoke to over 5 producers of peanuts in the area.
Beans (Green Vegetables)	25	The region has the correct soils and ability to grow green vegetables. Limited access to water has restricted the expansion of cropping in the area. We expect there will be a slower uptake in this crop mix as the region transitions. We have increased the crop mix percentage from 12% (year 1) to 25% (year 4). It is expected to also attract outside investment from the broader Wide-Bay Burnett area.
Macadamias	20	Many growers in the region have indicated that they would predominately undertake a gradual conversion to more capital intensive and larger downside risk perennial and high value tree crops particularly macadamias. We have increased in the crop mix percentage from 12% (year 1) to 20% (year 4). There is also strong soil suitability in the area which will also attract outside investment in Macadamias from the broader Wide-Bay Burnett area.
Melons	10	There is a known track record of Melons being grown in the region. We spoke with 3 farmers in the region to determine water use, margins and yield. Many are having success using drip tape to grow seedless melons. Further growth in Melon production would occur with greater access to water.
Corn	15	Corn is currently is one of the other main broadacre rotation crops in the region. Growers used it in rotation with Peanuts. It has been included to represent the current typical broadacre cropping margins.

G.1.2 Soil suitability

The soil in Coalstoun Lakes is suitable for many crops. The below summarises the suitability of peanuts, green beans, macadamias and corn. Soil suitability data on melons is not currently available. However, as it is successfully grown currently in the area, soil suitability is not considered a restraint.

G.1.2.1 Peanuts

The suitability for peanuts ranges from Class 2 to Class 5 – mostly class 3. This is shown on the map below, then the soil statistics for class 3,4 and 5 is shown below.

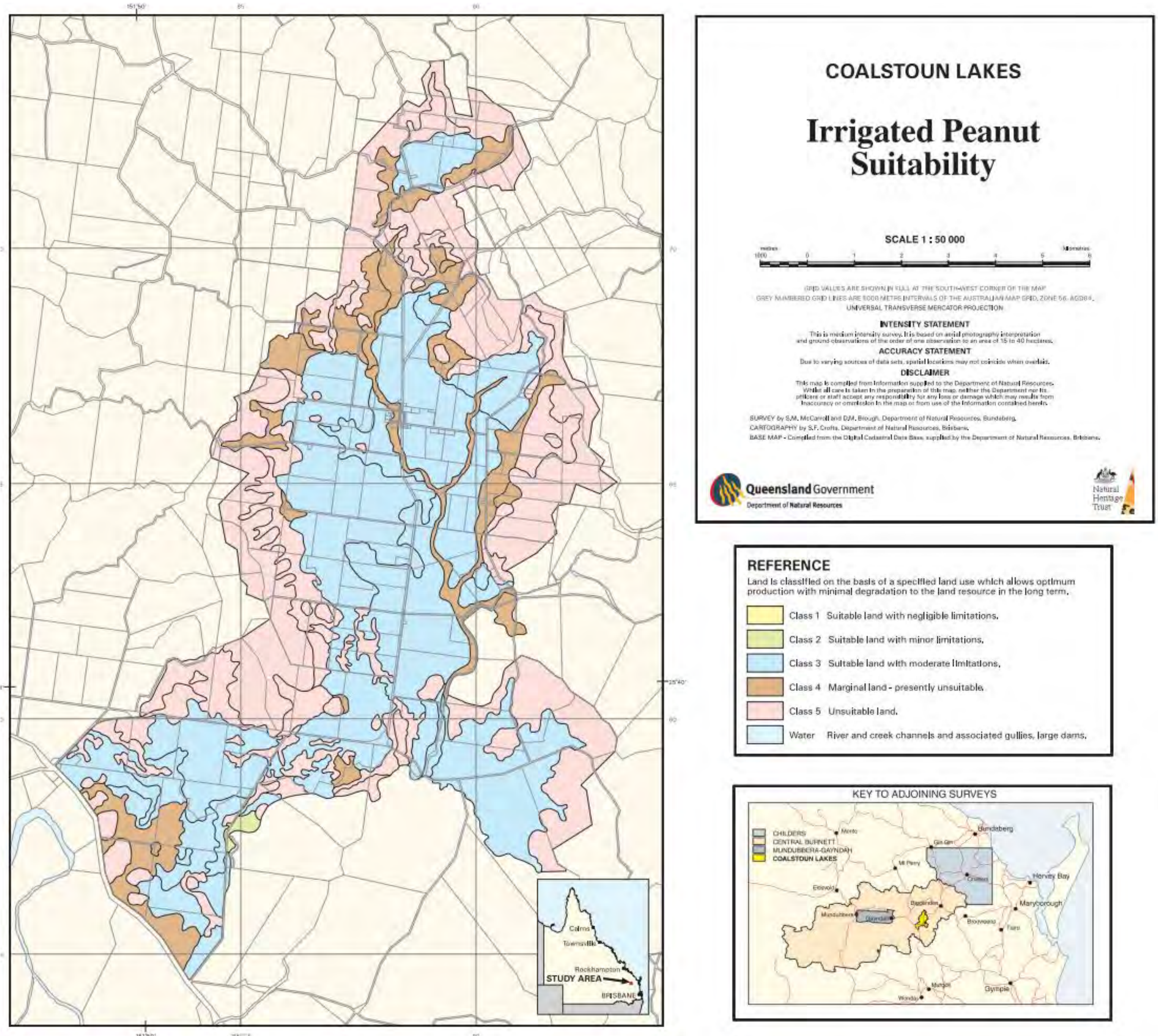


Table G.3: Soil and Land Information – Class 3

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Outflow potential	Ss	5H0	Well drained, Highly permeable (>500 mm/day), 0 - 100m to drainage outlet
Slope	Ts	0	<15%
Soil Profile Recharge	Ir	S0H	No Restrictions - Highly permeable (>500 mm/day)
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Surface condition	Ps	S0	No restrictions
Water availability	M	1	PAWC > 150mm (RAW > 105mm)
Wetness to 0.5m	W2	5H	Well drained, Highly permeable (>500 mm/day)
Subclass 3 limitations *(Suitable land with moderate limitations)*			
Rockiness	R	P2	Pebbles 6-20mm, 2_10%
Water erosion	E	E2	Ferrosols - 2-5%

Table G.4: Soil and Land Information – Class 4

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Rockiness	R	R0	No rock
Slope	Ts	0	<15%
Soil Profile Recharge	Ir	S1M	Hardsetting massive soils with sandy loam to clays loam surface texture with dry moderately firm consistency - Moderately permeable (50-500 mm/day)
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Water availability	M	4	PAWC 75 - 100mm (RAW 50 - 70mm)
Subclass 2 limitations *(Suitable land with minor limitations)*			
Outflow potential	Ss	3M0	Imperfectly drained, Moderatetly permeable (50 - 500 mm/day), 0 - 100m to drainage outlet
Surface condition	Ps	S1	Hardsetting massive soils with sandy loam to clays loam surface texture with dry moderately firm consistency
Water erosion	E	A1	Stable Soils - 0-2%
Subclass 4 limitations *(Marginal land which is presently considered unsuitable due to severe limitations)*			
Wetness to 0.5m	W2	3M	Imperfectly drained, Moderatetly permeable (50 - 500 mm/day)

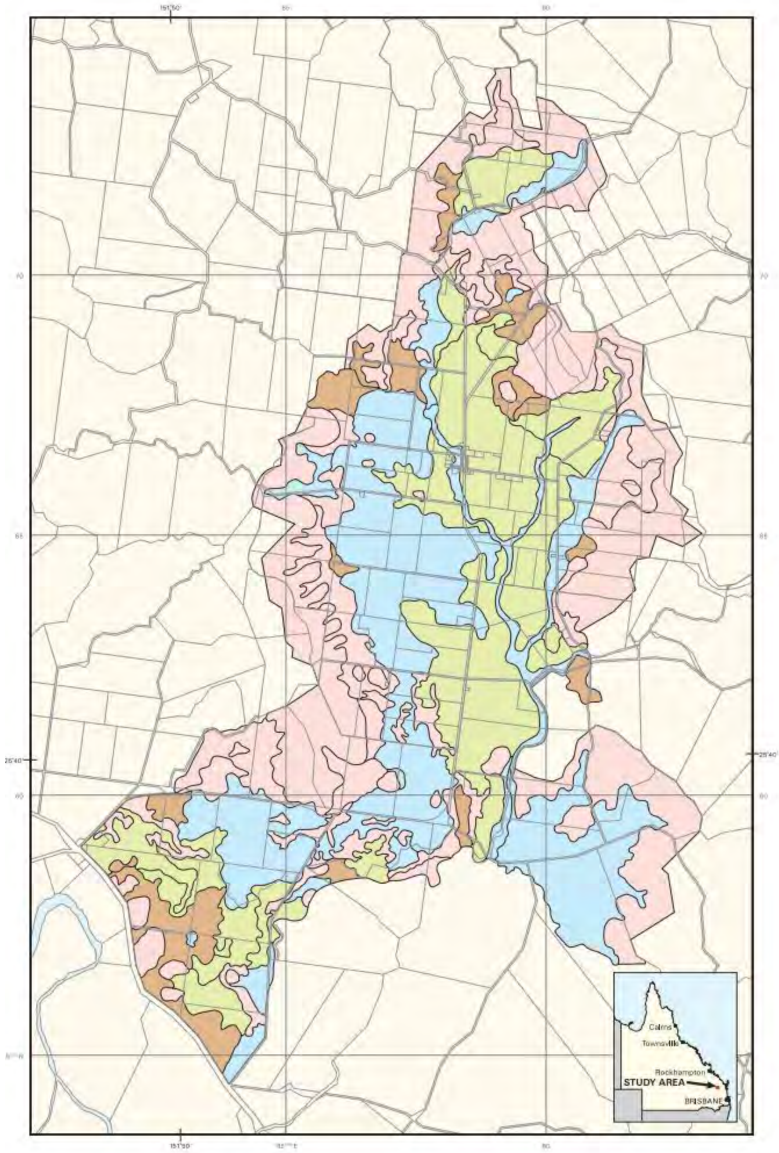
Table G.5: Soil and Land Information – Class 5

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Outflow potential	Ss	4H0	Moderately well drained, Highly permeable (>500 mm/day), 0 - 100m to drainage outlet
Slope	Ts	0	<15%
Soil Profile Recharge	Ir	S0H	No Restrictions - Highly permeable (>500 mm/day)
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Surface condition	Ps	S0	No restrictions
Water availability	M	1	PAWC > 150mm (RAW > 105mm)
Subclass 2 limitations *(Suitable land with minor limitations)*			
Water erosion	E	A1	Stable Soils - 0-2%
Wetness to 0.5m	W2	4H	Moderately well drained, Highly permeable (>500 mm/day)
Subclass 3 limitations *(Suitable land with moderate limitations)*			
Furrow Irrigated Erosion	Ef	A1	Erosion - Furrow Irrigated Stable Soils - 0-2%
Subclass 5 limitations *(Unsuitable land with extreme limitations)*			
Furrow Infiltration - Deep Drainage	If	H0	Highly permeable (>500 mm/day), Level Plains
Rockiness	R	G1	Gravel (20-60mm) <2%

The limitations in the soil can be managed. The on-ground experience is that this is an excellent location to grow peanuts, it is done very successfully using dryland methods currently. Some of the limitations relate to erosions and rockiness. This can be overcome by selecting the most suitable parts of a block to farm.

G.1.2.2 Green Beans

There are large parcels of land suitable for growing green beans, with lots of class 2 and class 3.



COALSTOUN LAKES

Irrigated Beans Suitability

SCALE 1 : 50 000

metres 1000 0 1 2 3 4 5 6 kilometres

GRID VALUES ARE SHOWN IN FULL AT THE SOUTH-WEST CORNER OF THE MAP
GREY NUMBERED GRID LINES ARE 1000 METRE INTERVALS OF THE AUSTRALIAN MAP GRID, ZONE 56, AGD84.
UNIVERSAL TRANSVERSE MERCATOR PROJECTION

INTENSITY STATEMENT

This is medium intensity survey. It is based on aerial photography interpretation and ground observations of the order of one observation to an area of 15 to 40 hectares.

ACCURACY STATEMENT

Due to varying sources of data sets, spatial locations may not coincide when overlaid.

DISCLAIMER

This map is compiled from information supplied to the Department of Natural Resources. Whilst all care is taken in the preparation of this map, neither the Department nor its officers or staff accept any responsibility for any loss or damage which may results from inaccuracy or ommission in the map or from use of the information contained herein.

SURVEY by S.M. McCarroll and D.M. Brough, Department of Natural Resources, Bundaberg.
CARTOGRAPHY by S.F. Crofts, Department of Natural Resources, Brisbane.
BASE MAP - Compiled from the Digital Cadastral Data Base supplied by the Department of Natural Resources, Brisbane.

Queensland Government
Department of Natural Resources

Natural Heritage Trust

REFERENCE

Land is classified on the basis of a specified land use which allows optimum production with minimal degradation to the land resource in the long term.

- Class 1 Suitable land with negligible limitations.
- Class 2 Suitable land with minor limitations.
- Class 3 Suitable land with moderate limitations.
- Class 4 Marginal land - presently unsuitable.
- Class 5 Unsuitable land.
- Water River and creek channels and associated gullies, large dams.

KEY TO ADJOINING SURVEYS

Table G.6: Soil and Land Information – Class 2

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Outflow potential	Ss	4H0	Moderately well drained, Highly permeable (>500 mm/day), 0 - 100m to drainage outlet
Slope	Ts	0	<15%
Soil Profile Recharge	Ir	S0H	No Restrictions - Highly permeable (>500 mm/day)
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Surface condition	Ps	S0	No restrictions
Subclass 2 limitations *(Suitable land with minor limitations)*			
Rockiness	R	G1	Gravel (20-60mm) <2%
Water availability	M	1	PAWC > 150mm (RAW > 105mm)
Water erosion	E	A1	Stable Soils - 0-2%
Wetness to 0.5m	W2	4H	Moderately well drained, Highly permeable (>500 mm/day)

Table G.7: Soil and Land Information – Class 4

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Rockiness	R	R0	No rock
Slope	Ts	0	<15%
Soil Profile Recharge	Ir	S1M	Hardsetting massive soils with sandy loam to clays loam surface texture with dry moderately firm consistency - Moderately permeable (50-500 mm/day)
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Surface condition	Ps	S1	Hardsetting massive soils with sandy loam to clays loam surface texture with dry moderately firm consistency
Subclass 2 limitations *(Suitable land with minor limitations)*			
Outflow potential	Ss	3M0	Imperfectly drained, Moderatetly permeable (50 - 500 mm/day), 0 - 100m to drainage outlet
Water availability	M	4	PAWC 75 - 100mm (RAW 50 - 70mm)
Water erosion	E	A1	Stable Soils - 0-2%
Subclass 4 limitations *(Marginal land which is presently considered unsuitable due to severe limitations)*			
Wetness to 0.5m	W2	3M	Imperfectly drained, Moderatetly permeable (50 - 500 mm/day)

Table G.8: Soil and Land Information – Class 5

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Outflow potential	Ss	5H0	Well drained, Highly permeable (>500 mm/day), 0 - 100m to drainage outlet
Slope	Ts	0	<15%
Soil Profile Recharge	Ir	S0H	No Restrictions - Highly permeable (>500 mm/day)
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Surface condition	Ps	S0	No restrictions
Wetness to 0.5m	W2	5H	Well drained, Highly permeable (>500 mm/day)
Subclass 2 limitations *(Suitable land with minor limitations)*			
Water availability	M	1	PAWC > 150mm (RAW > 105mm)
Subclass 3 limitations *(Suitable land with moderate limitations)*			
Water erosion	E	E2	Ferrosols - 2-5%
Subclass 5 limitations *(Unsuitable land with extreme limitations)*			
Rockiness	R	S5	Stone (200-600mm) >50%

19.2.2.1 Macadamias

The suitability for macadamias is largely class 1.

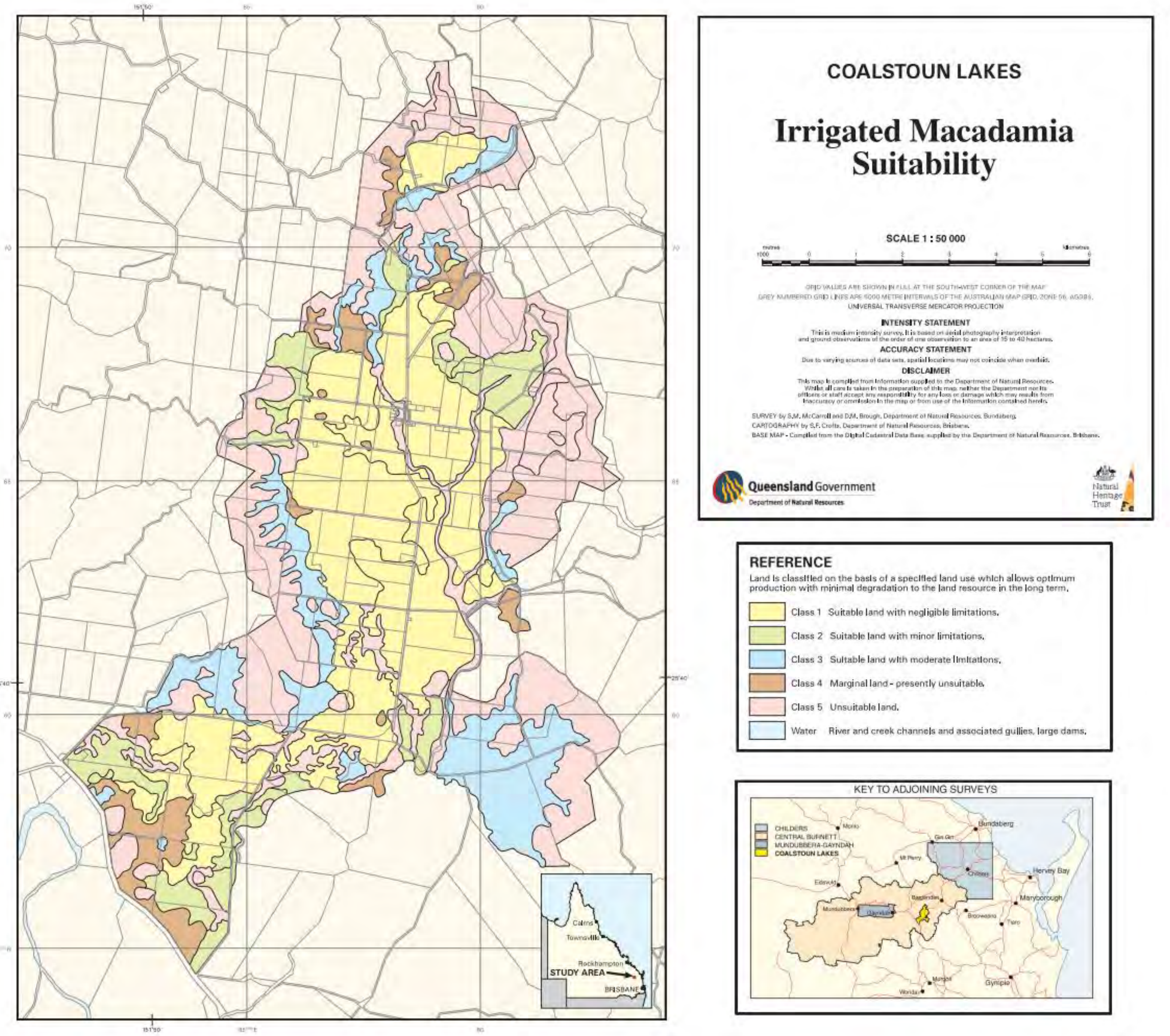


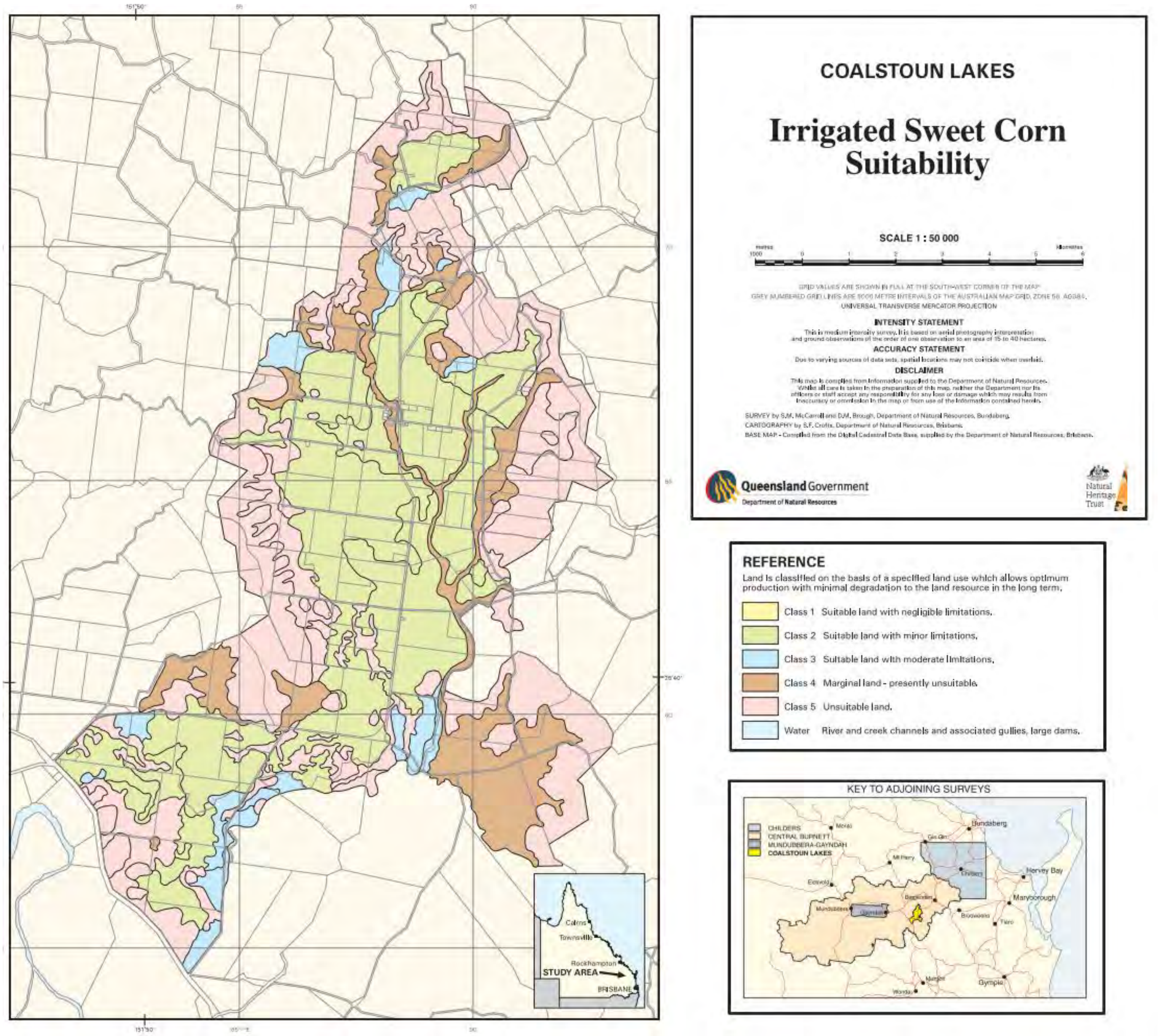
Table G.1: Soil and Land Information – Class 1

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Outflow potential	Ss	5H0	Well drained, Highly permeable (>500 mm/day), 0 - 100m to drainage outlet
Rockiness	R	G1	Gravel (20-60mm) <2%
Slope	Ts	0	<15%
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Surface condition	Ps	S0	No restrictions
Water availability	M	1	PAWC > 150mm (RAW > 105mm)
Water erosion	E	E1	Ferrosols - 0-2%
Wetness to 1.5m	W3	5H	Well drained, Highly permeable (>500 mm/day)

Table G.2: Soil and Land Information – Class 2

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Flooding	F	0	no flooding
Microrelief	Tm	0	<0.1 Level
Narrow moisture range	Pm	0	No restrictions
Outflow potential	Ss	4H0	Moderately well drained, Highly permeable (>500 mm/day), 0 - 100m to drainage outlet
Rockiness	R	G1	Gravel (20-60mm) <2%
Slope	Ts	0	<15%
Soil adhesiveness	Pa	0	No restrictions
Soil depth	Pd	1	effective soil depth >1m
Surface condition	Ps	S0	No restrictions
Water availability	M	1	PAWC > 150mm (RAW > 105mm)
Water erosion	E	E1	Ferrosols - 0-2%
Subclass 2 limitations *(Suitable land with minor limitations)*			
Wetness to 1.5m	W3	4H	Moderately well drained, Highly permeable (>500 mm/day)

G.1.2.3 Corn



G.1.3 Export and domestic potential

G.1.3.1 Peanuts[44]

Australia produces about 40,000 tonnes peanuts annually, representing around 0.2% of the global peanut production. More than 90% of Australia's peanuts are grown in the state of Queensland.

The Australian domestic market for peanuts Is about 40,000 tonnes annually, with approximately 5,000 to 8,000 tonnes imported each year.

The global export market for peanuts is dominated by China, USA, Argentina and a small number of other higher volume exporters. Australia has a small share of the international peanut market and there is significant capacity for increased exports to high value trading partners (with existing trade agreements) Japan, South Korea and Indonesia.

It is our view that there is capacity in both the domestic market and export market for growth in production of peanuts.

[44] Peanut Company of Australia, 2020

G.1.3.2 Beans (green vegetables)[45]

Australia's green bean market is relatively stable and there is some growth in the export market for Australian green beans. While Australia is a net exporter of green beans, there is still around 430 tonnes of green beans imported into Australia each year.

It is our view that there is capacity in both the domestic market and export market for growth in production of beans (green vegetables). The below table provides a summary of the key statistics relating to the production, import and export of beans (green vegetables).

Beans (green vegetables) production, import and export

Year ending June 2019	Domestic production (t)	Volume of fresh exports (t)	Volume of fresh imports (t)	Total fresh supply volume (t)
Beans (green vegetables)	38,012	1,741	431	36,702

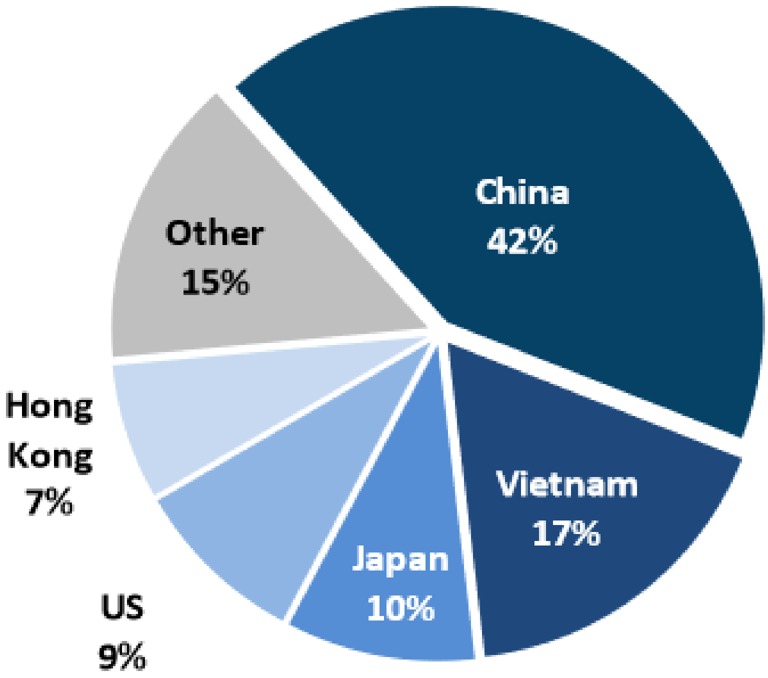
G.1.3.3 Macadamias[46]

The Australian macadamia industry is heavily focused on exports, with approximately 81% of total production exported. Domestic consumption of macadamias has steadily increased in recent years, and is currently 159g per capita, an increase of 7% in FY2019 and 13% in FY2018. The wholesale value of macadamias has increased significantly since 2017 from $77.4m to $89.7m to $113.3m.

China is the largest purchaser of Australian macadamias with 42% of exports. Under the Australia China Free Trade Agreement tariffs on Australian shelled macadamia nuts has reduced from a high of 24% in 2015 to 0% since January 2019.

[45] Australian Horticulture Statistic Handbook 2018/19
[46] Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019; Australian Table Grapes Association

FY2019 Macadamia exports by country



Source: Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019

It is our view that there is capacity in both the domestic market and export market for growth in production of macadamias. The below table provides a summary of the key statistics relating to the production, import and export of macadamias.

Macadamias production, import and export

Year ending June 2019	Domestic production (KWE t)	Volume of fresh exports (KWE t)	Volume of fresh imports (KWE t)	Total fresh supply volume (KWE t)
Macadamias	14,157	11,488	154	3,992

G.2 Boyne River and Tarong (Boyne River Weir)

G.2.1 Stakeholder interviews

Jacobs conducted multiple one on one conversation with 5-10 irrigators in the region. We also spoke with two representatives for the Boyne River including the chairperson of the Boyne River and Tarong's Irrigator Advisory Committee

Consultation confirmed that many irrigators would use the increase in reliability as part security water and part expansion depending on the individual circumstances. The combined water security for citrus farmers (scheme plus on-farm storages and investment) used to give 3-5 years water security. However, revised security is now 2.5 years (2-3) which causes genuine stress in the farming community. It also prevents planting of new trees from the nursery / so the opportunity cost is forgone expansion of citrus or other crops.

The region has significant investment in permanent plantings and perennial crops - customer representatives also highlighted the growth in Table Grapes, Pecans and Avocados in the area, which would require greater water security.

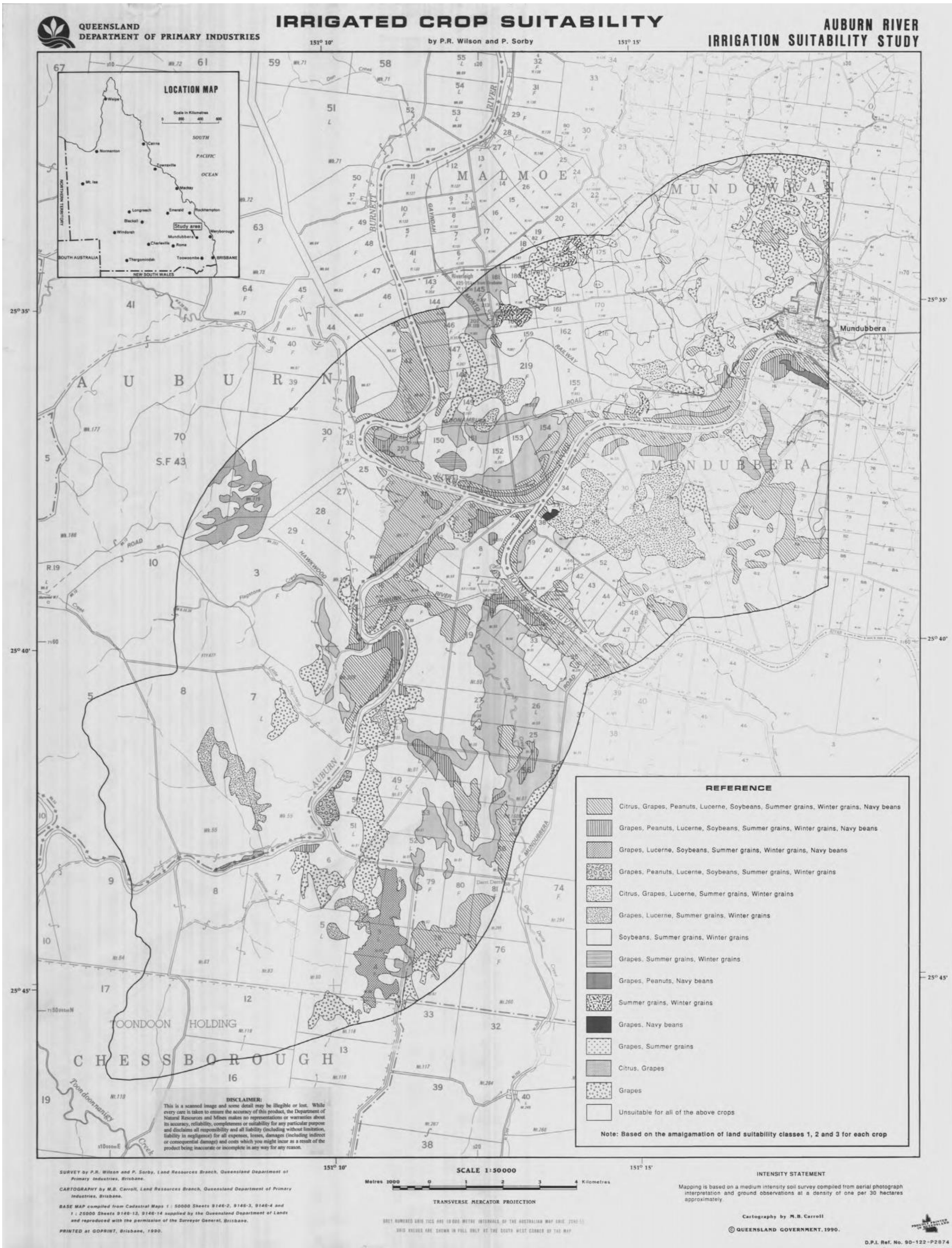
The stakeholder engagement register and willingness and capacity to pay assessment have detailed documentation of the consultation undertaken. A summary of this justification for the crop mix percentages used for the Boyne River shortlisted option is documented in the table below.

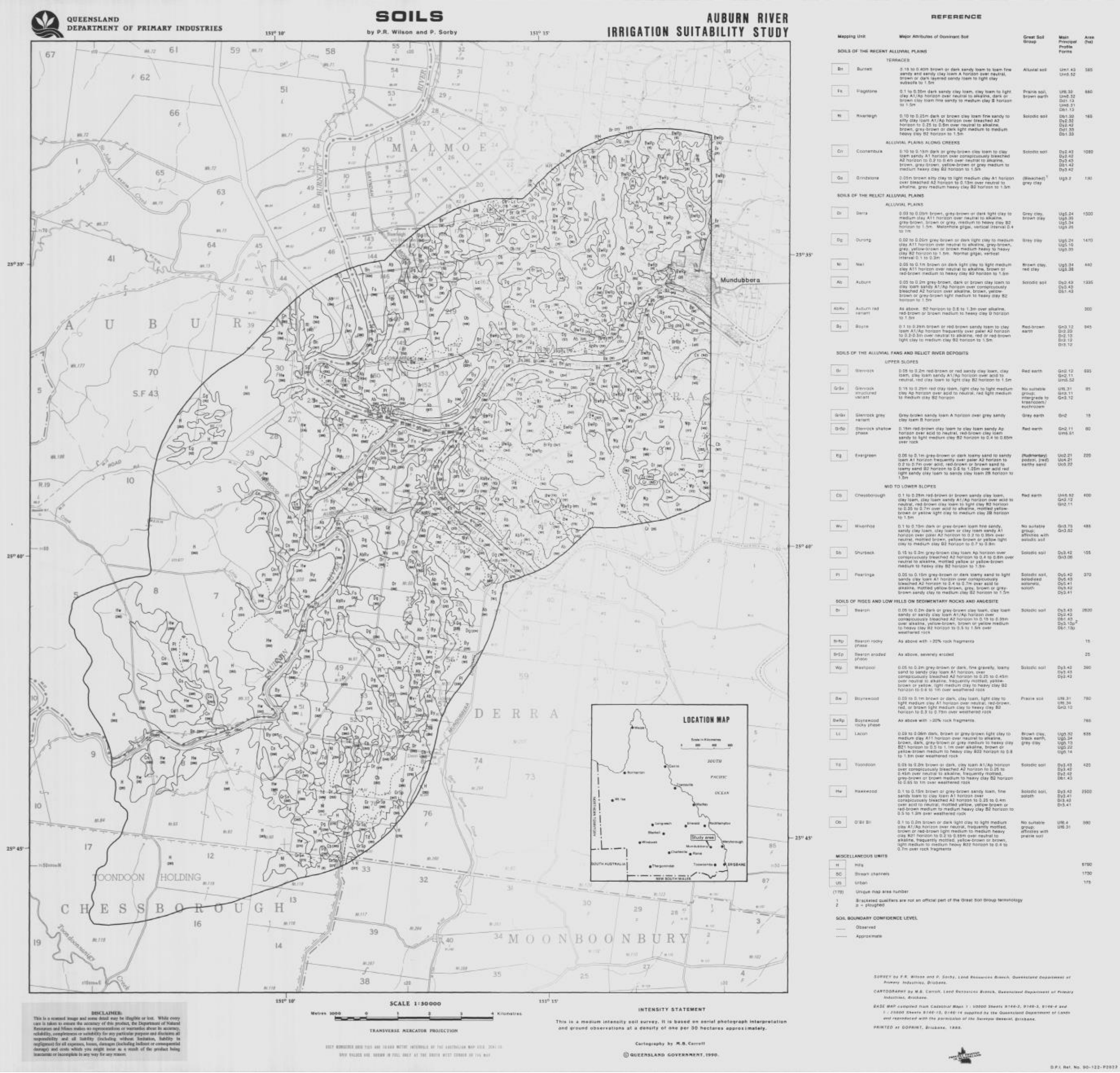
Table G.3: Boyne River crop mix percentages and justification

Crop	Percentage of mix (%)	Justification
Citrus (Mandarins)	40	Mandarins are still the largest perennial crop in the area (more than 5 farms producing) and will be one of the primary users of the increase in water reliability. Both representatives agreed the allocation should be between 40-50% One of the largest producers in the region Quebec Citrus could expand up to 250 ha on existing farm. This would result in an increase in usage of 200-600 ML.
Blueberries	15	Large capital investments have been made by Smart Berries in region. The current farm manager outlined plans for expansion if water was available. Estimates are that Smart Berries could conservatively expand between 50-100 ha which would result in an increase in usage of 250-500 ML.
Pecans	15	Consultation highlighted the growth in Pecan farming in the area (2 known farms expanding). Strong evidence exists that Pecans can be grown successfully in area. Expansion is based on getting more water. One irrigator outlined that if was to get more yield that has sufficient volume, then they could process on site.
Table Grapes	15	The Burnett is one of the fastest-growing wine areas in Queensland. Customers representatives highlighted the growth in Table Grapes in the area. This has been reflected in the allocation percentage.
Mungbeans	5	Mungbeans are one of the region's largest grown broadacre crop according to the last agricultural census. It has been included to represent the typical broadacre cropping margin in the region.
Mangoes	5	There is a known track record of growing Mangoes in the area. Expansion is smaller than Pecans, Tables grapes and Blueberries. Representatives agreed 5 per cent was appropriate.
Avocados	5	There is a known track record of growing Avocados in the area. Expansion is smaller than Pecans, Tables grapes and Blueberries. Representatives agreed 5 per cent was appropriate. Growth is occurring in the area and has the potential to increase more than current percentage.

G.2.2 Soil suitability

The below maps shop the soil suitability for the Auburn River, however, there is also a component of the Boyne River, that is relevant to this assessment.


QUEENSLAND
DEPARTMENT OF PRIMARY INDUSTRIES
IRRIGATED CROP SUITABILITY
by P.R. Wilson and P. Sorby
AUBURN RIVER
IRRIGATION SUITABILITY STUDY
LOCATION MAP
Study area
Mundubbera
MALMOE
MUNDOWRAN
AUBURN
MUNDUBBERA
CHESSBOROUGH
TOONDOON HOLDING
REFERENCE
Citrus, Grapes, Peanuts, Lucerne, Soybeans, Summer grains, Winter grains, Navy beans
Grapes, Peanuts, Lucerne, Soybeans, Summer grains, Winter grains, Navy beans
Grapes, Lucerne, Soybeans, Summer grains, Winter grains, Navy beans
Grapes, Peanuts, Lucerne, Soybeans, Summer grains, Winter grains
Citrus, Grapes, Lucerne, Summer grains, Winter grains
Grapes, Lucerne, Summer grains, Winter grains
Soybeans, Summer grains, Winter grains
Grapes, Summer grains, Winter grains
Grapes, Peanuts, Navy beans
Summer grains, Winter grains
Grapes, Navy beans
Grapes, Summer grains
Citrus, Grapes
Grapes
Unsuitable for all of the above crops
Note: Based on the amalgamation of land suitability classes 1, 2 and 3 for each crop
DISCLAIMER:
This is a scanned image and some detail may be illegible or lost. While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way for any reason.
SURVEY by P.R. Wilson and P. Sorby, Land Resources Branch, Queensland Department of Primary Industries, Brisbane.
CARTOGRAPHY by M.B. Carroll, Land Resources Branch, Queensland Department of Primary Industries, Brisbane.
BASE MAP compiled from Cadastral Maps 1 : 50000 Sheets 9146-2, 9146-3, 9146-4 and 1 : 25000 Sheets 9146-13, 9146-14 supplied by the Queensland Department of Lands and reproduced with the permission of the Surveyor General, Brisbane.
PRINTED at GOPRINT, Brisbane, 1990.
SCALE 1:50000
Metres 1000 0 1 2 3 4 Kilometres
TRANSVERSE MERCATOR PROJECTION
INTENSITY STATEMENT
Mapping is based on a medium intensity soil survey compiled from aerial photograph interpretation and ground observations at a density of one per 30 hectares approximately.
Cartography by M.B. Carroll
© QUEENSLAND GOVERNMENT, 1990.
D.P.I. Ref. No. 90-122-P2874



G.2.3 Mandarins

Along the Boyne river there is substantial soil that is suitable for growing citrus.

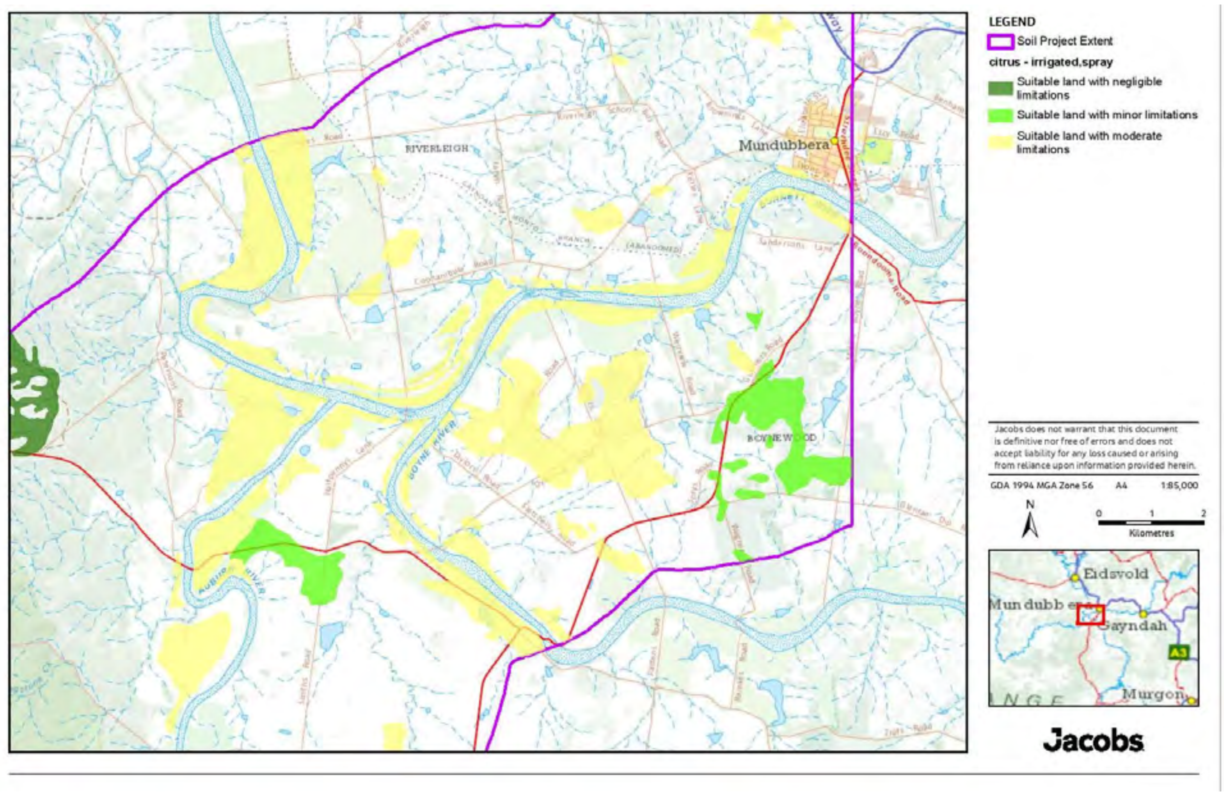


Table G.4: Soil and Land Information – Class 3

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Microrelief	Tm	0	Gilgai Vertical interval <0.1 m
Narrow moisture range	Pm	6	Moderate moisture range (P6)
Rockiness	R	G0	No coarse fragments
Soil adhesiveness	Pa	3	Moderately adhesive soils (P3)
Surface condition	Ps	4	Crusting (P4)
Water availability	M	1C	Structured meduim to heavy textured soils -Rooting depth 0.4 to 0.6 m
Water erosion	E	P3	Red and brown prairie soils / 2-4%
Subclass 3 limitations *(Suitable land with moderate limitations)*			
Frost	Cf	2	Regular frosts
Soil depth	Pd	3	Effective depth 0.4 - 0.6 m
Wetness to 1m	W1	4M	Moderately well drained / Moderately permeable

G.2.4 Pecans

There are substantial areas that are suitable for growing pecans, with minor limitations.

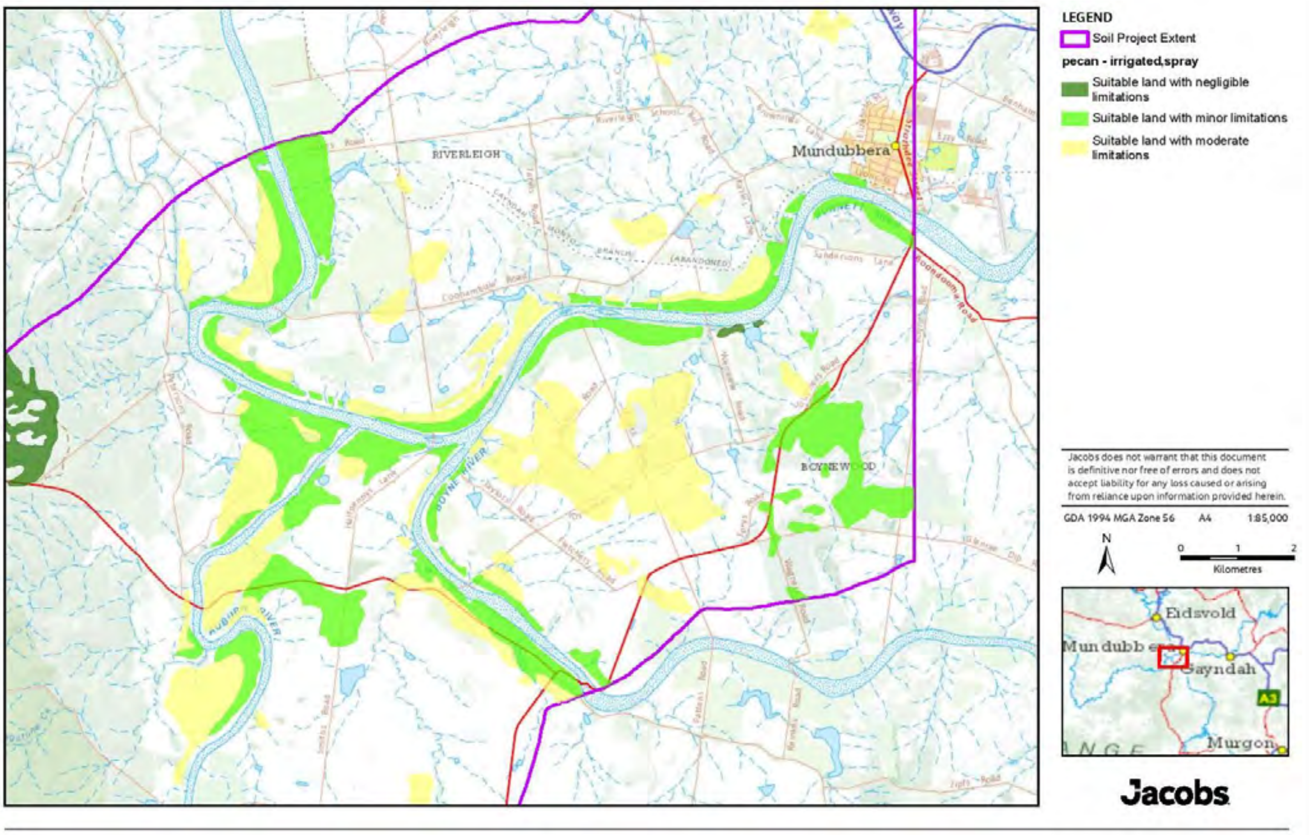


Table G.5: Soil and Land Information – Class 2

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Frost	Cf	2	Regular frosts
Microrelief	Tm	0	Gilgai Vertical interval <0.1 m
Outflow potential	Ss	0	No restriction
Rockiness	R	R0	No coarse fragments
Soil depth	Pd	1	Effective soil depth >1 m
Surface condition	Ps	0	No restrictions (P0)
Water availability	M	2A	Massive uniform and gradational medium texture soils- Rooting depth >1 m
Water erosion	E	E1	Red earth and other massive soils / <1%
Subclass 2 limitations *(Suitable land with minor limitations)*			
Wetness to 1m	W1	5M	Well drained / Moderately permeable

Table G.6: Soil and Land Information – Class 3

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Frost	Cf	2	Regular frosts
Microrelief	Tm	0	Gilgai Vertical interval <0.1 m
Narrow moisture range	Pm	6	Moderate moisture range (P6)
Rockiness	R	G0	No coarse fragments
Soil adhesiveness	Pa	3	Moderately adhesive soils (P3)
Surface condition	Ps	4	Crusting (P4)
Water availability	M	1C	Structured meduim to heavy textured soils -Rooting depth 0.4 to 0.6 m
Water erosion	E	P3	Red and brown prairie soils / 2-4%
Subclass 3 limitations *(Suitable land with moderate limitations)*			
Soil depth	Pd	3	Effective depth 0.4 - 0.6 m
Wetness to 1m	W1	4M	Moderately well drained / Moderately permeable

G.2.5 Mungbeans

There is substantial land adjoining the Boyne River that is suitable for growing mungbeans, with only minor limitations.

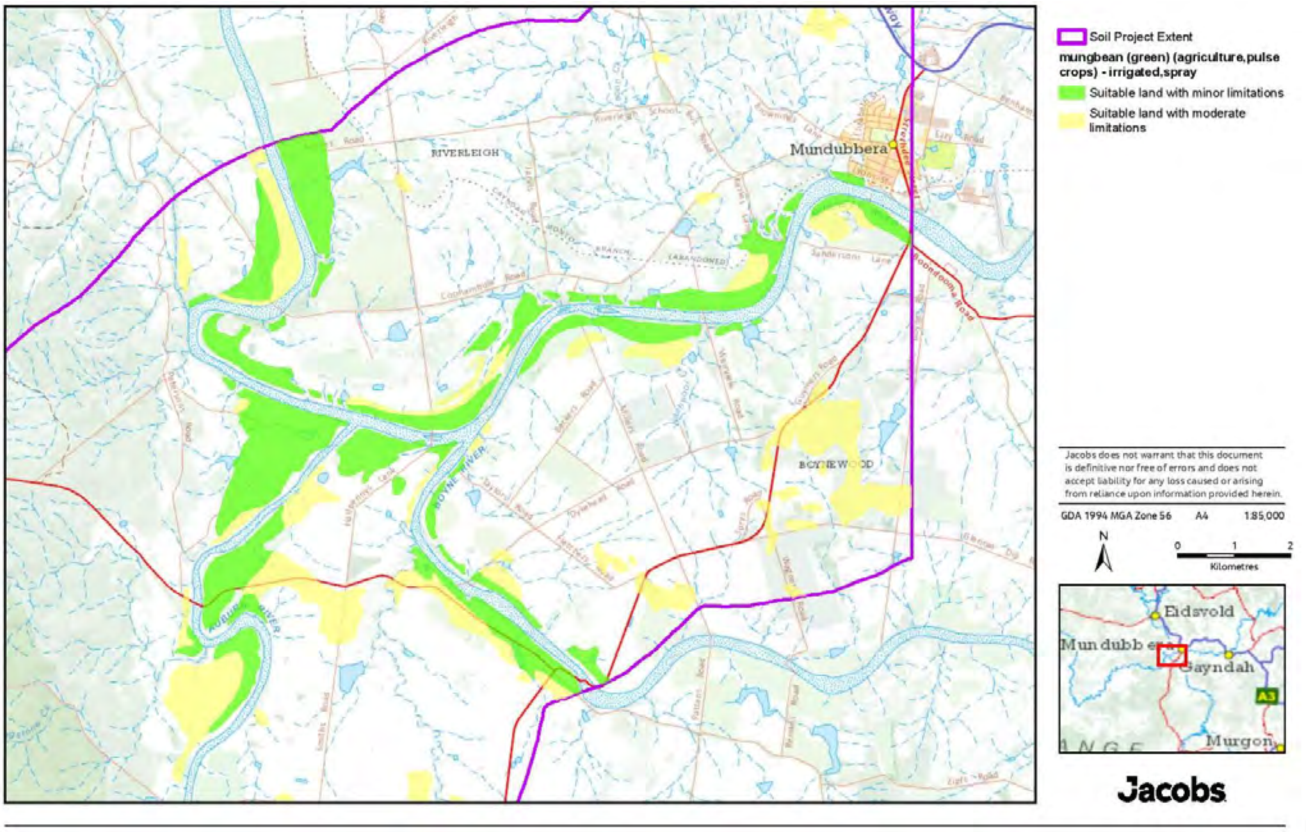


Table G.7: Soil and Land Information – Class 2

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Frost	Cf	2	Regular frosts
Microrelief	Tm	0	Gilgai Vertical interval <0.1 m
Outflow potential	Ss	0	No restriction
Rockiness	R	R0	No coarse fragments
Soil depth	Pd	1	Effective soil depth >1 m
Surface condition	Ps	0	No restrictions (P0)
Water erosion	E	E1	Red earth and other massive soils / <1%
Subclass 2 limitations *(Suitable land with minor limitations)*			
Water availability	M	2A	Massive uniform and gradational medium texture soils- Rooting depth >1 m
Wetness to 0.5m	W2	5M	Well drained / Moderately permeable

Table G.8: Soil and Land Information – Class 4

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Frost	Cf	2	Regular frosts
Microrelief	Tm	0	Gilgai Vertical interval <0.1 m
Rockiness	R	G0	No coarse fragments
Soil adhesiveness	Pa	3	Moderately adhesive soils (P3)
Soil depth	Pd	3	Effective depth 0.4 - 0.6 m
Subclass 2 limitations *(Suitable land with minor limitations)*			
Narrow moisture range	Pm	6	Moderate moisture range (P6)
Surface condition	Ps	4	Crusting (P4)
Water availability	M	1C	Structured meduim to heavy textured soils -Rooting depth 0.4 to 0.6 m
Wetness to 0.5m	W2	5M	Well drained / Moderately permeable
Subclass 3 limitations *(Suitable land with moderate limitations)*			
Water erosion	E	P3	Red and brown prairie soils / 2-4%
Subclass 4 limitations *(Marginal land which is presently considered unsuitable due to severe limitations)*			
Furrow Irrigated Erosion	Ef	P3	Erosion Furrow Irrigated_Red and brown prairie soils / 2-4%
Furrow infiltration	I	2	Soils which are sodic(ESP 6 to 14), moderately alkaline (pH 7.5 to 8.5), and low in salt at 1 m

G.2.6 Table grapes

There is substantial land adjoining the Boyne River that is suitable for growing grapes with minor limitations.

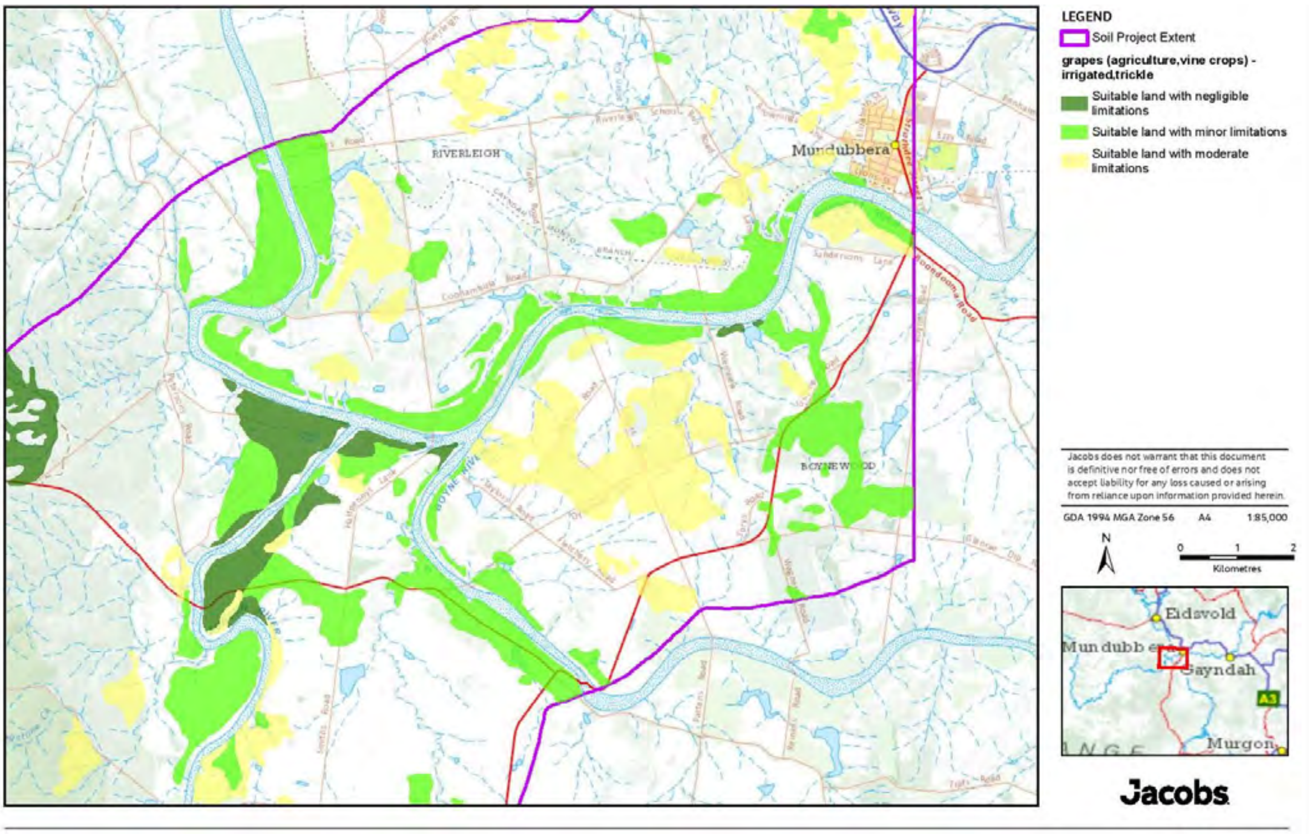
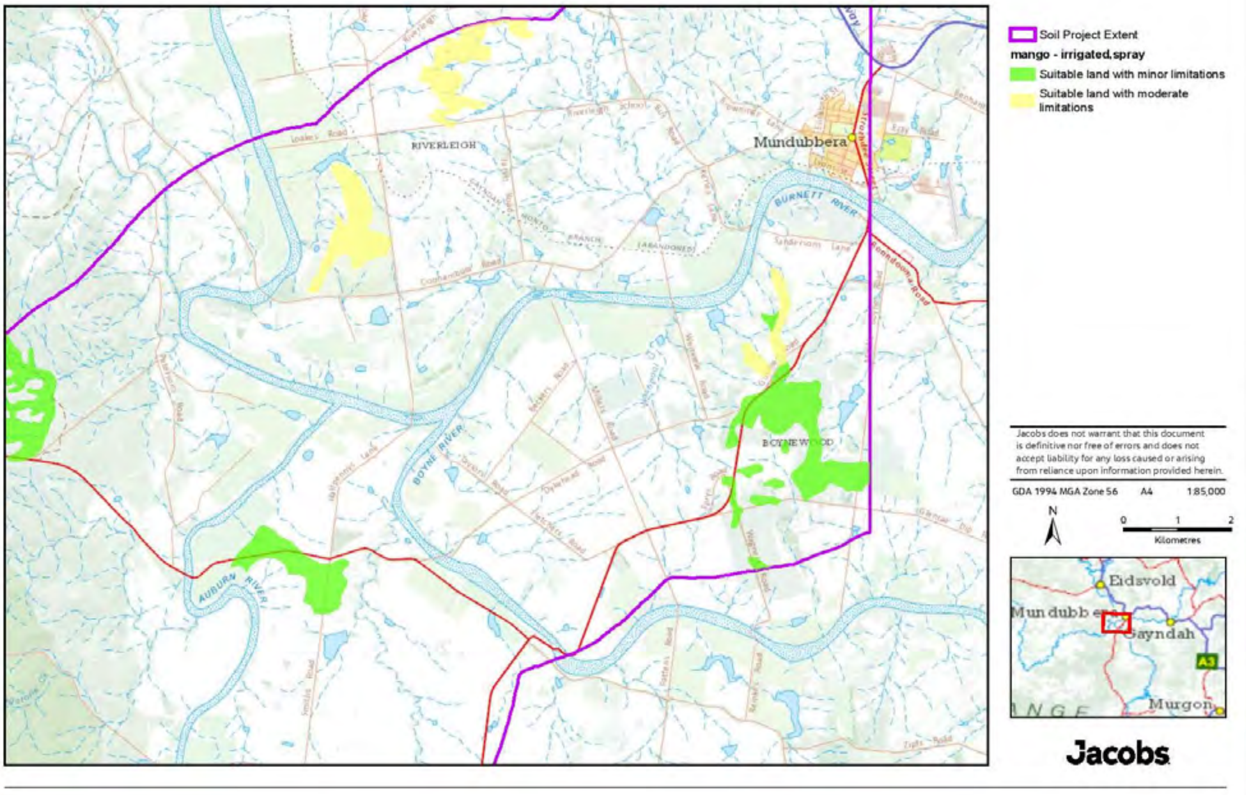


Table G.9: Soil and Land Information – Class 2

	Code	Value	Description
Subclass 1 limitations *(Suitable land with negligible limitations)*			
Frost	Cf	2	Regular frosts
Microrelief	Tm	0	Gilgai Vertical interval <0.1 m
Narrow moisture range	Pm	6	Moderate moisture range (P6)
Rockiness	R	G0	No coarse fragments
Soil adhesiveness	Pa	3	Moderately adhesive soils (P3)
Soil depth	Pd	3	Effective depth 0.4 - 0.6 m
Surface condition	Ps	4	Crusting (P4)
Water availability	M	1C	Structured meduim to heavy textured soils -Rooting depth 0.4 to 0.6 m
Water erosion	E	P3	Red and brown prairie soils / 2-4%
Subclass 2 limitations *(Suitable land with minor limitations)*			
Wetness to 1.5m	W3	5M	Well drained / Moderately permeable

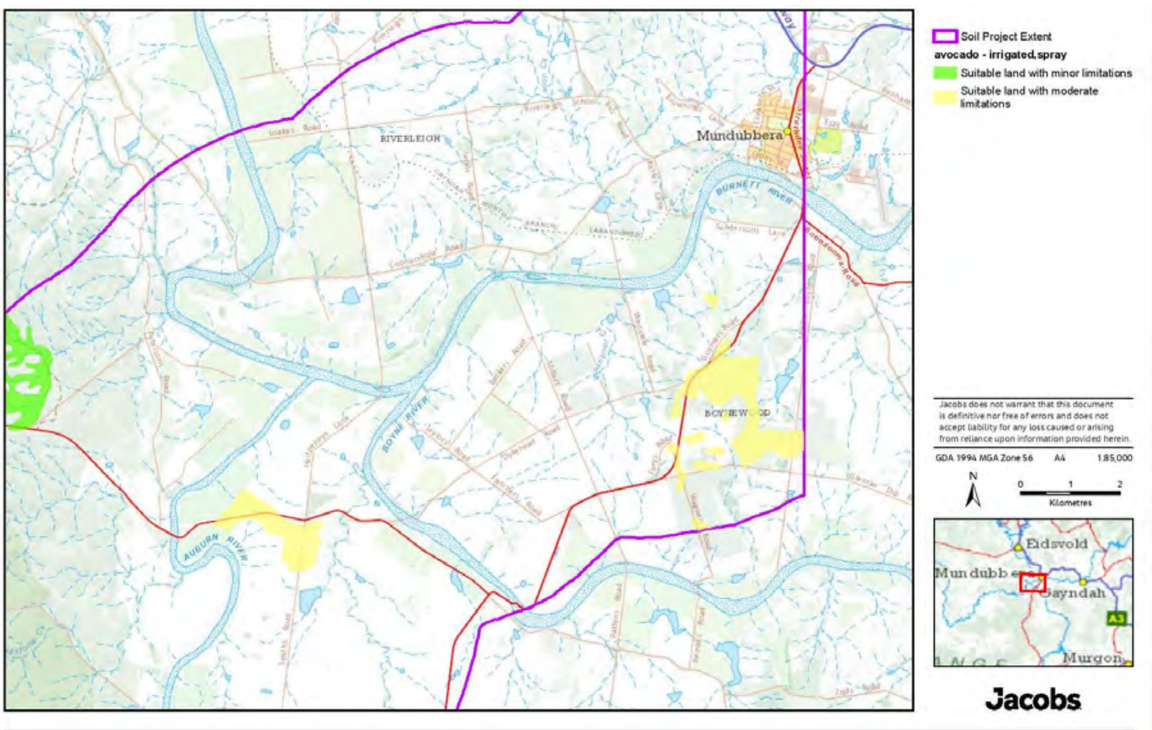
G.2.7 Mangoes

There is a small amount of land that is suitable for growing mangoes with minor limitations within 2-4 km of the Boyne River.



G.2.8 Avocados

There is a small amount of land that is suitable for growing mangoes with moderate limitations within 2-4 km of the Boyne River



G.3 Export and domestic potential

G.3.1 Citrus (mandarins)[47]

Mandarins are grown in most Australian states. The domestic production in FY2019 represented at small 2% annual reduction, while domestic supply per capita increased 1% to 3.93kg. Australia imports approximately 4,250 tonnes of Mandarins each year, with FY2019 representing 21% import volume annual growth.

Mandarin exports represent approximately 22% of Australia's citrus export volume and are currently valued at $139.4m (FY2019). World mandarin exports totalled 4.82 million tonnes in 2012, and Australia has around 1-1.5% of the global export market. The major export markets were China, the United Arab Emirates, Thailand, New Zealand and Indonesia.

It is our view that there is capacity in both the domestic market and export market for growth in production of mandarins. The below table provides a summary of the key statistics relating to the production, import and export of mandarins.

Citrus (Mandarin) production, import and export

Year ending June 2019	Domestic production (t)	Volume of fresh exports (t)	Volume of fresh imports (t)	Total fresh supply volume (t)
Citrus (mandarins)	156,914	59,471	4,612	98,978

G.3.2 Blueberries[48]

Most blueberries produced in Australia are grown in the region of Coffs Harbour. The domestic production in FY2019 represented a 13% annual increase, and national production has almost doubled since 2017. Australia imports an increasing percentage of blueberries each year, and exports around 1% of national production. Supply per capita of blueberries in Australia has increased by 13% and 37% respectively in the past two years.

Australian has significant blueberry export growth markets in China and Japan, which both have trade agreements with Australia. The global export production volume of blueberries was approximately 5.5 million tonnes, which was valued at USD3.73b in 2019.

It is our view that there is capacity in both the domestic market and export market for growth in production of blueberries. The below table provides a summary of the key statistics relating to the production, import and export of blueberries.

Blueberries production, import and export

Year ending June 2019	Domestic production (t)	Volume of fresh exports (t)	Volume of fresh imports (t)	Total fresh supply volume (t)
Blueberries	19,008	201	1,555	18,713

19.2.3 Pecans[49]

Most pecans in Australia are produced in Gwydir Valley, New South Wales. The Australian domestic market for pecans 60g per capita, which has doubled since 2017. The wholesale value of pecans in Australia has increased by 17% and 24% in the last two years respectively.

[47] Sources: Citrus Australia Limited (CAL) 2017, 'New record for citrus exports', Press release, 9th March 2017; Australian mandarin production manual, NSW Department of Primary Industries, 2017; Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019
[48] Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019; Tridge 2020
[49] Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019; Australian Pecan Association, 2020

Australian exports a small volume of pecans – 357 tonnes in-shell and 182 tonnes in kernel form. The global production of pecans is over 124,000 metric tonnes, with 93% of production by the United States and Mexico. There is an increasing market for pecans in Asia, including multiple countries with trade agreements with Australia.

It is our view that there is capacity in both the domestic market and export market for growth in production of pecans. Table 2.1.3 provides a summary of the key statistics relating to the production, import and export of pecans.

Table 2.1.3: Pecans (Inshell) production, import and export

Year ending June 2019	Domestic production (KWE t)	Volume of fresh exports (KWE t)	Volume of fresh imports (KWE t)	Total fresh supply volume (KWE t)
Pecans	1,767	386	0	1,381

19.2.4 Table grapes[50]

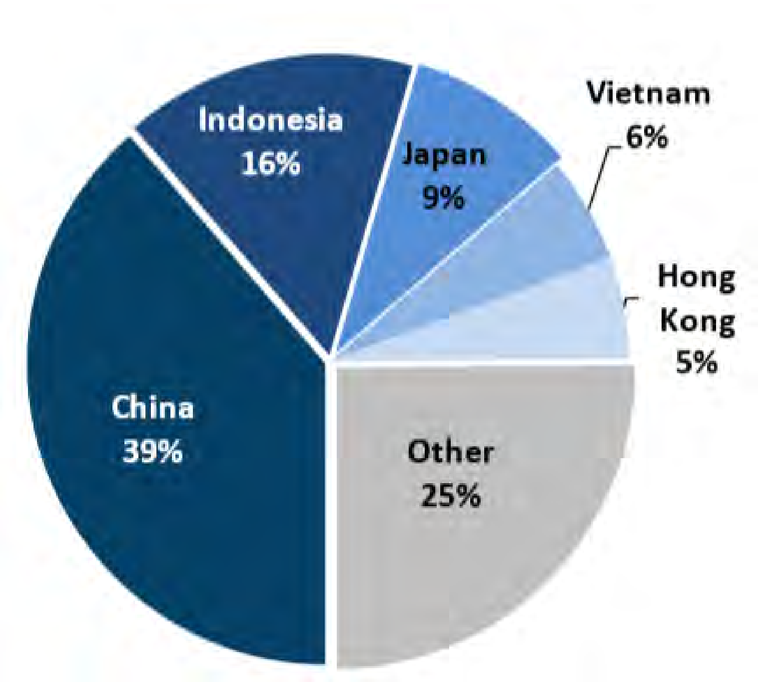
Table grapes are grown all over Australia with Victoria representing 71% of production and only 5% of production in Queensland. Australia is a net exporter of table grapes, although it imports an increasing volume of table grapes, being approximately 16,000 tonnes in FY2019.

Figure 2.1.3a shows how Australia's export of table grapes has significantly increased since FY2015, and Figure 2.1.3b illustrates that China is the largest purchaser of Australia table grapes with 39% of exports. Global table grape exports are approximately 4 million tonnes per year - Australia represents less than 5% of global trade.

Figure 2.1.3a: Net fresh table grapes international trade

[50] Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019; Australian Table Grapes Association

FY2019 Fresh table grapes exports by country



Source: Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019

It is our view that there is capacity in both the domestic market and export market for growth in production of table grapes. Table 2.1.3c provides a summary of the key statistics relating to the production, import and export of table grapes.

Table 2.1.3c: Table grapes production, import and export

Year ending June 2019	Domestic production (t)	Volume of fresh exports (t)	Volume of fresh imports (t)	Total fresh supply volume (t)
Table grapes	208,276	146,093	16,809	78,992

G.4 Barker Barambah (Barlil Weir)

G.4.1 Stakeholder interviews

Jacobs conducted site visits and one on one conversations with over ten irrigators in the Barker Barambah Scheme in addition to six Moffatdale irrigators. We also spoke with two representatives from the Barker Barambah Boyne River including the chairperson.

These conversations allowed us to determine and also check our assumptions on crop mix percentages and net margin parameters.

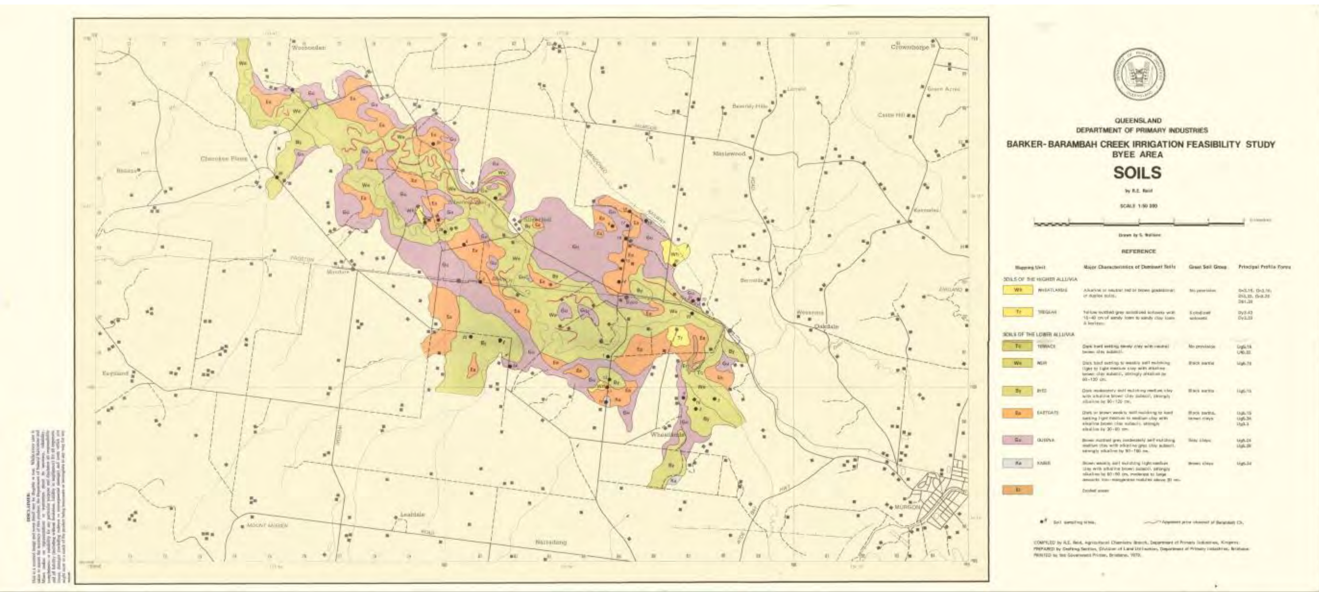
The regions weighted crop mix has a significant allocation in broadacre cropping reflecting the current practices. There is also a smaller portion of perennial and tree crops included which have already begun expanding or have the desire to with greater reliability and/or more water.

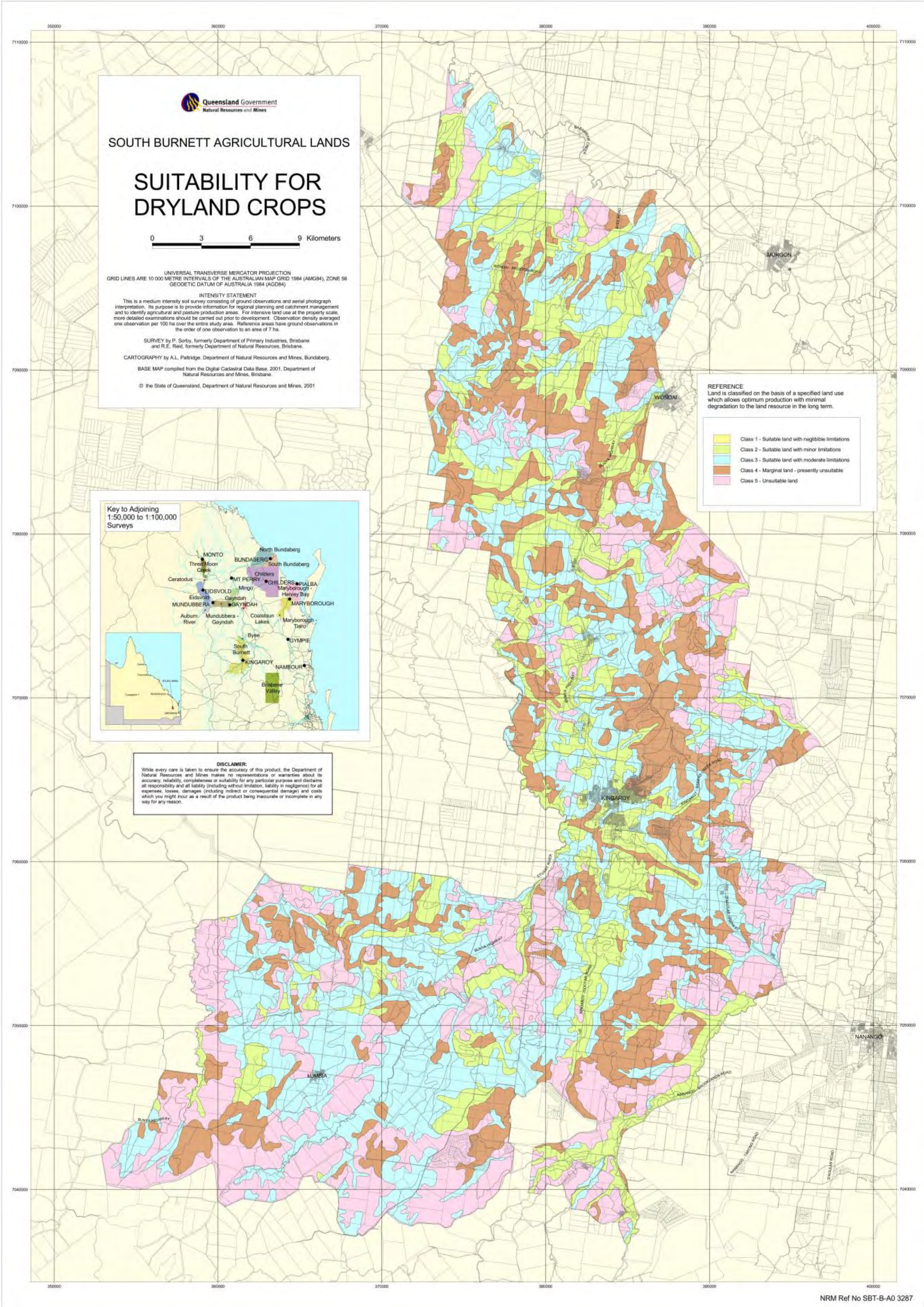
The stakeholder engagement register and willingness and capacity to pay assessment have detailed documentation of the consultation undertaken. A summary of this justification for the crop mix percentages used for the Barker Barambah shortlisted option is documented in the table below.

Table G.1: Barker Barambah crop mix percentages and justification

Crop	Percentage of mix (%)	Justification
Cotton	50	Cotton is the largest crop type in the region. Customer representatives in the area confirmed this percentage and estimate. Consulted with 2 large cotton growers in the area who would have potential to expand significantly.
Lucerne Hay	12.5	Lucerne Hay is being grown by Moffatdale irrigators. Strong commercial crop when water reliability is low. Growers would double production with greater reliability and/or more water resulting from Barlil Weir.
Navy Beans	12.5	The literature review revealed the production of Navy Beans in the area. It has been included alongside Wheat as a representative of typical broadacre cropping margins in the area.
Wheat	10	Wheat is often grown in rotation with Cotton. It has been included to represent the typical broadacre rotation crop margin.
Lemons & Limes	5	Evidence of citrus being grown, and areas of suitable soils exist for continued growth. Small percentage allocated due to current size of production. Transition into higher value crops will be required for some irrigators to justify the increased water charges resulting from the short-listed option.
Table Grapes	5	The Burnett is one of the fastest-growing wine areas in Queensland. There are smaller boutique operations in the area – many of which have plans for expansion with greater access to water. Spoke with 2 producers in the area.
Peanuts	5	Evidence of peanuts being grown, and areas of suitable soils exist. Small percentage allocated due to size of production.

G.4.1.1 Soil suitability




Queensland Government
Natural Resources and Mines
SOUTH BURNETT AGRICULTURAL LANDS
SUITABILITY FOR DRYLAND CROPS
0 3 6 9 Kilometers
UNIVERSAL TRANSVERSE MERCATOR PROJECTION
GRID LINES ARE 10 000 METRE INTERVALS OF THE AUSTRALIAN MAP GRID 1984 (AMG84), ZONE 56
GEODETIC DATUM OF AUSTRALIA 1984 (AGD84)
INTENSITY STATEMENT
This is a medium intensity soil survey consisting of ground observations and aerial photograph interpretation. Its purpose is to provide information for regional planning and catchment management and to identify agricultural and pasture production areas. For intensive land use at the property scale, more detailed examinations should be carried out prior to development. Observation density averaged one observation per 100 ha over the entire study area. Reference areas have ground observations in the order of one observation to an area of 7 ha.
SURVEY by P. Sorby, formerly Department of Primary Industries, Brisbane and R.E. Reid, formerly Department of Natural Resources, Brisbane.
CARTOGRAPHY by A.L. Paltridge, Department of Natural Resources and Mines, Bundaberg.
BASE MAP compiled from the Digital Cadastral Data Base, 2001, Department of Natural Resources and Mines, Brisbane.
© the State of Queensland, Department of Natural Resources and Mines, 2001
Key to Adjoining 1:50,000 to 1:100,000 Surveys
MONTO
Three Moon Creek
North Bundaberg
BUNDABERG
South Bundaberg
Childers
Ceratodus
MT PERRY
CHILDERS
PIALBA
Mingo
Maryborough - Hervey Bay
EIDSVOLD
Eidsvold
Gayndah
MUNDUBBERA
GAYNDAH
MARYBOROUGH
Auburn River
Mundubbera - Gayndah
Coalstoun Lakes
Maryborough - Tiaro
Byee
GYMPIE
South Burnett
KINGAROY
NAMBOUR
Brisbane Valley
DISCLAIMER:
While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way for any reason.
REFERENCE
Land is classified on the basis of a specified land use which allows optimum production with minimal degradation to the land resource in the long term.
Class 1 - Suitable land with negligibile limitations
Class 2 - Suitable land with minor limitations
Class 3 - Suitable land with moderate limitations
Class 4 - Marginal land - presently unsuitable
Class 5 - Unsuitable land
MURGON
WONDAI
KINGAROY
NANANGO
KUMBIA
NRM Ref No SBT-B-A0 3287

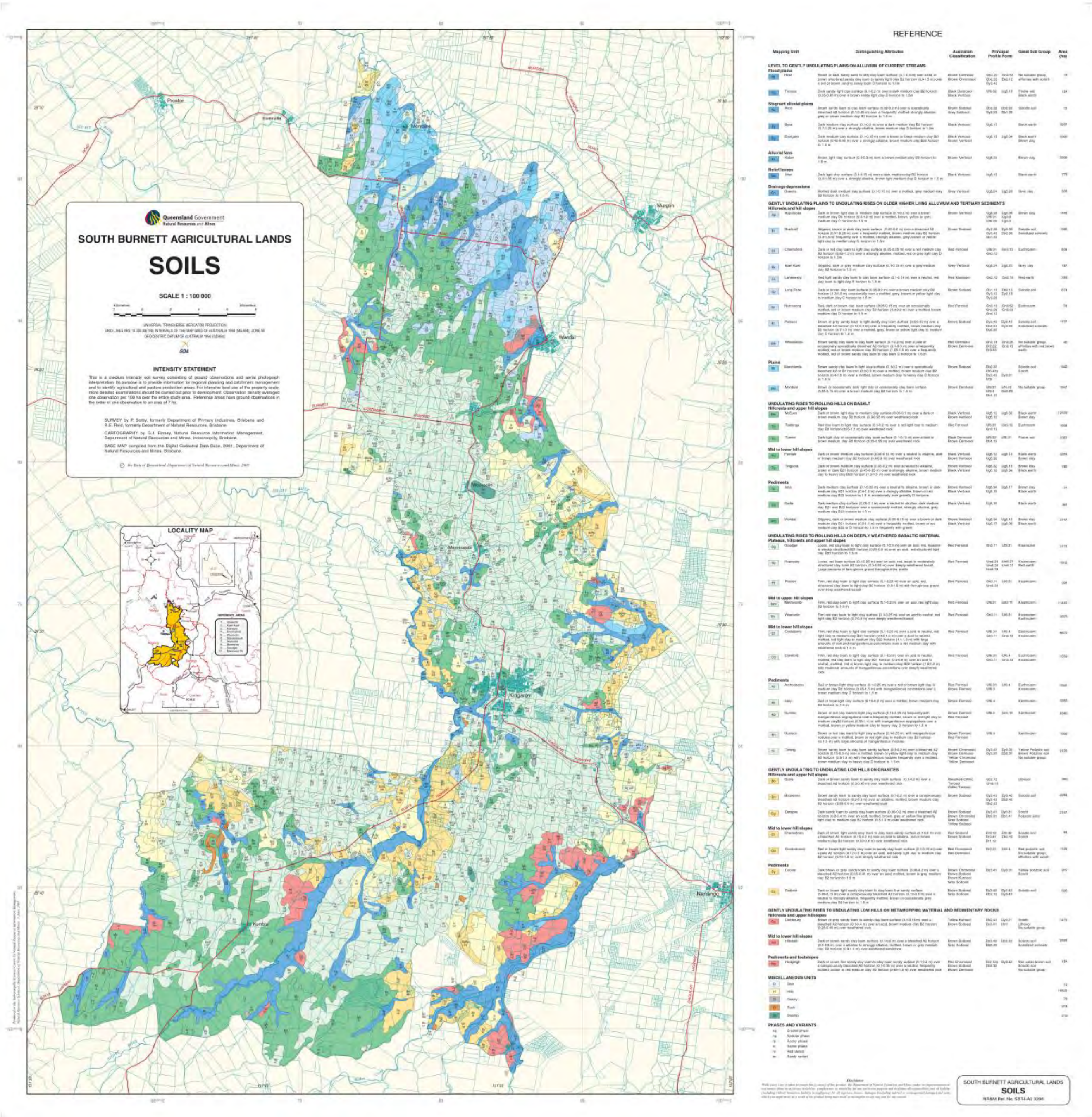

SOUTH BURNETT AGRICULTURAL LANDS
SOILS
SCALE 1 : 100 000
INTENSITY STATEMENT
LOCALITY MAP
REFERENCE
SOUTH BURNETT AGRICULTURAL LANDS
SOILS

Figure G.1: Soil suitability for cotton

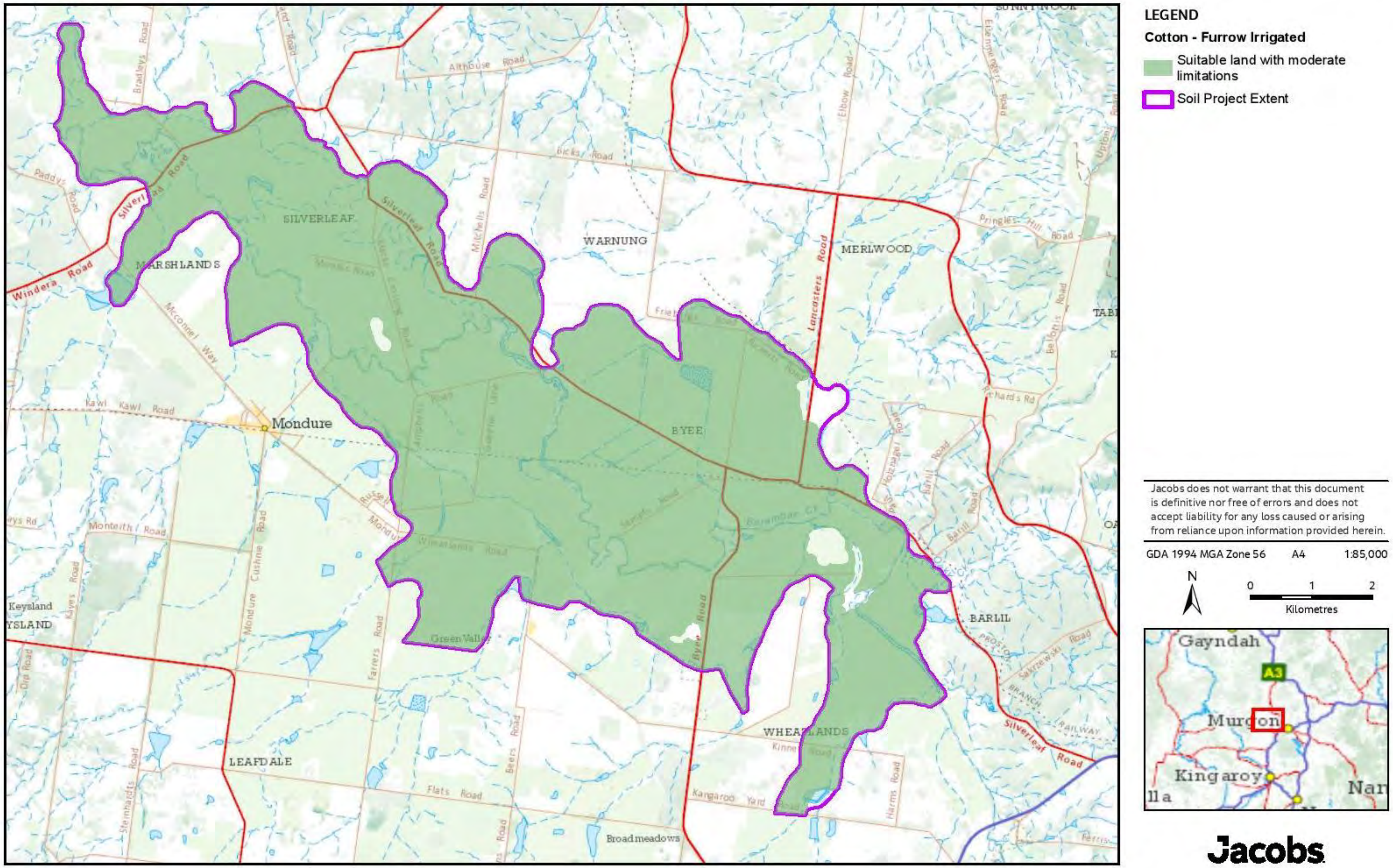


Figure G.2: Soil suitability for lucerne

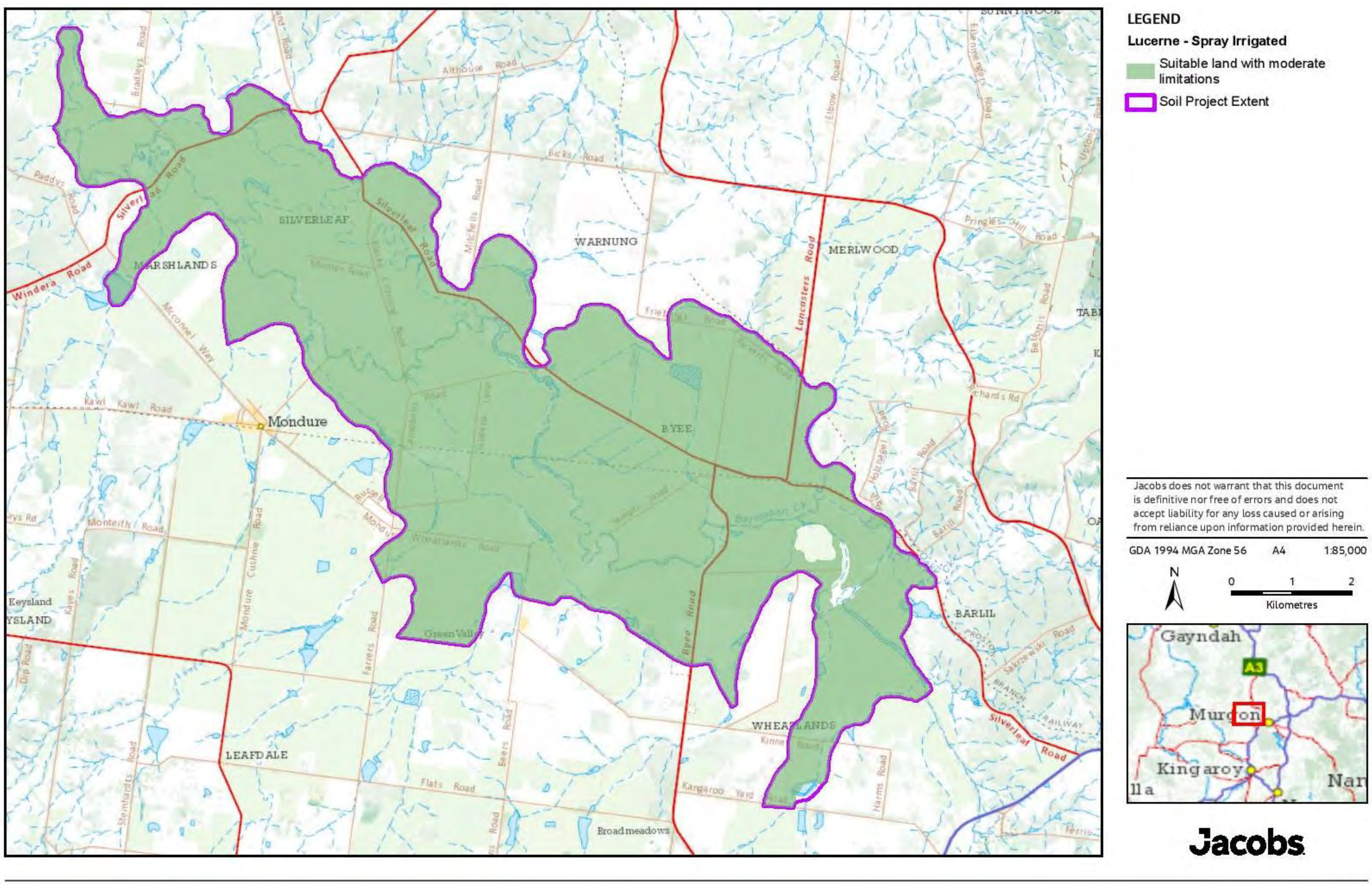


Figure G.3: Soil suitability for Mungbean

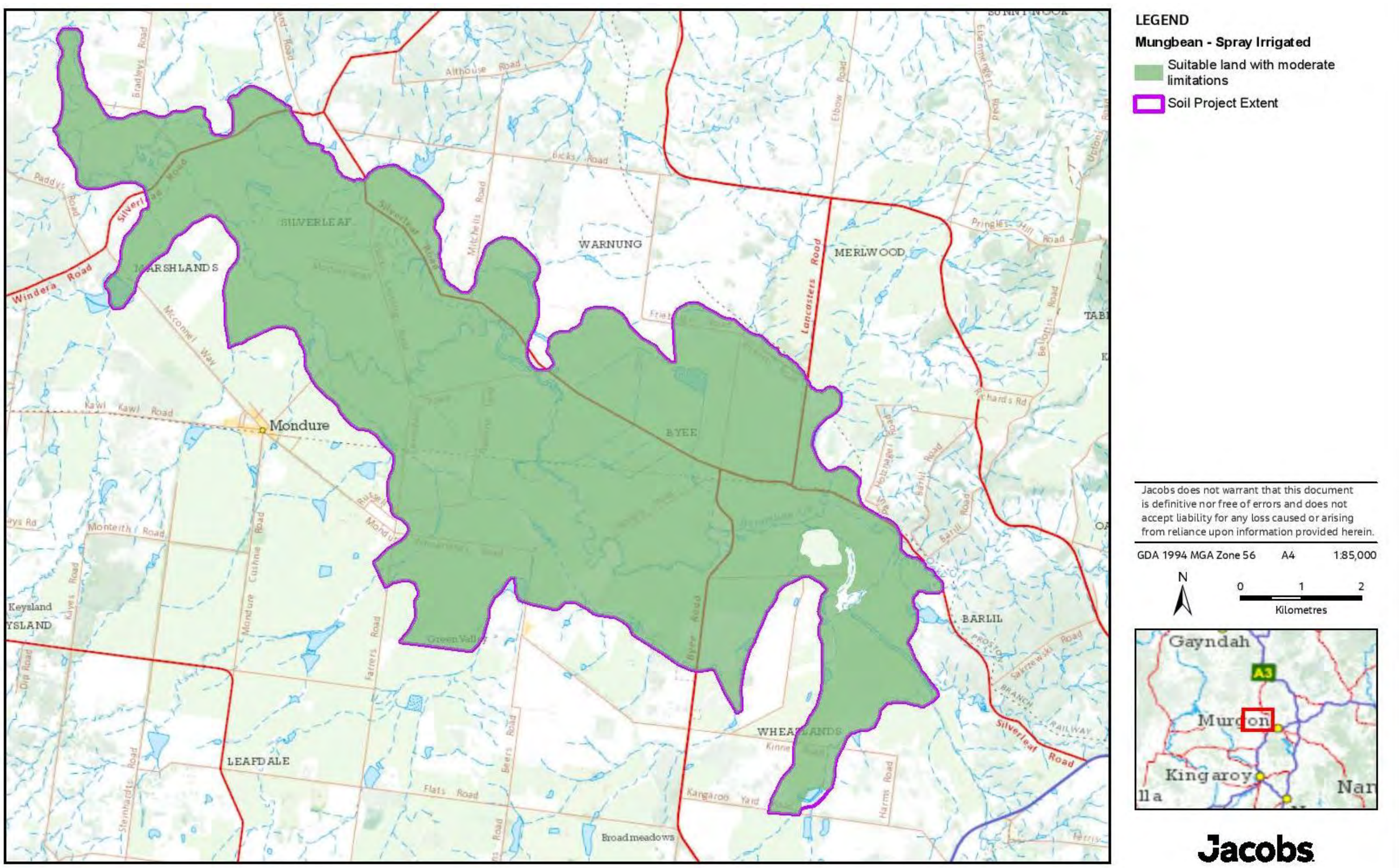


Figure G.4: Soil suitability for wheat

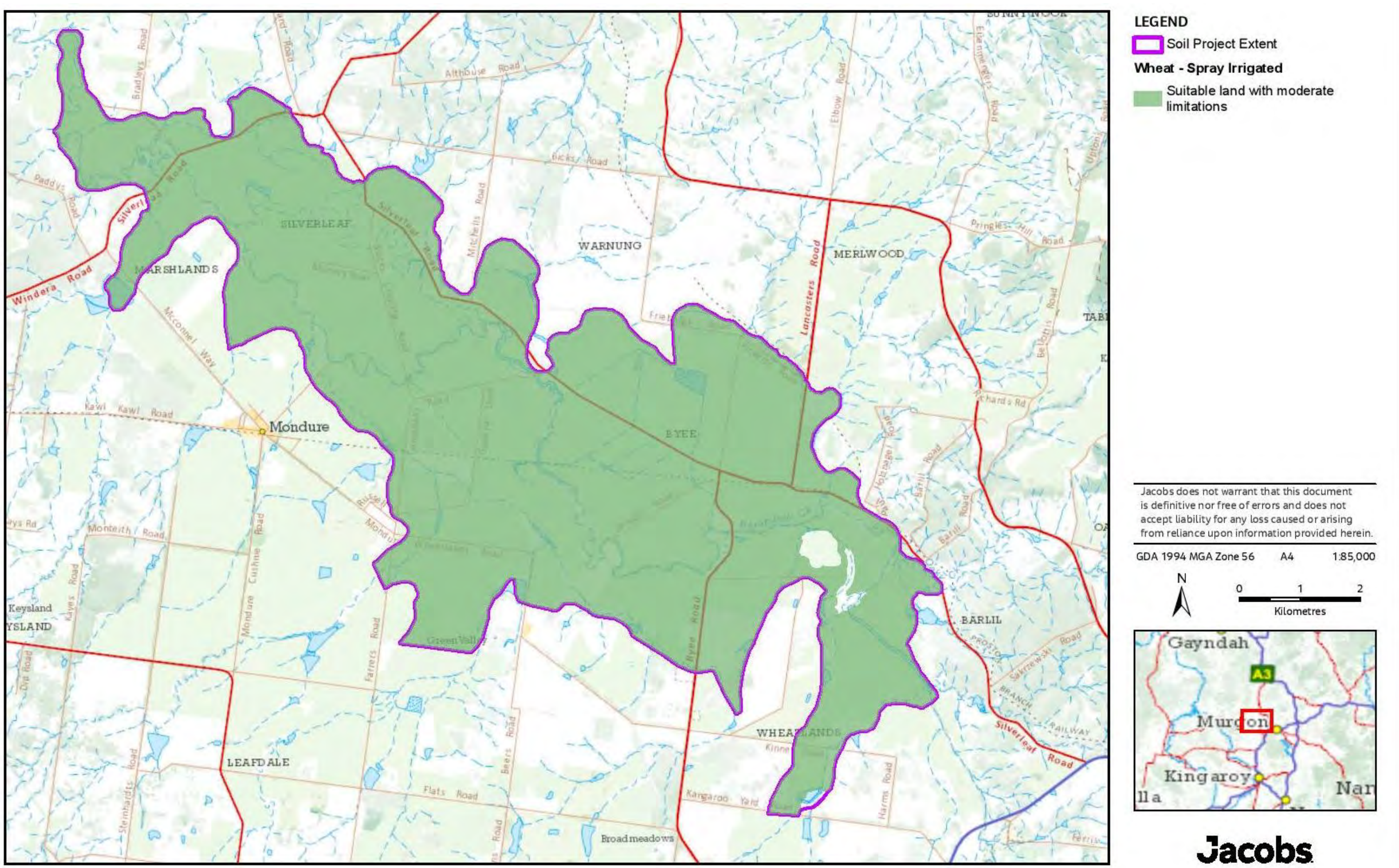


Figure G.5: Soil suitability for grapes

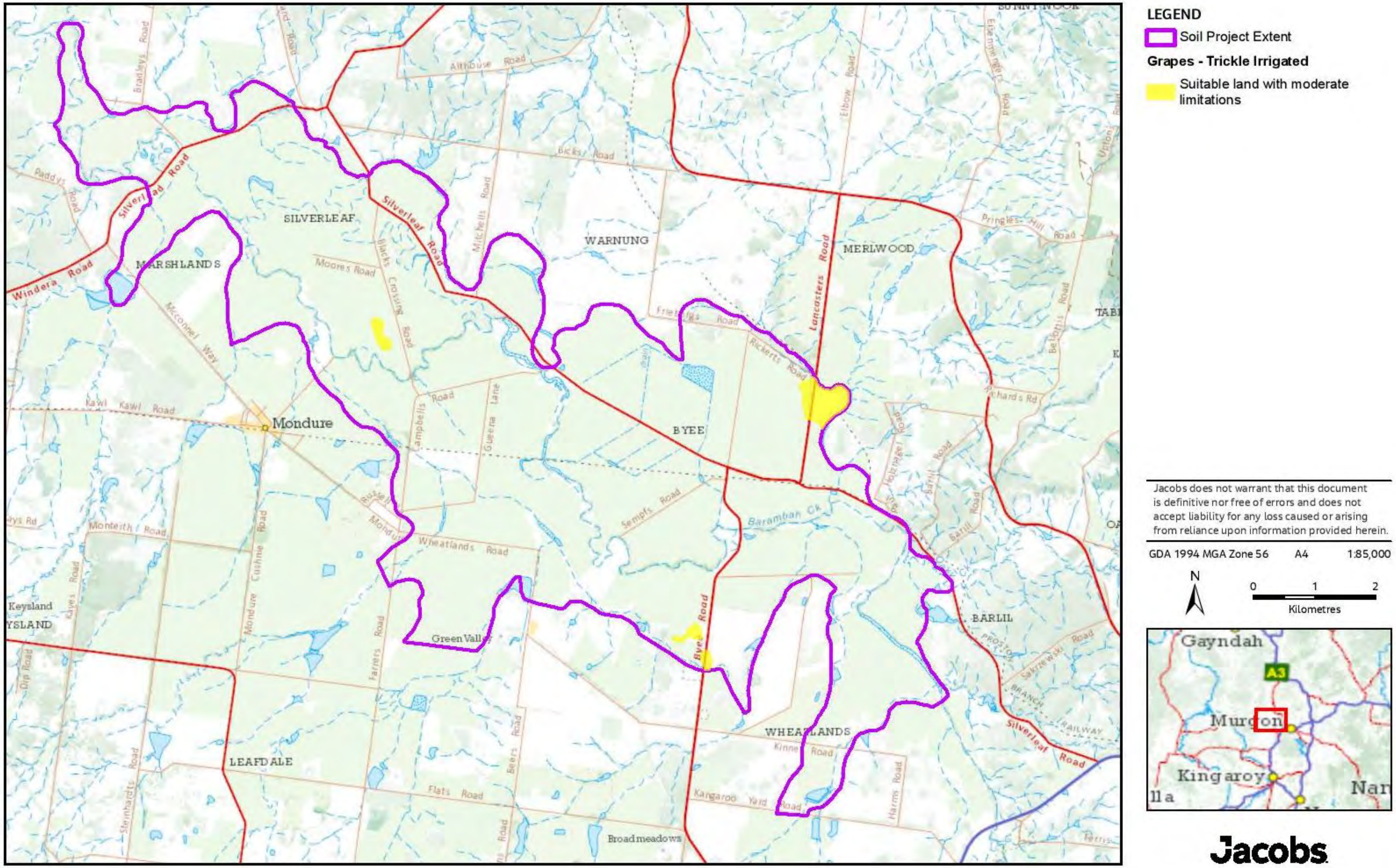
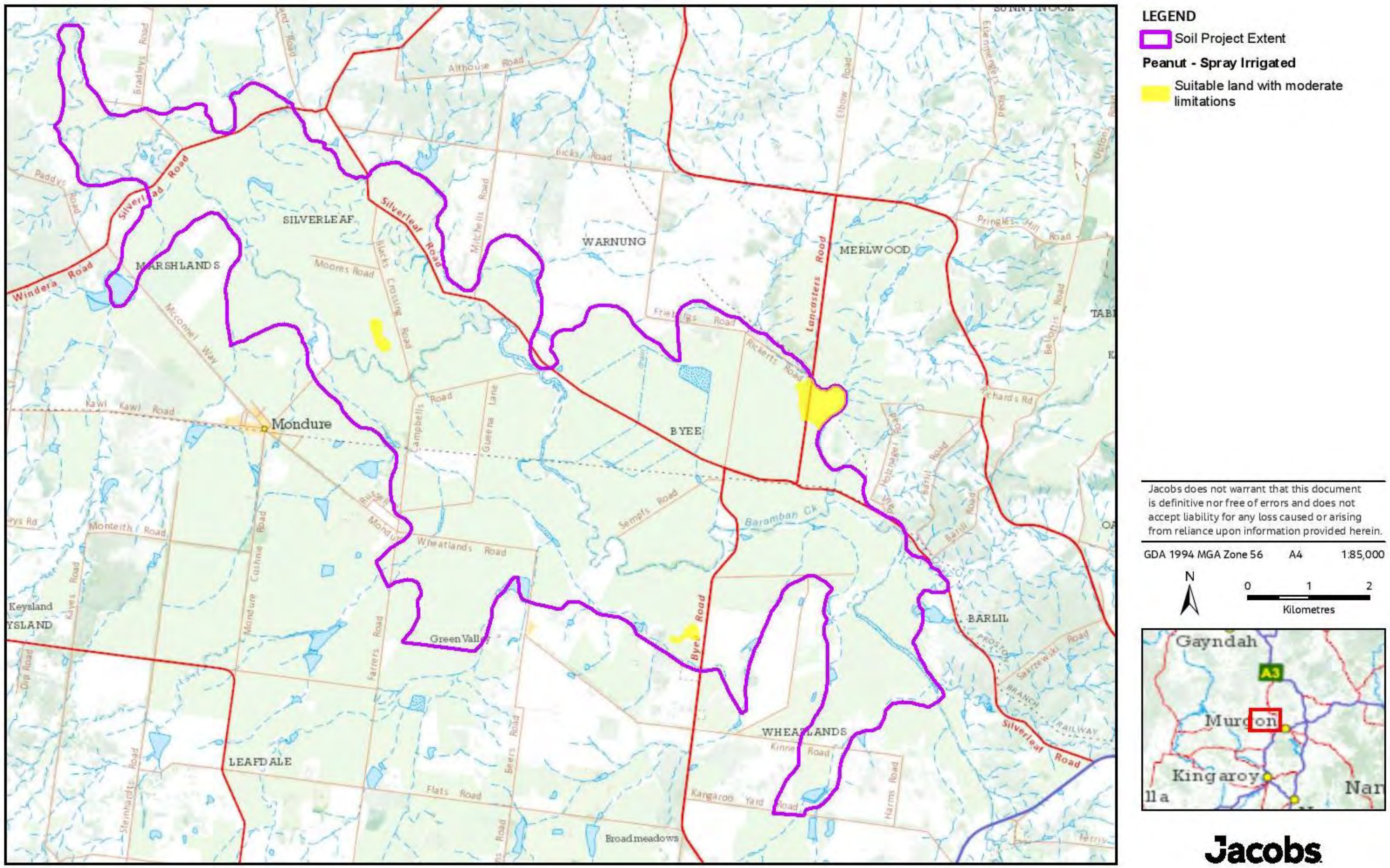


Figure G.6: Soil suitability for peanuts



G.4.2 Export and domestic potential

G.4.2.1 Cotton [51]

Australia has a very large cotton growing industry and is the third largest exporter of cotton in the world behind the United States and India. Approximately 99% of raw cotton is exported - around 63% of total exports goes to China, 11% to Indonesia, 8% to Thailand, and 5% to Bangladesh.

The average annual output of cotton lint in Australia over the past decade is 641,906 metric tonnes or 2.8 million bales. Australian cotton growers generally produce yields at a rate of approximately three times the global average. The Australian cotton industry generates around $2b in annual export earnings.

It is our view that there is capacity in both the domestic market and export market for growth in production of cotton.

G.5 Blackbutt

G.5.1 Stakeholder interviews

A preliminary demand assessment was conducted with more than 15 irrigators and customers in the region. This process was conducted through in-person discussions and over the telephone.

The crop mix and net margins used in the economic assessment were sourced directly from information received during this consultation process. The willingness and capacity to pay assessment outlines the completed findings from this assessment.

Table 19.2: Blackbutt crop mix percentages resulting from demand assessment

Crop	Percentage of mix (%)
Avocados	60
Beans (Green Vegetables)	22
Lucerne Hay	16
Macadamias	2

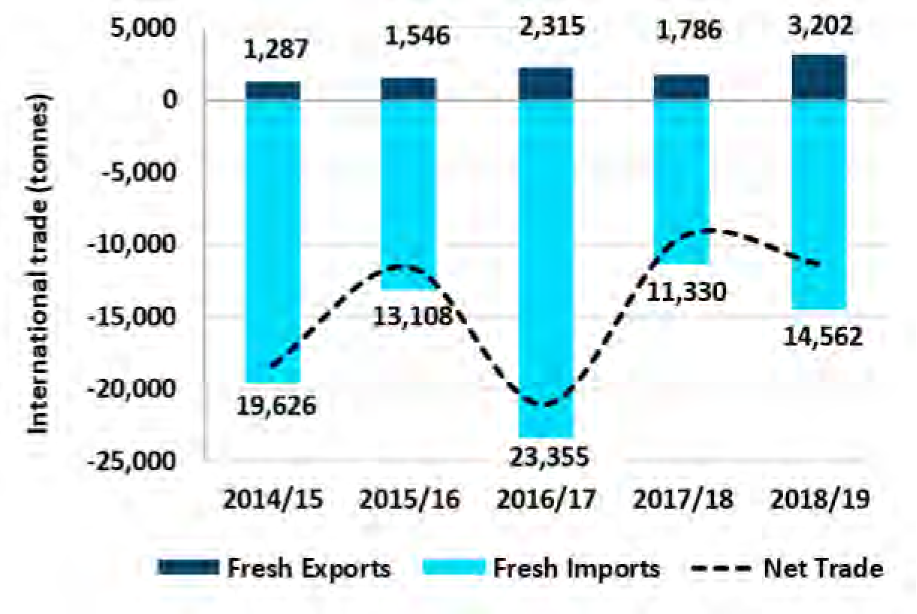
Avocado [52]

Avocados production occurs predominantly in Queensland and New South Wales during the winter and Western Australia during the summer.

In FY2019, 60% of Australian households purchased avocados and the annual supply per capita was 3.6kg, which has maintained steady in recent years. Australia imports approximately 15-20% of its total fresh supply of avocados, with most imports coming from New Zealand. Australian avocado exports have generally trended upwards in recent years, as shown below.

[51] Sources: AgriFutures Australia, 2020;
[52] Sources: Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019

Net fresh avocado international trade



Source: Australian Horticulture Statistic Handbook 2018/19, Hort Innovation. 2019

It is our view that there is capacity in both the domestic market and export market for growth in production of avocados. The below table provides a summary of the key statistics relating to the production, import and export of avocados.

Avocado production, import and export

Year ending June 2019	Domestic production (t)	Volume of fresh exports (t)	Volume of fresh imports (t)	Total fresh supply volume (t)
Avocado	85,546	3,202	14,562	91,516

Beans (green vegetables)[53]

Australia's green bean market is relatively stable and there is some growth in the export market for Australian green beans. While Australia is a net exporter of green beans, there is still around 430 tonnes of green beans imported into Australia each year.

It is our view that there is capacity in both the domestic market and export market for growth in production of beans (green vegetables). The below table provides a summary of the key statistics relating to the production, import and export of beans (green vegetables).

Beans (green vegetables) production, import and export

Year ending June 2019	Domestic production (t)	Volume of fresh exports (t)	Volume of fresh imports (t)	Total fresh supply volume (t)
Beans (green vegetables)	38,012	1,741	431	36,702

[53] Australian Horticulture Statistic Handbook 2018/19

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Water supply requirements in the North and South Burnett

Appendix H

Options Analysis

Appendix H. Reference Project concept designs and costing

The purpose of this report is to provide further information and guidance on the scope for the proposed detailed business case for the Reference Projects identified as part of this study.

The purpose of the detailed business case is to evaluate the viability of the reference projects with surety of outcomes across all evaluation criteria and to develop investment implementation plans. The evaluation in the detailed business case will involve a comprehensive assessment across all criteria (socio-economic, environmental, financial and sustainability) using in-depth evaluation tools to develop conclusive evidence of investment viability. The detailed business case also involves the development of implementation documentation covering the critical areas of risk management, procurement, operations, contractual terms and governance.[54]

This report provides a set of project critical issues relevant to each Reference Project to help guide the relevant project proponent when developing the scope of the detailed business case. This report also provides concept designs and maps that provide further context and detail to the proposed infrastructure required for each of the Reference Projects.

H.1 Approach to estimating costs

The approach to estimating costs has depending on a number of factors including:

- The detail and recency of previous studies
- The complexity of design
- The unknowns about the project and/or site

In general terms, our approach included:

7) Reviewing the existing information
8) Consider whether the existing design is suitable and whether any adjustments are needed to reflect contemporary design approaches.
9) Refined the quantities (if required) in the year 2000 design. For example, adding a fish passage or environmental offset to reflect current requirements.
10) Determined unit rates by:
    a) Escalating the previous unit rates using individual ABS cost escalation data
    b) Obtaining current market quotes for material items
    c) Applied engineering judgement to make adjustments based on experience

H.2 Summary of estimated capital costs

Project	Low cost estimate (P10)	Medium cost estimate (P50)	High cost estimate (P90)
Re-regulating weir on the Barambah Creek (Barlil Weir)	6.98	8.20	11.35
Construct re-regulating weir on the Boyne River	11.31	17.98	26.92
Paradise Dam to Coalstoun Lakes Pipeline	45.99	47.82	57.42
Total for 'combo' option	48.86	52.19	71.43
Barambah Creek Dam	91.00	96.04	130.12

[54] Framework: Detailed Business Case, *Building Queensland*

H.3 Construct a re-regulating weir on the Barambah Creek (Barlil Weir)

H.3.1 Approach to estimating costs

The costs for the construction of Barlil Weir have been estimated by doing the following

1) Reviewing the existing information, including:
   - Barlil Weir Initial Advice Statement, Department of Natural Resources, 1998
   - Barlil Weir Design Report, Department of Natural Resources State Water Services Engineering Projects, 2000
2) Considered the appropriateness of the 2000 design and considered whether any adjustments are needed to reflect contemporary design approaches.
3) Refined the quantities (if required) in the year 2000 design and then escalated each line using individual ABS cost escalation data from 2000 to 2020.
4) Identified the major cost drivers of the weir and undertook a separate market testing to identify key costs.
5) Benchmarked the overall costs of the weir against recent weir constructions of a similar size, complexity and remoteness.

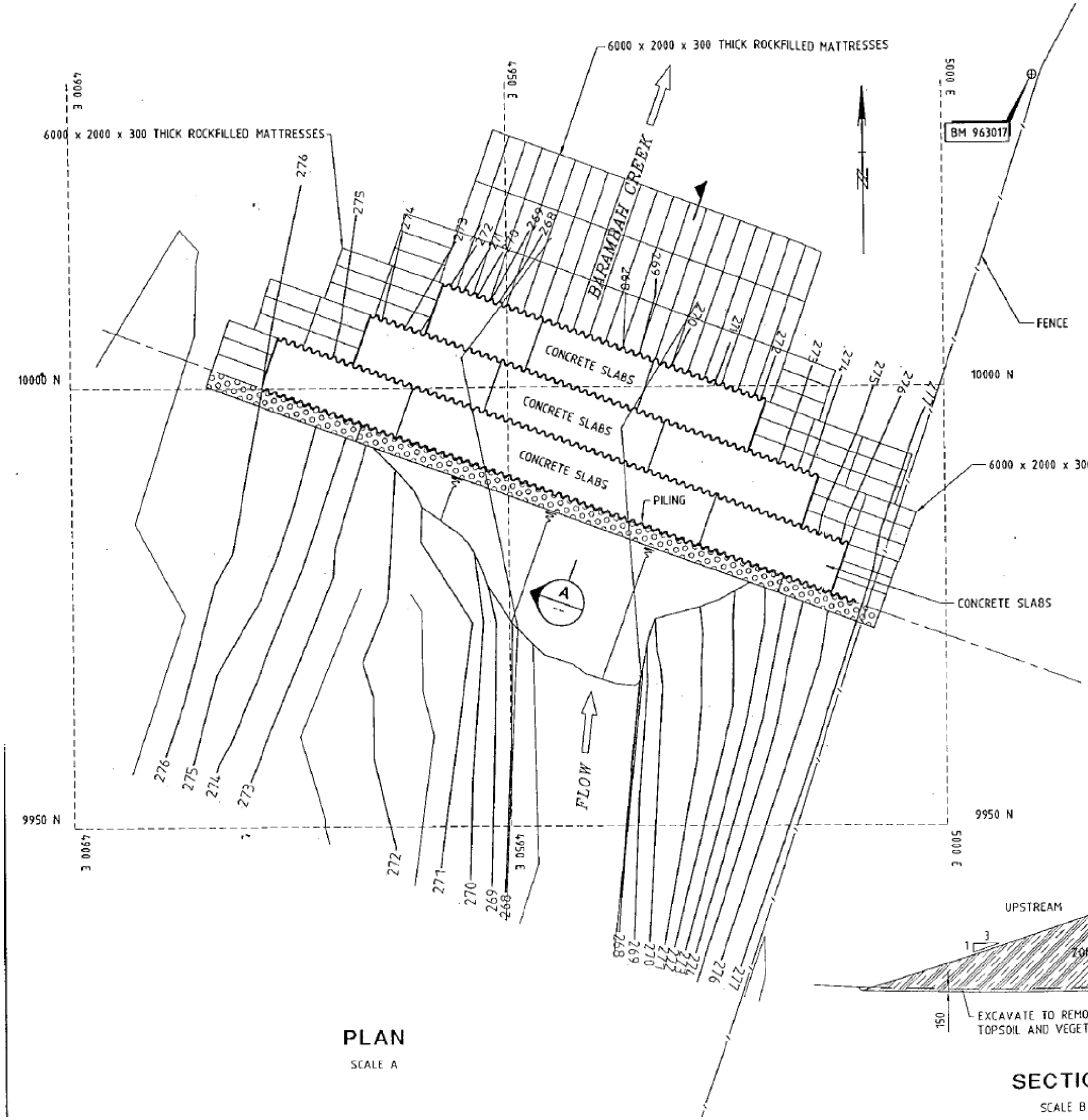
H.3.2 Appropriateness of year 2000 design

The year 2000 design has been reviewed by engineers with modern weir design and construction experience. Their investigation found that the design was materially appropriate and could be implemented. A detailed design may identify areas of improvement, however, for the purpose of an Option Analysis investigation, the existing design was considered appropriate for the purpose of developing a cost estimate.

Some aspects of weir investigation may change over time, but some will not. The results in an older report relating to geology, soil and hydraulics can continue to be relied on. If the design is appropriate then the resulting quantities can also be relied on.

The year 2000 design does not include a fish passage. In order to meet contemporary regulatory preferences, a fish passage may potentially be included in the final design and budget of Barlil Weir. Paragraph 1.4.3 discusses the options for a fish passage and the implications for the cost estimate.

Some of the drawings done in 2000 are available for inspection. The primary drawings are shown below.

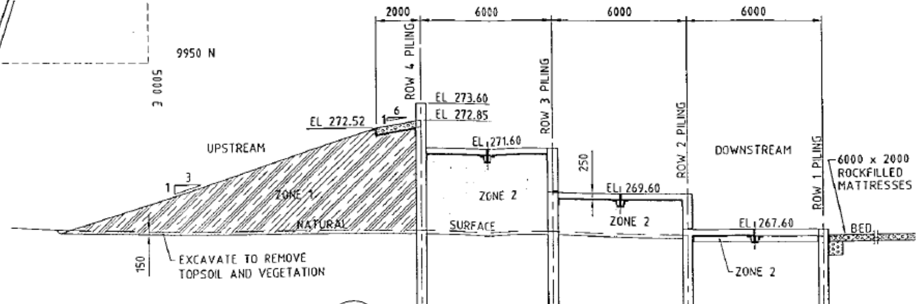


PLAN

SCALE A

NOTES:

1. LEVEL DATUM: AHD BASED ON BM 783440 AT EL 275.277m.
   LOCAL GRID: BM 783440 AT 5028.257 E 10065.951 N
   BM 963017 AT 5010.350 E 10034.573 N
2. NO EARTHWORKS HAVE BEEN CONSIDERED IN PLAN OF WEIR.
3. EXTENT OF PILING AND MATTRESSES IS REPRESENTATIVE ONLY.
4. CONTOURS FROM CIVILCAD 5.4 FILE
   Q:\BARLIL WEIR\CIVILCAD\BARLIL.ZOO



SECTION A

SCALE B

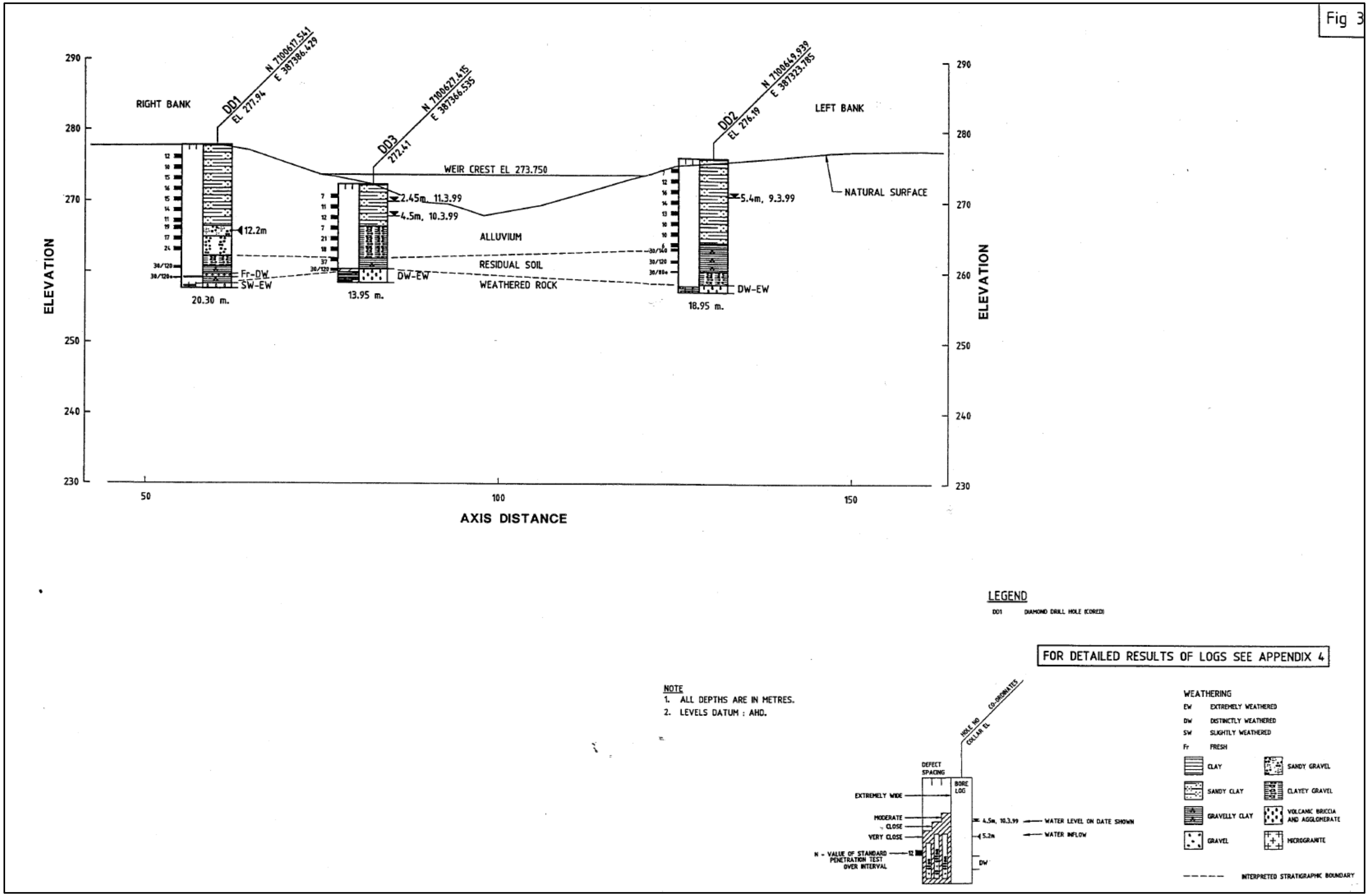
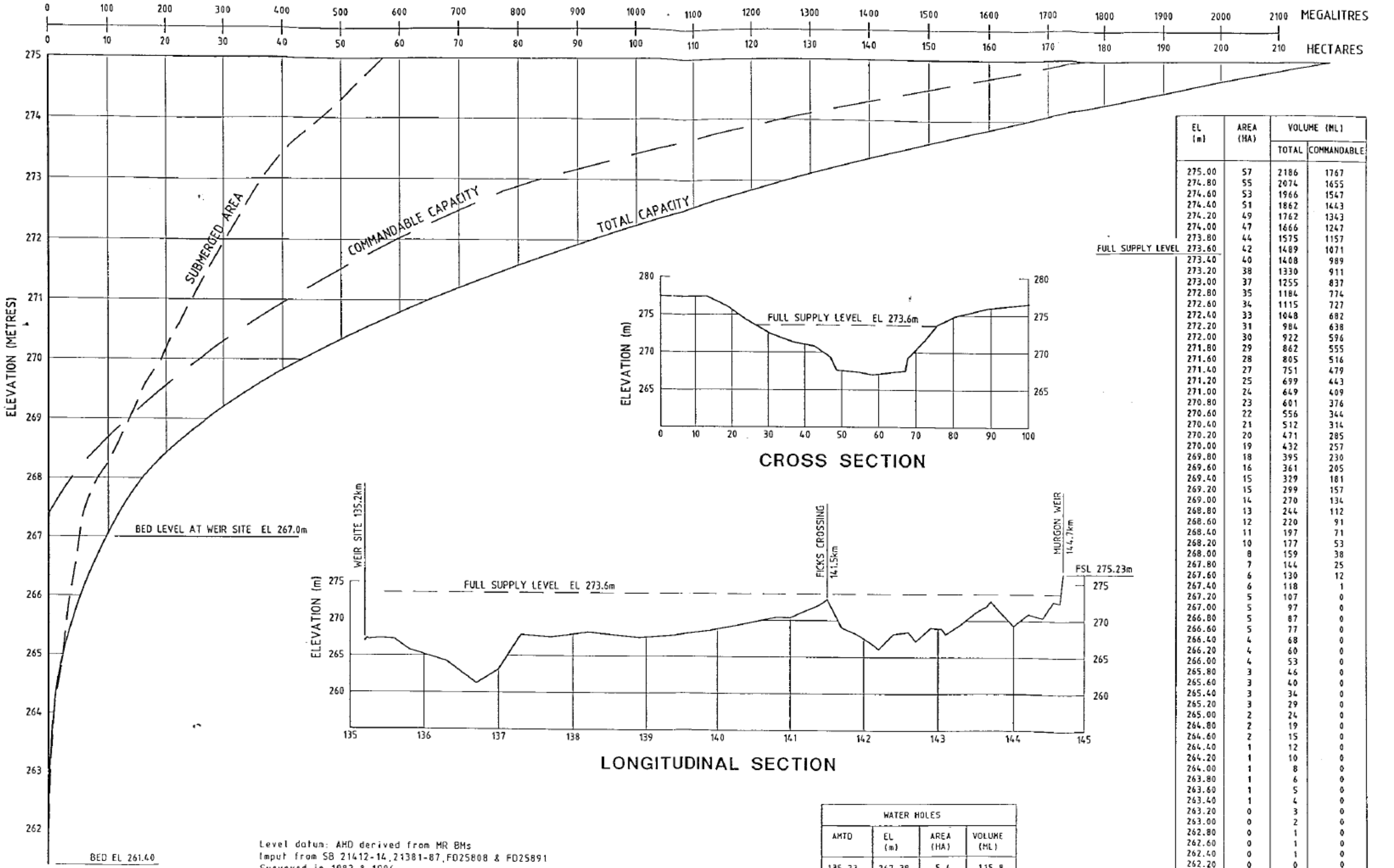

RIGHT BANK
LEFT BANK
DD1
EL 277.94
N 7100617.541
E 387386.429
DD3
272.41
N 7100627.415
E 387366.535
DD2
EL 276.19
N 7100649.939
E 387323.785
WEIR CREST EL 273.750
NATURAL SURFACE
ALLUVIUM
RESIDUAL SOIL
WEATHERED ROCK
2.45m, 11.3.99
4.5m, 10.3.99
5.4m, 9.3.99
12.2m
Fr-DW
SW-EW
DW-EW
DW-EW
20.30 m.
13.95 m.
18.95 m.
ELEVATION
AXIS DISTANCE
290
280
270
260
250
240
230
50
100
150
LEGEND
DD1 DIAMOND DRILL HOLE (CORED)
FOR DETAILED RESULTS OF LOGS SEE APPENDIX 4
NOTE
1. ALL DEPTHS ARE IN METRES.
2. LEVELS DATUM : AHD.
HOLE NO
COLLAR EL
CO-ORDINATES
DEFECT SPACING
BORE LOG
EXTREMELY WIDE
MODERATE
CLOSE
VERY CLOSE
N - VALUE OF STANDARD PENETRATION TEST OVER INTERVAL
4.5m, 10.3.99
WATER LEVEL ON DATE SHOWN
5.2m
WATER INFLOW
DW
WEATHERING
EW EXTREMELY WEATHERED
DW DISTINCTLY WEATHERED
SW SLIGHTLY WEATHERED
Fr FRESH
CLAY
SANDY CLAY
GRAVELLY CLAY
GRAVEL
SANDY GRAVEL
CLAYEY GRAVEL
VOLCANIC BRICCIA AND AGGLOMERATE
MICROGRANITE
INTERPRETED STRATIGRAPHIC BOUNDARY

Fig 3



LONGITUDINAL SECTION

EL (m)	AREA (HA)	VOLUME (ML)	
		TOTAL	COMMANDABLE
275.00	57	2186	1767
274.80	55	2074	1655
274.60	53	1966	1547
274.40	51	1862	1443
274.20	49	1762	1343
274.00	47	1666	1247
273.80	44	1575	1157
273.60	42	1489	1071
273.40	40	1408	989
273.20	38	1330	911
273.00	37	1255	837
272.80	35	1184	774
272.60	34	1115	727
272.40	33	1048	682
272.20	31	984	638
272.00	30	922	596
271.80	29	862	555
271.60	28	805	516
271.40	27	751	479
271.20	25	699	443
271.00	24	649	409
270.80	23	601	376
270.60	22	556	344
270.40	21	512	314
270.20	20	471	285
270.00	19	432	257
269.80	18	395	230
269.60	16	361	205
269.40	15	329	181
269.20	15	299	157
269.00	14	270	134
268.80	13	244	112
268.60	12	220	91
268.40	11	197	71
268.20	10	177	53
268.00	8	159	38
267.80	7	144	25
267.60	6	130	12
267.40	6	118	1
267.20	5	107	0
267.00	5	97	0
266.80	5	87	0
266.60	5	77	0
266.40	4	68	0
266.20	4	60	0
266.00	4	53	0
265.80	3	46	0
265.60	3	40	0
265.40	3	34	0
265.20	3	29	0
265.00	2	24	0
264.80	2	19	0
264.60	2	15	0
264.40	1	12	0
264.20	1	10	0
264.00	1	8	0
263.80	1	6	0
263.60	1	5	0
263.40	1	4	0
263.20	0	3	0
263.00	0	2	0
262.80	0	1	0
262.60	0	1	0
262.40	0	1	0
262.20	0	0	0
262.00	0	0	0
261.80	0	0	0
261.60	0	0	0
261.40	0	0	0
261.20	0	0	0

Level datum: AHD derived from MR BMs
Imput from SB 21412-14,21381-87,FD25808 & FD25891
Surveyed in 1982 & 1996
Latitude: 26 11 50 Longitude: 151 52 20
Catchment area: 2785 sq kms

WATER HOLES			
AMTD	EL (m)	AREA (HA)	VOLUME (ML)
135.23	267.38	5.4	115.8
137.30	267.88	0.1	0.1
138.20	268.24	0.7	1.6
140.80	270.41	0.0	0.0
141.50	272.88	11.5	301.1

H.3.2.1 Site location

The Barlil Weir Design Report considered two locations, approximately 40 metres apart. The downstream option was adopted on the basis that there was less interference with farm land and the natural batters were flatter.

H.3.2.2 Survey investigation

The Barlil Weir Design Report included photogrammetric coverage of the inundated area and land adjacent to Barambah Creek was obtained. This information has an accuracy of 0.7 metres both vertically and horizontally. The inundated area plan was produced from this data.

More detailed survey information was obtained for the weir site to determine the weir arrangement.

We consider that this level of survey investigation is appropriate.

H.3.2.3 Hydraulics

The Barlil Weir Design Report considered the calculation of headwater and tailwater curves for the weir, the determination of the weir development level and the sizing of the outlet based on cross sections of Barambah Creek and using Manning's equation.

These physical parameters are considered still to be relevant.

H.3.2.4 Geotechnical

Three investigation holes were drilled at the weir site and one hole was drilled adjacent to Savage's existing crossing. These holes were drilled until bedrock was encountered. Field classification of material encountered was carried out.

Standard penetration tests were conducted at 1.5 metres vertical interval.

We consider it appropriate to rely on the results on these investigations.

H.3.2.5 Land holder impacts

Surveyed levels were obtained for the landowner's pump sites, Savage's farm crossing, deck of Kreb's bridge on the Murgon to Wondai road, the jetty at the Wondai water supply intake and the deck of the rail bridge. These were required so that an appreciation could be obtained of the impact of the proposed weir on upstream infrastructure. After examination of contour' plans produced from the photogrammetry coverage further survey was carried out at potential break out points.

Survey was carried out at these locations with the weir full supply level and level one metre above full supply level pegged. Based on survey data, it is assumed that resumptions will only be necessary for the major break outs at A.M.T.D. 135.4 and A.M.T.D. 137.3. Assuming resumptions would be taken to a metre above the weir full supply level it is estimated that 3.2 ha at A.M.T.D. 135.4 and 1.8 ha at A.M.T.D. 137.3 would be resumed.

These land resumption areas have been used to estimate the cost of land resumption.

H.3.2.6 Conclusion

The year 2000 weir design is still considered fit for purpose in terms of the intent. Good management around concrete detail will be required to minimise failure risk with concrete cracking.

An alternative weir design is to construct a roller concrete compacted structure with possible additional embedded steel reinforcement for additional strength if required. The advantage of an RCC weir, would be a continuous concrete structure with a decreased risk of undermining through minor cracking with the edges of the concrete.

In conclusion, the year 2000 weir design is appropriate for developing costings for an Options Analysis. Further optimisation of weir design could occur during a Detailed Business Case.

H.3.3 Escalation of the Barlil Weir Design Report costings

The Barlil Weir Design Report identified the quantities for 57 individual line items. The quantities required were specifically identified based on the engineering drawings.

These quantities were then multiplied by the year 2000-unit rate for each line. To update these costs, we escalated each row individually based on the relevant ABS cost escalator from 2000 to 2020. The escalators used are presented below.

Table H.1: Cost escalation 2000 to 2020

Escalation category	Description	Series ID	Escalation rate	Average annual escalation
Labour	WPI index, Total hourly rates of pay excluding bonuses; Australia; Private and Public; Construction	A2603589K	91%	3.3%
Concrete	Ready-mixed concrete manufacturing	A2307548V	89%	3.2%
Steel	Structural steel fabricating	A2307686T	100%	3.5%
Road and Bridge Construction index	Road and bridge construction Queensland	A2333727L	94%	3.4%
Land	Coordinator-General's land valuation		375%	8.1%
Computing	Data processing, web hosting and electronic information storage services	A3343942K	15%	0.7%
Electrical	Electrical equipment	A3344000X	33%	1.4%
PPI	Producer Price Index	A2314865F	51%	2.1%
Heavy Engineering - water projects	Road and bridge construction Queensland (2000 to 2007) and Other heavy and civil engineering construction Australia (2007 to 2020)	A2333727L and A85220823L	90%	3.2%
Building construction	Building construction Queensland	A2333712W	89%	3.2%
Average			**103%**	**3.2%**

Construction prices have increased more rapidly that consumer prices. By comparison, the Consumer Price Index (CPI) has increased by 63.5 per cent since 2000, or 2.49 per cent per year on average.

These escalators were then individually applied to each line item.

Table H.2:General cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Mobilisation			Lump sum	30,000	Labour	57,000
Demobilisation			Lump sum	20,000	Labour	38,000
Clearing and Grubbing of Works Area			Lump sum	5,000	Labour	10,000
Environmental concerns			Lump sum	10,000	Heavy Engineering - water projects	19,000

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Additional environmental concerns^						21,000
Diversion and Care of Stream			Lump sum	15,000	Heavy Engineering - water projects	28,000
Additional diversion and care of stream^						22,000
Storage and Sheet piling and Reinstatement of Storage Area			Lump sum	2,500	Labour	5,000
All work in Burn and Stockpile Area			Lump sum	2,500	Labour	5,000
Access Road	km	0.72	65,000	47,000	Road and Bridge Construction	47,000
Concrete Causeway			Lump sum	14,000	Concrete	26,000
Maintenance and restoration of fencing			Lump sum	1,500	Steel	3,000
Provision of As Built Information			Lump sum	1,000	Labour	2,000
Total			**149,000**			**273,000**

Note: ^ These were not included in the original 2000 design report, and have been added to align with increased contemporary standards.

Table H.3: Weir construction cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Stripping Overburden	m3	2170	8	17,000	Heavy Engineering - water projects	32,000
Disposal of excavated material	m3			2,000	Labour	4,000
Supply, Place and Compact Zone 1 Material - clay	m3	1350	16	22,000	Heavy Engineering - water projects	42,000
Supply, Place and Compact Zone 2 Material - Granular fill	m3	515	44	23,000	Heavy Engineering - water projects	44,000
Supply and Place Top Soil - Zone 3 Fill	m3	381	14	5,000	Heavy Engineering - water projects	9,000
Supply and Place Miscellaneous Fill - Zone 4 Fill	m3	275	11	3,000	Labour	6,000
Supply and Install sheet piles	m2	1577	210	331,000	Steel	663,000
Cutting of driven sheet piles	no. of	145	60	9,000	Labour	17,000
Construction of drain holes in sheet piling	no. of	26	50	1,000	Labour	2,000
Concrete for slabs	m3	263	500	132,000	Concrete	250,000
Reinforcing bars	Tonne	1	1800	2,000	Steel	4,000
Reinforcing Fabric	Tonne	25	2540	64,000	Heavy Engineering - water projects	121,000
No fines Aggregate Drainage Trench	m	160	45	7,000	Heavy Engineering - water projects	13,000

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Provide Pressure Reducing Holes in Concrete Slabs	No. of	83	20	2,000	Heavy Engineering - water projects	4,000
Total				**620,000**		**1,211,000**

Table H.4: Outlets works cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Concrete	m3	79	500	40,000	Concrete	76,000
Reinforcement for concrete work	Tonne	6	1800	11,000	Steel	22,000
Trash Screens			Lump sum	12,000	Heavy Engineering - water projects	23,000
Gratings for inlet box			Lump sum	2,000	Heavy Engineering - water projects	4,000
Lifting Frame			Lump sum	3,000	Heavy Engineering - water projects	6,000
Preparation & Compaction of foundation for outlet pipe			Lump sum	1,000	Heavy Engineering - water projects	2,000
1050 mm Diameter Outlet Pipe	m3	13	777	10,000	Heavy Engineering - water projects	19,000
Supply and Install butterfly valve			Lump sum	25,000	Heavy Engineering - water projects	47,000
Supply and Install hydraulic Actuator & Power Unit			Lump sum	25,000	Electrical	33,000
Supply and Install Electrical Switchgear & control gear			Lump sum	30,000	Electrical	40,000
Operating & maintenance manuals			Lump sum	5,000	Labour	10,000
Supply & install Computer, modem & software			Lump sum	13,000	Computing	15,000
Supply of Electricity			Lump sum	12,000	Electrical	16,000
Supply of Telephone			Lump sum	5,000	Computing	6,000
Total				**194,000**		**319,000**

Table H.5: Control Building cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Design and Supply to site			Lump sum	7,000	Design and Supply to site	13,000
Erect			Lump sum	10,000	Erect	19,000
Control conduits and cable pit			Lump sum	5,000	Control conduits and cable pit	7,000
Total				**22,000**		**39,000**

Table H.6: Protection cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Supply & install Filter Fabric	m2	828	8	7,000	Heavy Engineering - water projects	13,000
Supply & Place Concreted Rockfill	m3	45	130	6,000	Heavy Engineering - water projects	11,000
Supply & Place Rockfill Mattresses	m2	828	65	54,000	Heavy Engineering - water projects	102,000
Rock filled Trenches	m3	41	100	4,000	Heavy Engineering - water projects	8,000
Rock Pitching	m2	30	50	2,000	Heavy Engineering - water projects	4,000
Total				**73,000**		**138,000**

Table H.7: Landscaping cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Grass by seeding	m2	144	2	288	Labour	1,000
Grassing by Hydro mulching (Type 1)	m2	1694	4	7,000	Labour	13,000
Grassing by Hydro mulching (Type 2)	m2	703	1	1,000	Labour	2,000
Total				**8,000**		**16,000**

Table H.8: Upstream effects cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Resiting of Gauging station			Lump Sum	15,000	Heavy Engineering - water projects	28,000
Raising of Farmer's pumps sites			Lump Sum	40,000	Heavy Engineering - water projects	76,000
Raising of Savage's crossing			Lump Sum	260,000	Road and Bridge Construction	505,000
Simpson's Crossing			Lump Sum	35,000	Road and Bridge Construction	68,000
Total				**350,000**		**677,000**

Table H.9: Indirect cost escalation

Sub Category	Unit	Quantity	Rate ($)	Amount ($,2000)	Escalation Category	Amount ($,2020)
Contingency	%	15		212,000	Increased to 40 per cent of updated costs	1,045,000
Overheads					10 per cent of direct costs	261,000
Investigation and Design				147,000	Labour	281,000
Project and Contract Management	%	5		81,000	Labour	155,000
Site Supervision and Administration	%	5		81,000	Labour	155,000
Land resumption			Lump sum	60,000	Land	285,000
Environmental approvals and offsets						1,750,000
Total				**581,000**		**3,932,000**

Table H.10: Summary of total costs

Category	Original	Escalated	Average escalation
General	149,000	240,000	61%
Weir Construction	620,000	1,211,000	95%
Outlet works	194,000	319,000	64%
Control Building	22,000	39,000	77%
Protection	73,000	138,000	89%
Landscaping	8,000	16,000	100%
Upstream effects	350,000	677,000	93%
Contingency	212,000	1,045,000	523%
Overheads		261,000	
Indirect costs	309,000	591,000	91%
Land Resumption	60,000	285,000	375%
Environmental approvals and offsets		1,700,000	
Total Cost	**1,997,000**	**6,536,000**	**227%**

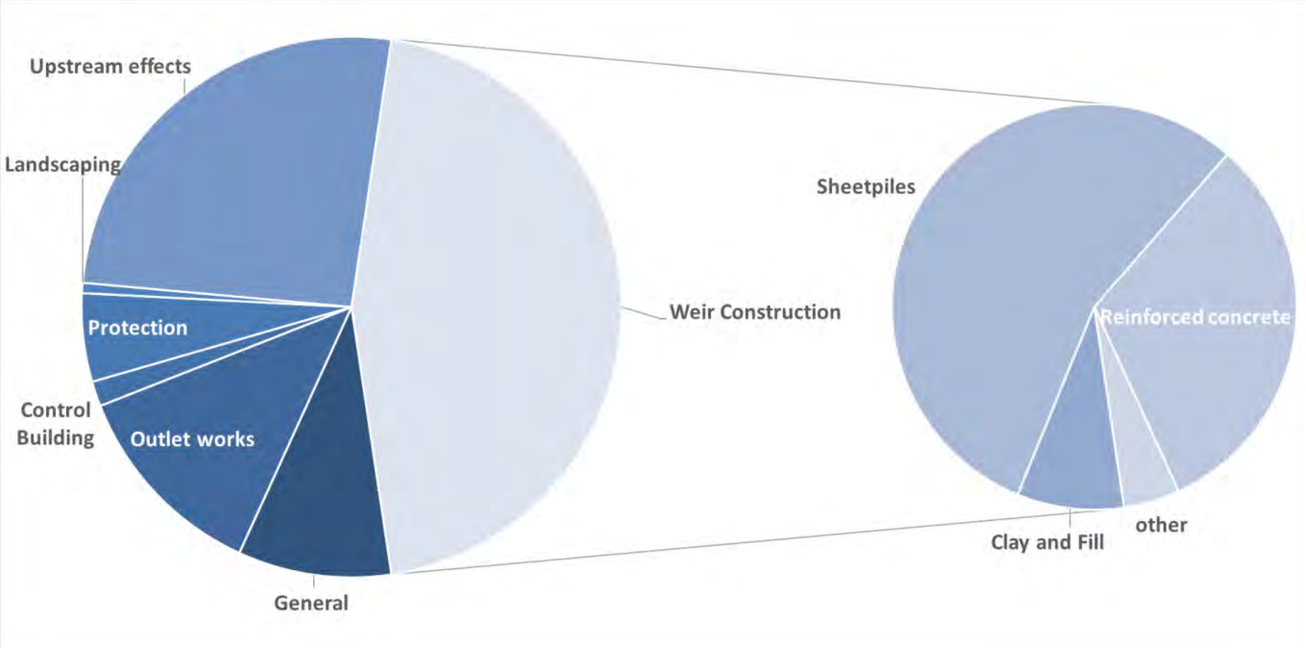
H.3.3.1 Testing of unit rates

While escalating costs in an appropriate mechanism to estimate current costs, it is prudent to cross check some of the larger costs against current market conditions. This has been done by:

- Identifying the largest cost drivers
- Comparing the escalated costs against cost benchmarks
- Market testing the escalated costs against current market quotes.

Identifying the largest cost drivers

To identify the largest cost drivers, the cost component that contributes the most to direct costs was identified as 'Weir Construction' This makes up 45 per cent of direct costs. Within Weir Construction, 85 per cent of costs are made up of sheet piles and reinforced concrete.



Sheet piles

The Barlil Weir Design has three rows of sheet piling. This provides for drops of 2m and 1.7m between rows, associated with a distance of 6.0m between rows. This should provide satisfactory flow conditions based on extensive experience with this type of weir. Based on the results of the geotechnical investigation row 3 sheet piles need to be driven to approximately EL262m A.H.D in order to achieve adequate cut-off.

Based on anticipated earth and water loadings an LX12 pile is considered adequate. However due to the high S.P.T. values obtained at the base of investigation hole DD3 and the fact that 12-metre-long piles are required for row three, LX 16 piles have been adopted for row three. Elsewhere LX12 piles have been specified.

LX12 and LX16 refers to an old European British Steel standard Larssen Box piles product.

In total, 1,577 m^2 has been estimated as the required quantity. The impact of escalation was to calculate a unit rate of $420 per m^2. Two different pile suppliers were contracted to obtain a current market equivalent standards, being Hot rolled U shaped profiles - PSU12 and PSU16. Their masses are 107 kg/m^2 and 118 kg/m^2 respectively. This equates to a total tonnage of circa 180 tonnes.

With a quoted dollar per tonne cost (ex Brisbane port) of $1,800 per tonne, with a delivery fee this equates to a site supplied cost of $350,000 ($221/m^2.)

A current installation methodology can be done through the use of a franna crane or a suitable reach excavator. For the purpose of this a crane hire and crew at $500/hr was adopted and assuming an approximant 1-month site mobilisation this equates to an installation cost of $150,000

A total supply and installation cost is calculated at $500,000 with the unit rate per square metre to be $317. This is 25 per cent lower than the escalation rate.

Concrete

The Barlil Weir Design includes concrete for the weir itself, and the outlets works. A total of 342 m^3 is the required quantity. The cost of the concrete and reinforcement is escalated to be $352,000. The total cost for both the concrete and reinforcement is $1,029 per m^3, including installation.

The Rawlinson's construction handbook for 2020, estimates the cost of reinforced concrete. Prices are based on ready-mixed concrete prices and include delivery to site and placing in position, as well as an allowance for wasting and loss during placing.

The concrete has been assumed to be 32 MPa, but the cost of higher MPa is not significant. The cost is approximately $290 per m^3delivered, but not installed.

The Murgon Holicm Australia Plant were contacted and asked for a delivered cubic metre unit rate cost for a 20 and 32 MPa mix. A current (June 2020) price was verbally given as $230 and $250 per cubic metre, respectively. A delivery allowance is included in the quoted price.

The weir design is reasonably labour intensive to construct the formwork and lay the concrete. Accordingly, for this approach, the current construction (supplied, formed and placed) concrete pricing is circa $1000 per cubic metre. What is proposed for Barlil Weir does not appear to be technically difficult, however good interface detail around the edges is required to ensure the structure does not fail with minor cracking.

Market testing has supported the escalated rate as it is only 3 per cent lower.

Environmental offsets

Mapping undertaken by the Department of Environment and Science for Matter of State Environmental Significance does not identify any MSES values present for:

- Protected areas – estates
- Protected Areas – nature refuges
- State Marine Parks – highly protected zones
- Fish habitat areas (A and B areas)
- Strategic Environmental Areas
- Wetlands in High Ecological Value (HEV) waters
- Waterways in High Ecological Value (HEV) waters
- Threatened (endangered or vulnerable) wildlife species records
- Special least concern animal species records
- Regulated Vegetation - Essential habitat
- Mapping does identify values present for:
- High Ecological Significance wetlands
- Threatened (endangered or vulnerable) wildlife

The Queensland Government register of species (Wildlife online), identifies one vulnerable species (Phascolarctos cinereus, Koala) and one near threatened species (Aponogeton elongatus subsp. Elongatus).

However, the Koala Mapping undertaken by the Department of Environment and Science for Matter of State Environmental Significance, does not identify any Koala Habitat within 2 km of the proposed Weir Site.

Aponogeton elongatus subsp. elongatus is a tuberous, aquatic perennial plant with mainly submerged leaves and a few floating leaves. The submerged leaves are narrow to broadly elliptic in shape, green or dark green to maroon-green, up to 34cm long and 0.8-3.7cm wide. The floating leaves are narrowly elliptic to slightly inverse-egg-shaped and 9-19cm long by 2.2-3.5cm wide. The leaf stalks are up to 1m long, depending on the water depth. The floating leaves are not commonly formed in the subspecies.

The spike-like clusters of yellow flowers are well-spaced, inserted evenly around the spike which is a stalk reaching 90cm long. The fruits are rounded, thick-coated, 2.5-5.8mm long by 1.8-5.0mm wide with a lateral beak to 1.5mm long. There are 2-5 seeds per fruit, elliptic in shape with a single, thin seed coat.

Uncertainty of offset estimate

The value of offsets is very sensitive to the underlying assumptions, which are subject to significant uncertainty.

Mapping undertaken by the Department of Environment and Science for Matter of State Environmental Significance identifies of threatened habitat. The cost of these offsets is shown below:

Offset details	Low	Medium	High
Estimated impacted area	0	12.5	28.23
	The REF reported that the condition of the vegetation was very poor so it may not meet the criteria to be classified as Remnant even though on current DNRME mapping, it is. On ground surveying is needed to confirm whether any values still exist that meet the necessary conservation quality.	The Review of Environmental Factors for the project assumed much of the vegetation would survive as a result of the proposed operations strategy of keeping the water level relatively low to allow the weir to fill from local runoff. A subset of the total inundation level is used, to reflect operational factors.	All vegetation within Full Supply Level is assumed to be impacted and require offset. The estimated area of both "impacted vegetation" and "waterway providing for fish passage" is therefore likely an over-estimate.
On ground cost		$1,003,200	$3,049,600
Landholder incentive payment		$109,549	242,970
Administrative cost		$250,800	762,400
Total		**$1,363,649**	**$4,054,970**

H.3.3.2 Fish passage

The Barlil Weir Design does not include a fish passage, and the Design Report stated that there was no requirement for a fish passage. Since the development of the Barlil Weir Design, there has been increased emphasis on the utilisation of fish passageways in planning approvals and approvals under the *Fisheries Act 1994*. Accordingly, consideration was given to the type and potential cost of including a fish passage on Barlil Weir. It will be necessary for the potential requirement for a fish passage to be further considered in a detailed business case, including the type of structure that should be constructed.

Structure type

The Barlil Weir Design estimates that the Full Supply Level for the weir will be 6.7 m above the stream bed, and that the water storage level will be maintained at approximately 3.0m below FSL to take advantage of the opportunity to maximise runoff capture.

One of the considerations of the type of fish passage is the height of head differential on the weir, and based on the anticipated weir size the two most likely types of fish passage would be a vertical slot fishway or mechanical fish lock. Provided it is capable of performing the necessary function, the vertical slot fishway has the advantages that it has significantly lower capital costs and it does not have the operational and mechanical risk and cost of a fish lock. The table below provides a summary of the key consideration of the vertical slot fishway and fish lock options.

Consideration	Vertical slot fishway	Mechanical (fish lock or lift)
Fish size	Suitable for fish 700-1,300mm In the Burnett River, the mean length of lungfish was 906 ± 199 mm (2002)	Suitable for larger fish 700+mm In the Burnett River, the mean length of lungfish was 906 ± 199 mm (2002)
Weir size (head differential)	Up to around 6m Based on current design this structure should be sufficient	5-14m Based on current design this structure should be sufficient
Cost	Lower capital and operational costs	More expensive. Large variation in cost. Require power and computer control. High maintenance fishways.
Comparable fish passages	Moura Weir – height 6.2m; vertical slot	Ned Churchward Weir – height 15m; hydraulic operating system.

Cost estimate

The range of cost estimates for the options of vertical slot fishway and mechanism fish lock are set out below.

Type	Low	Medium	High
Vertical slot fishway	$0.90m	$1.20m	$1.50m
Mechanical fish lock	$1.83m	$2.13m	$2.43m

The cost estimate for the mechanical fish lock is based on a single chamber fish lock (hydraulically operated), including the mechanical and electrical elements.

H.3.3.3 Total core costs

The Year 2000 Barlil Weir Design Report specifies a design that meets contemporary standards, although some modern techniques may be introduced. The design is suitable for the purpose of developing a cost estimate

The main cost components of the weir (sheet piling and concrete) are consistent with contemporary market rates. The escalated rates are slightly higher, so were retained for additional conservatism. However, this design did not include a fish lock, or environmental offsets. These costs have been included in the medium cost estimate.

A summary of the costs is shown below:

Category	Cost estimate
General	273,000
Weir Construction	1,211,000
Outlet works	319,000
Control Building	39,000
Protection	138,000
Landscaping	16,000
Upstream effects	677,000
Fish passage	1,800,000
Contingency	1,069,000
Indirect costs	591,000
Land Resumption	285,000
Approvals	553,651
Environmental offsets	1,363,649
Contingency	1,069,000
Total Cost	**8,335,300**

Risk adjustments

The above costs are subject to considerable uncertainty. This uncertainty includes:

- The need and cost of environmental approvals
- The need and quantity for environmental offset
- The need, design and costs for a fish passage

On the basis of these factors, and other smaller changes in costs, the cost range is shown below.

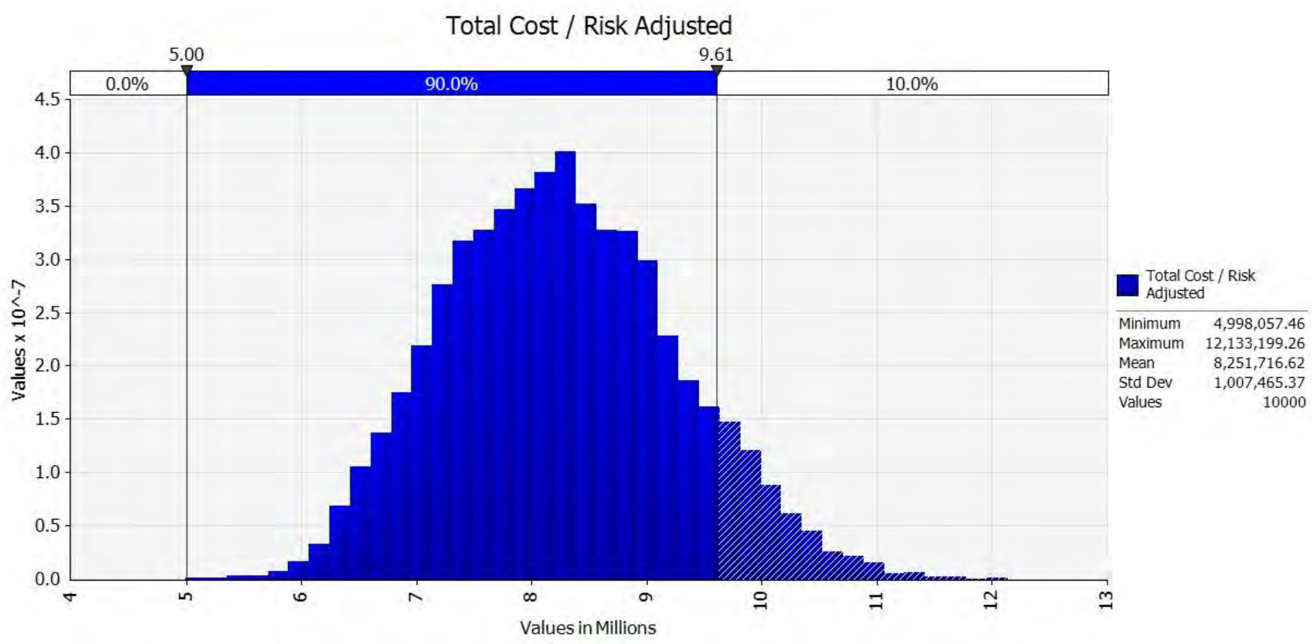
Low cost estimate	Medium cost estimate	High cost estimate
$4.2 million	$7.7 million	$17.0 million

We have identified the major cost risks and contingent risks. The contingent risks include:

- Design growth
- Labour availability
- Geotechnical
- Wet weather
- Availability of materials
- Flood
- Competition with other projects
- Dewatering
- Project delays

On the basis of the low, medium and high cost estimates, and the identified risks, the probabilistic costs are summarised in the table below, and presented in the figure further below.

Item	Low cost estimate (P10)	Medium cost estimate (P50)	High cost estimate (P90)
Risk adjusted total	$7.0 million	$8.2 million	$11.3 million



H.4 Construct re-regulating weir on the Boyne River

H.4.1 Approach to estimating costs

There is significant doubt around the location, weir type and intended capacity for the weir on the Boyne River. At this stage, any attempt to undertake a detailed cost estimate would be speculative and would result in an unnecessary over-statement or under-statement of the cost of the project. The cost range for the construction of the Boyne River Weir have been estimated by doing the following

1) Reviewing the existing information, including:
   - Boyne River Weir sites at AMTD 34.45km & AMTD 33.95km, 1998
2) Considered the appropriateness of the cost estimates and considered whether any adjustments are needed to reflect contemporary design approaches.
3) Added additional allowances for a fish passage and environmental offsets and approvals.

H.4.2 Options considered

H.4.3 Geotechnical investigations

A previous investigation at the AMTD 33.95 km and 34.45km undertook seismic refraction, geological mapping and materials reconnaissance. The conclusions gained from the geotechnical investigations include:

- Slightly weathered to fresh high strength and andesitic rock underlies both sites at shallow depths.
- -Rock levels suitable for concrete foundation are likely to be shallower in the downstream site
- -Further direct sampling methods such as excavator pitting or shallow core drilling would be required to confirm actual foundation levels.

H.4.4 Survey information

Storage curves have been produced for weir sites at A.M.T.D. 33.80 km and A.M.T.D. 34.45km.

In order to clearly establish the full supply levels and top of banks further survey is required.

Figure 19.7: Storage curve at 33.8 km AMTD

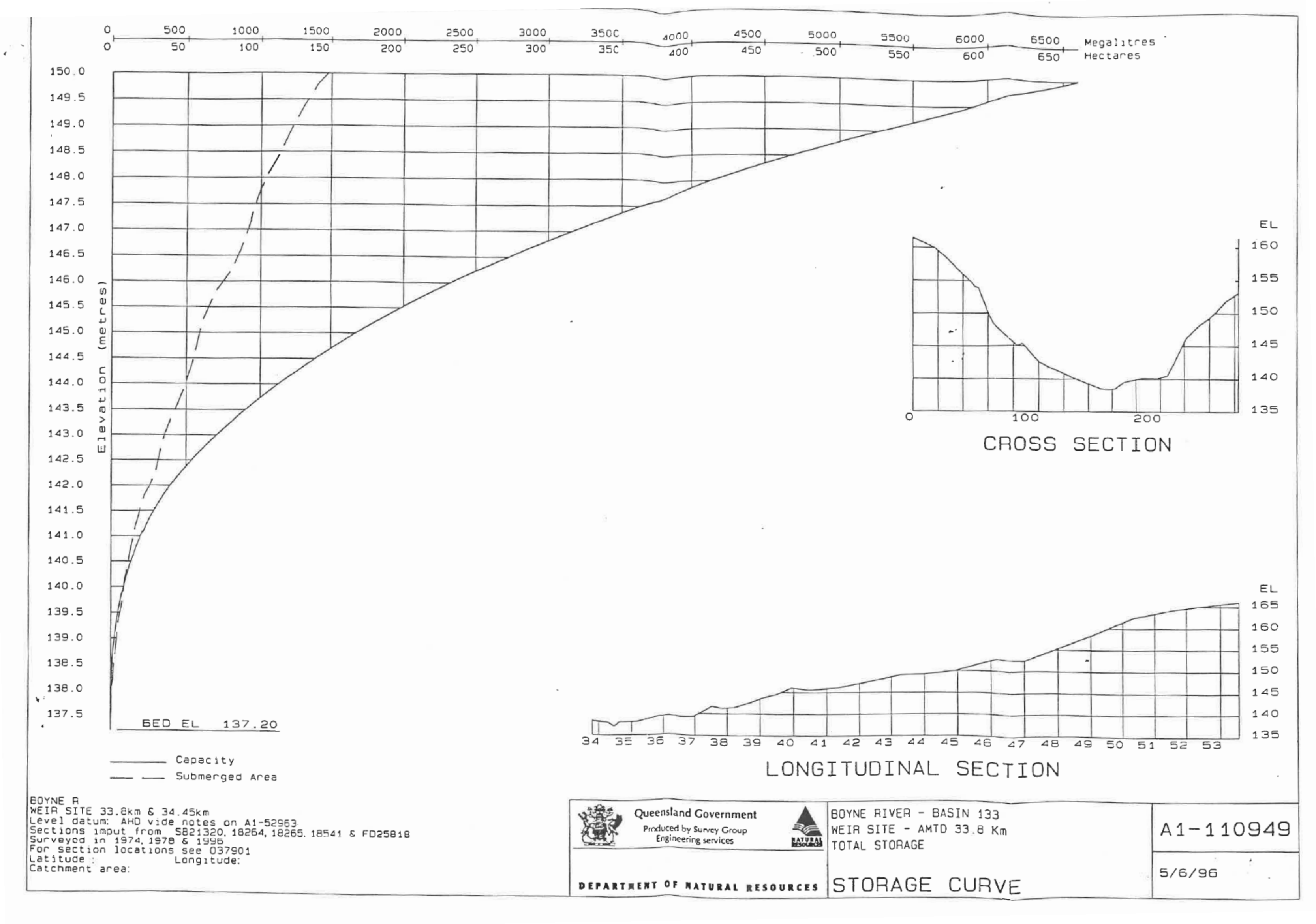


Figure 19.8: Storage curve at 34.45 km AMTD

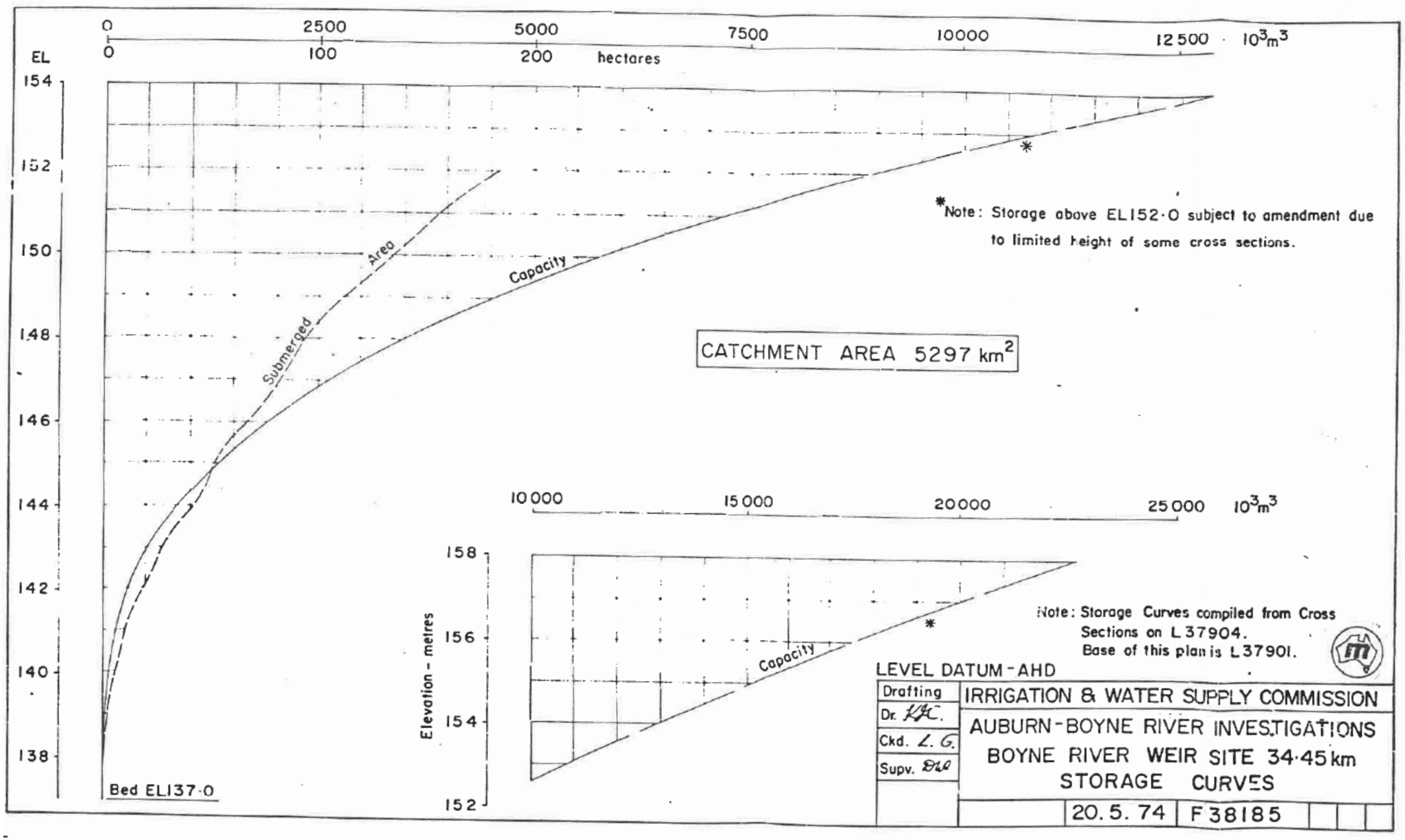


Figure H.9: Mass Concrete Weir

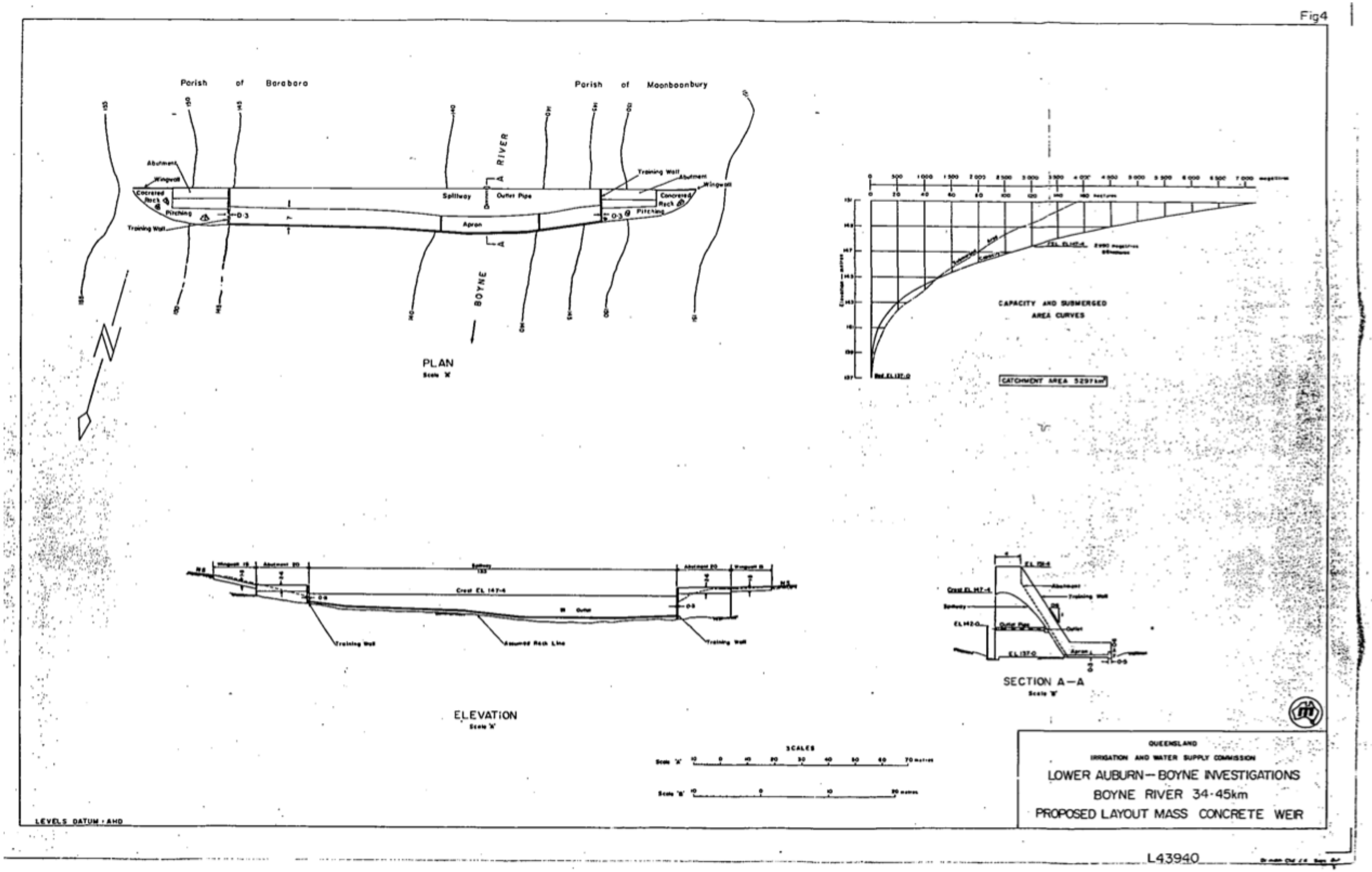
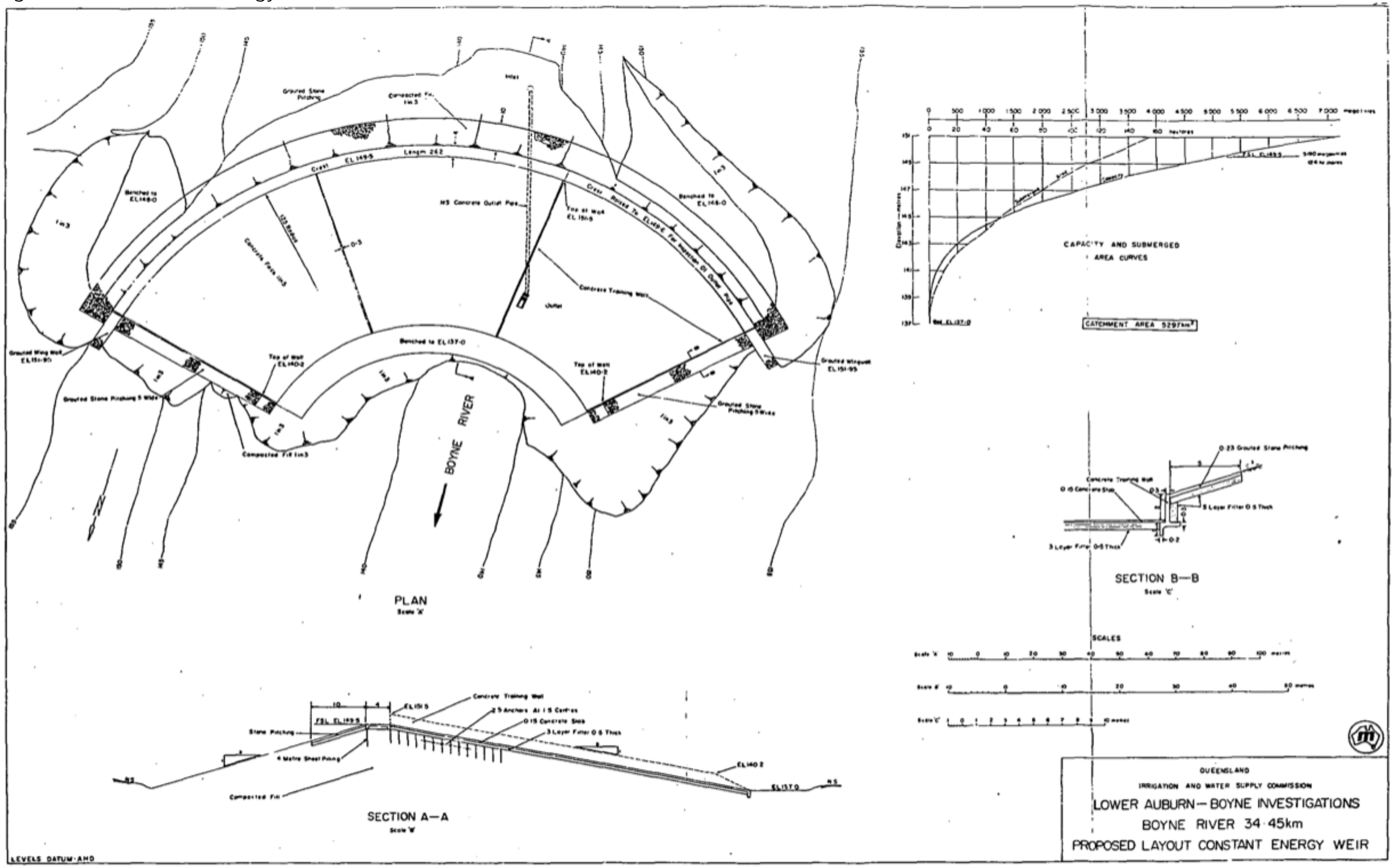


Figure H.10: Constant Energy Weir



H.4.5 Cost estimates

Costs were estimated in 1998 for all the permutations, as shown below. We have escalated these costs to 2020 values, using the Producer Price Index.

AMTD	Weir Type	Full Supply Elevation (m)	Capacity	Estimated Cost ($1998)	Escalation factor	Estimated Cost ($2020)
33.95	Mass Concrete	146.5	2,790	3,758,000	2.014	7,569,002
33.95	Mass Concrete	147.5	3,700	4,615,000	2.014	9,295,089
33.95	Mass Concrete	149.0	5,350	5,317,000	2.014	10,708,990
33.95	Constant Energy	146.5	2,790	4,630,000	2.014	9,325,301
33.95	Constant Energy	147.5	3,700	6,115,000	2.014	12,316,245
33.95	Constant Energy	149	5,350	7,187,000	2.014	14,475,365
34.45	Mass Concrete	146.5	2,220	3,826,000	2.014	7,705,961
34.45	Mass Concrete	147.5	3,000	4,755,000	2.014	9,577,064
34.45	Mass Concrete	149	4,500	5,418,000	2.014	10,912,415
34.45	Constant Energy	146.5	2,220	3,910,000	2.014	7,875,146
34.45	Constant Energy	147.5	3,000	5,021,000	2.014	10,112,816
34.45	Constant Energy	149	4,500	6,248,000	2.014	12,584,121

Note: The escalation factor is calculated by using ABS PPI escalation rates for Non-residential building construction (Series ID A2333658V) for 1998 to 2000, Road and Bridge Construction (Series ID A2333727L) for 2000 to 2007 and Other heavy civil engineering construction (Series ID A85220823L) for 2007 to 2020.

The average escalated 2020 cost is $10.2 million, with a range from $7.5 million to $14.5 million. This estimate did not include costs for a fishway or for environmental offsets.

Fish lock cost estimate

The range of cost estimates for the options of vertical slot fishway and mechanism fish lock are set out below.

Type	Low	Medium	High
Vertical slot fishway	$0.90m	$1.20m	$1.50m
Mechanical fish lock	$1.83m	$2.13m	$2.43m

Environmental offsets

There are 26 species recorded new the proposed weir and inundation site. Of these, two are listed as vulnerable, the Australian Lungfish and Southern Greater Glider. The Matters of State Environmental Significance environmental report identifies 35.23 hectares (2.8 per cent) of Threatened (endangered or vulnerable) wildlife within the area of interest.

The Australian Lungfish is not listed as an endangered, threatened or vulnerable species under Queensland's *Nature Conservation Act 1992*. It therefore does not come under any of the matters of environmental significance, that are prescribed environmental matters under Queensland's environmental offsets framework and are not required to calculate an offset for it.

However, the Australian Lungfish is listed as vulnerable under the Commonwealth Government's *Environmental Protection and Biodiversity Conservation Act 1999*. The species is also currently protected from fishing, and collection requires a permit under Queensland's *Fisheries Act 1994*.

Accordingly, it is expected that offsets will range from $1 million to $3 million.

H.4.5.1 Total cost estimate

To calculate the total cost, we have summed the escalated costs, fish passage costs, environmental offsets and approvals.

Type	Low	Medium	High
Infrastructure costs	$7.5 million	$10.2 million	$14.5 million
Fish Passage	$1 million	$2 million	$2.5 million
Environmental offsets	$1 million	$2 million	$3 million
Environmental Impact Statement and approvals	$1 million	$2.5 million	$5 million
Total costs	**$10.5 million**	**$16.7 million**	**$25 million**

There is still significant uncertainty, to be resolved prior, or during a detailed business case:

- Location - Stakeholders have clearly indicated that the Cooranga Weir site is not necessarily the optimal site and that the detailed business case would need to consider multiple other sites. This is supported by the Boyne River Planning Report (1998), which considered locations at ATMD 33.95 and 34.45. Additional sites will also be under consideration, including ATMD 33.8.
- Weir type - the detailed business case would need to determine whether the preferable option is a mass concrete structure or a constant energy structure. The cost difference between these two options is considerable.
- Full supply elevation - the detailed business case would need to determine the fully supply elevation. The cost difference between the considered options is considerable.
- Environmental offsets – the calculation of environmental offsets will need to be refined based

In that context, and to avoid unnecessary confusion, our methodology to the costs for the Boyne River Weir was to test the estimate provided by Sunwater to the Boyne River stakeholders. That estimate was tested against the escalation of the range of cost estimates for the 12 variations identified previously. It was determined that the Sunwater estimate was within the range of reasonable estimates, taking into account Sunwater's statements that the environmental assessment activities would require an approximately $5m. We note that this estimate could have been supported by access to the estimates (if any) conducted by Sunwater.

H.5 Paradise Dam to Coalstoun Lakes Pipeline

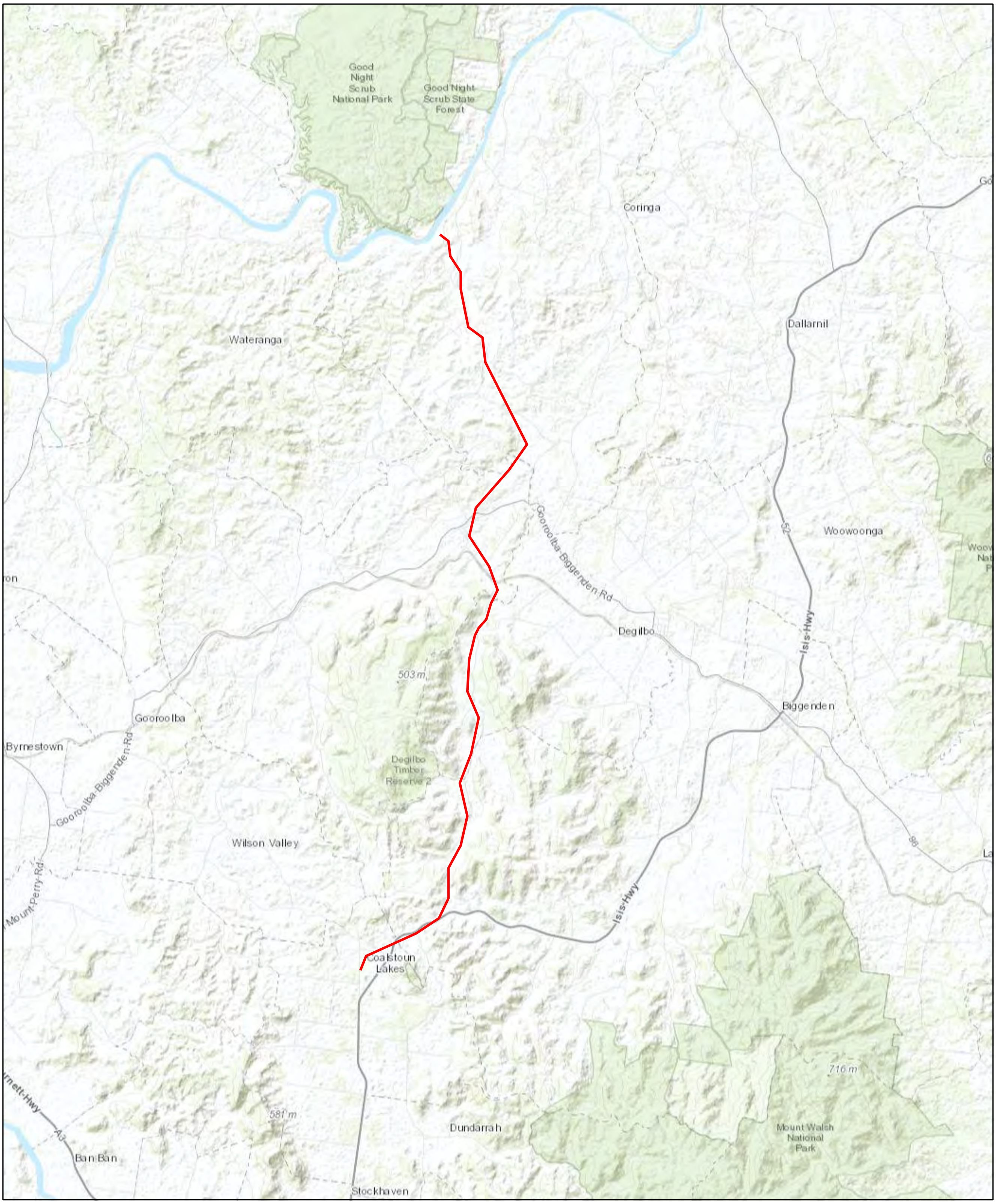
H.5.1 Preliminary design drawings

A preliminary drawing of a potential route for the pipeline from Paradise Dam to Coalstoun Lakes is shown below and further below shows the hydraulic grade line between Paradise Dam and Coalstoun Lakes. The design has calculated the need for 4.4GW of pumping capacity. This is split across three pump station to minimise overall operating and capital costs. A single pump station increases pressure and energy losses due to friction. This increases overall operating costs. The need for increased pressure also increases the pressure rating of the pipe, which adds additional costs. The number and location of pump stations can be determined during a detailed business case.

The location of the pipeline route has been determined based on topographical contours. The exact route will need to take into account:

- Environmental impacts
- Property access
- Creek and road crossings

Figure H.11: Proposed pipeline route



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IS316900_008_Pipeline_8674

1

1:144,448

0 1.5 3 6 mi

0 2.25 4.5 9 km

Figure H.12: Hydraulic grade line

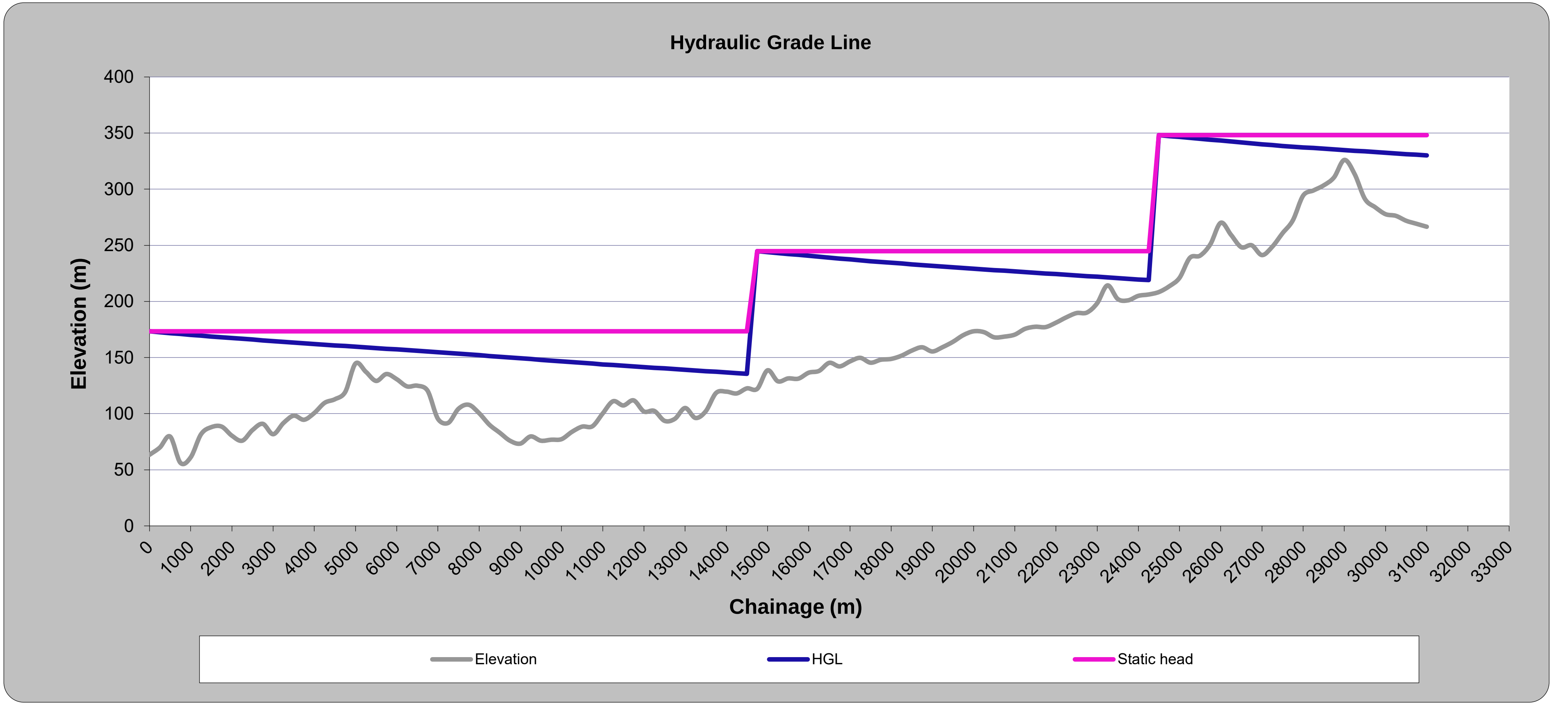


Table H.1: Paradise Dam to Colastoun Lake cost estimate

Description	Unit	Quantity	Unit rate	Amount
Preliminaries and general				
Establishment	LS	1	250,000	250,000
Survey	LS	1	1,000,000	1,000,000
Environmental	LS	1	1,000,000	1,000,000
Disestablishment and rehabilitation	LS	1	250,000	250,000
Pipe supply, installation and testing				
Pipe Supply - OD630 PE100 PN10	m	31,000	360	9,300,000
String, Lay and Joint Pipe	m	31,000	60	1,550,000
Trench Excavation	m	31,000	80	1,860,000
Bedding, Shade, Backfill	m	31,000	150	3,720,000
Restoration of ROW	m	31,000	15	310,000
Hydrostatic Testing	m	31,000	5	155,000
Air Valve - various sizes	LS	50	10,000	500,000
Fittings and valves	%	10		1,739,500
Crossings	%	10		1,739,500
Pump stations				
600 kW Pump	each	7	180,000	1,260,000
Piping inside pump station	each	3	1,000,000	3,000,000
Fittings and valves	%	10		426,000
Electricals, switchboards, lighting etc		3	1,000,000	3,000,000
Power connection	each	3	2,000,000	6,000,000
Irrigation network				
Pipe Supply	m	15,000	288	3,600,000
String, Lay and Joint Pipe	m	15,000	48	600,000
Trench Excavation	m	15,000	64	720,000
Bedding, Shade, Backfill - TYPE A TRENCH	m	15,000	120	1,440,000
Restoration of ROW	m	15,000	12	120,000
Hydrostatic Testing	m	15,000	4	60,000
Air Valve - various sizes	LS	30	10,000	300,000
Customer connection	LS	40	25,000	1,000,000
Fittings and valves	%	10		784,000
Crossings	%	15		1,176,000
Contingency	%	25		11,090,000
Total costs				**57,950,000**

19.2.4.1 Risk adjustments

The above costs are subject to considerable uncertainty. The route may change, which will increase the total distance of the pipeline. Also, the unit rates applied could also change. Accordingly, we have estimated the range of costs as follows:

Description	Low amount	Medium Amount	High amount
Establishment	200,000	250,000	300,000
Survey	750,000	1,000,000	1,500,000
Environmental	500,000	1,000,000	1,500,000
Disestablishment and rehabilitation	200,000	250,000	300,000
Pipe Supply	8,400,000	9,300,000	12,000,000
String, Lay and Joint Pipe	1,400,000	1,550,000	2,000,000
Trench Excavation	1,680,000	1,860,000	2,400,000
Bedding, Shade, Backfill	3,360,000	3,720,000	4,800,000
Restoration of ROW	280,000	310,000	400,000
Hydrostatic Testing	140,000	155,000	200,000
Air Valve - various sizes	500,000	500,000	500,000
Fittings and valves	1,576,000	1,739,500	2,230,000
Crossings	1,576,000	1,739,500	3,345,000
600 kW Pump	1,120,000	1,260,000	1,400,000
Piping inside pump station	2,250,000	3,000,000	3,750,000
Fittings and valves	337,000	426,000	515,000
Electricals, switchboards, lighting etc	2,250,000	3,000,000	4,500,000
Power connection	4,500,000	6,000,000	7,500,000
Pipe Supply	2,592,000	3,600,000	4,320,000
String, Lay and Joint Pipe	432,000	600,000	720,000
Trench Excavation	516,000	720,000	864,000
Bedding, Shade, Backfill	1,032,000	1,440,000	1,728,000
Restoration of ROW	84,000	120,000	144,000
Hydrostatic Testing	48,000	60,000	72,000
Air Valve - various sizes	300,000	300,000	500,000
Customer connection	750,000	1,000,000	1,250,000
Fittings and valves	575,400	784,000	1,439,700
Crossings	575,400	1,176,000	1,439,700
Contingency	7254760	11090000	17405220
Total costs	**37,923,800**	**46,860,000**	**61,617,400**

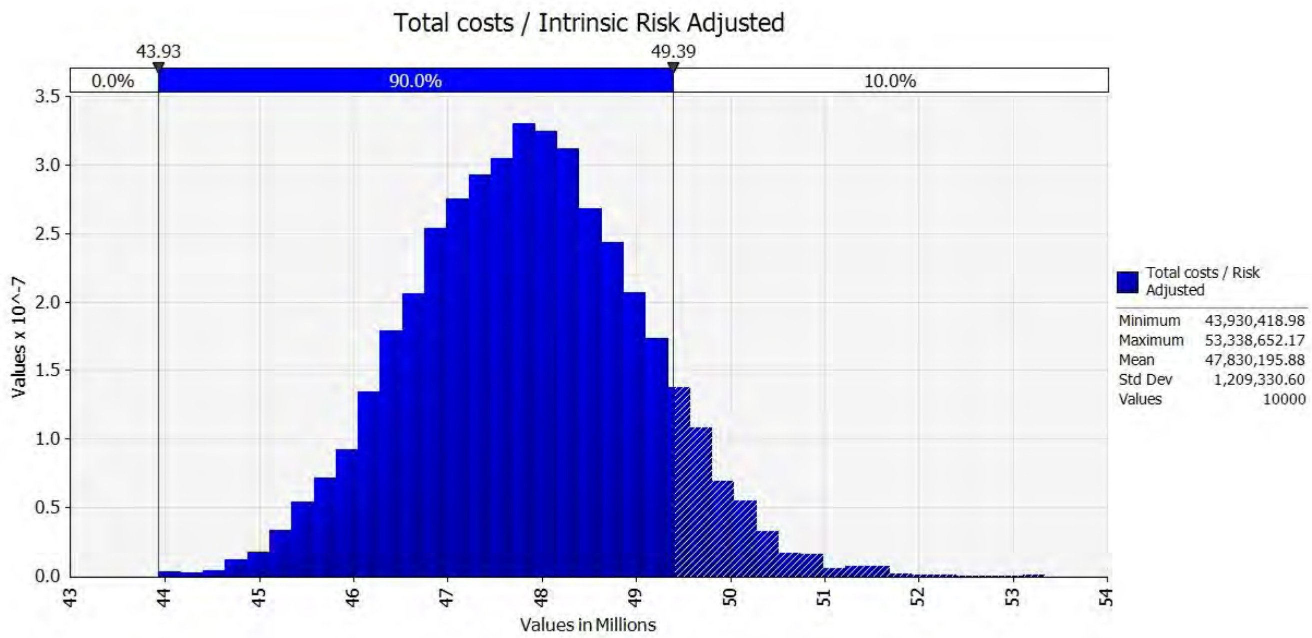
We have identified the major cost risks and contingent risks. The contingent risks include:

- cost of environmental approvals and offsets
- Design growth
- Labour availability
- Geotechnical
- Wet weather

- Availability of materials
- Flood
- Competition with other projects
- Project delays

On the basis of the low, medium and high cost estimates, and the identified risks, the probabilistic costs are summarised in the table below, and presented in the figure further below.

Item	Low cost estimate (P10)	Medium cost estimate (P50)	High cost estimate (P90)
Risk adjusted total	$46.0 million	$47.8 million	$57.4 million



H.6 Raise Jones Weir, Raise Claude Wharton Weir, build a weir on the Burnett River downstream of the confluence with the Barambah Creek, irrigation network primarily for Coalstoun Lakes, and extend the downstream extent of the Upper Burnett Water Supply Scheme

H.6.1 Raising Jones Weir

The costs for the raising Jones Weir have been estimated by doing the following

1) Reviewing the existing information, including the Initial Advice Statement, Jones Weir, Stage 2, 1998
2) Considered the appropriateness of the 1998 design and considered whether any adjustments are needed to reflect contemporary design approaches.
3) Refined the quantities (if required) in the year 1998 design and then escalated each line using individual ABS cost escalation data from 1998 to 2020.
4) Considered additional components / risks not included and added appropriate contingent risks.

H.6.2 Appropriateness of year 2000 design

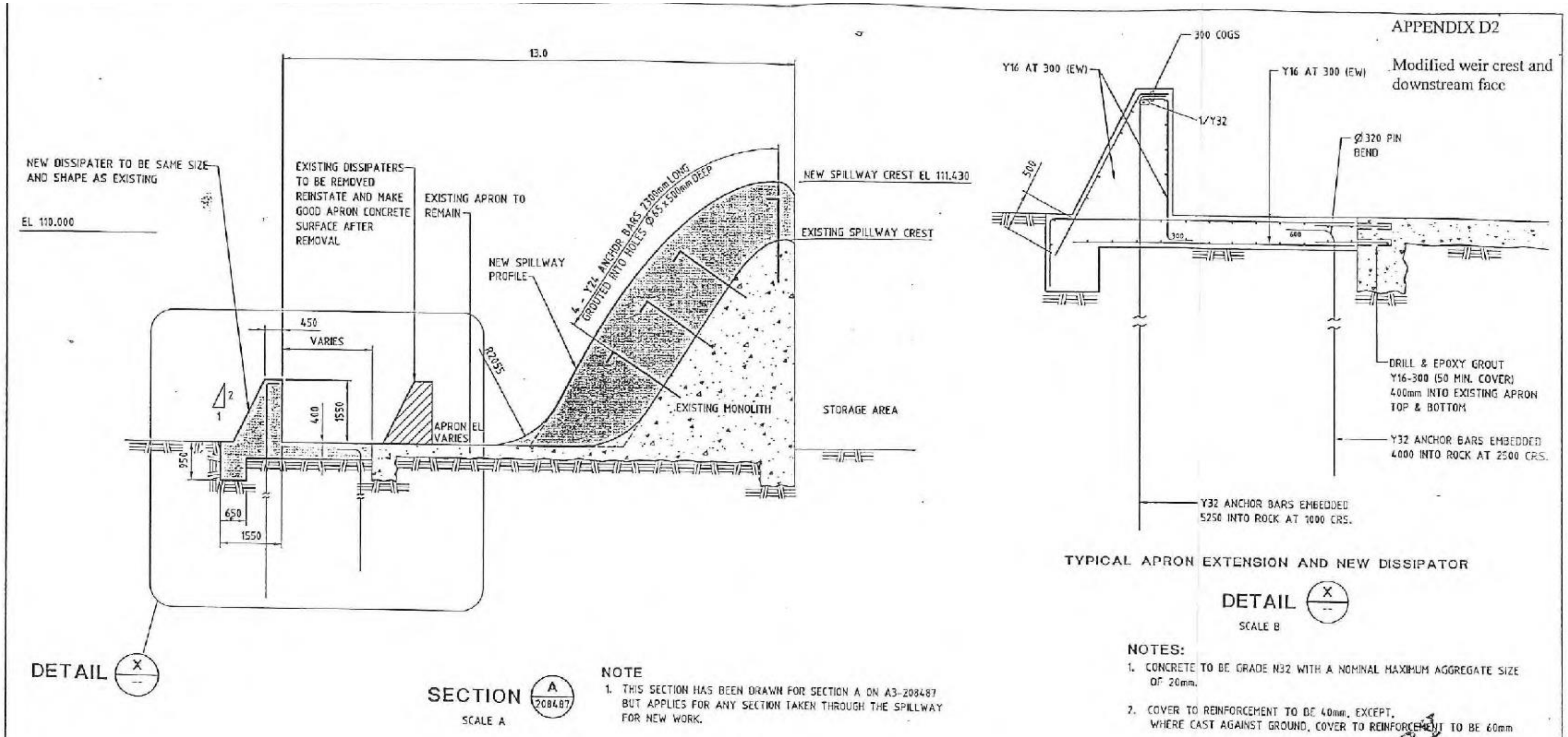
The year 2000 design has been reviewed by engineers with modern weir design and construction experience. Their investigation found that the design was materially appropriate and could be implemented. A detailed design may identify areas of improvement, however, for the purpose of an Option Analysis investigation, the existing design was considered appropriate for the purpose of developing a cost estimate.

Some aspects of weir investigation may change over time, but some will not. The results in an older report relating to geology, soil and hydraulics can continue to be relied on. If the design is appropriate then the resulting quantities can also be relied on.

Some of the drawings done in 2000 are available for inspection. The primary drawings are shown below.

APPENDIX D2

Modified weir crest and downstream face



NOTES:

1. CONCRETE TO BE GRADE N32 WITH A NOMINAL MAXIMUM AGGREGATE SIZE OF 20mm.
2. COVER TO REINFORCEMENT TO BE 40mm, EXCEPT, WHERE CAST AGAINST GROUND, COVER TO REINFORCEMENT TO BE 60mm
3. FOR REINFORCEMENT BAR FABRICATION AND DETAILS, SEE A3-64555.
4. ABBREVIATIONS:
   - NF MEANS NEAR FACE
   - FF MEANS FAR FACE
   - EF MEANS EACH FACE
   - EW MEANS EACH WAY
5. ALL BAR LAP SPLICES AND DEVELOPMENT LENGTHS TO BE AS SHOWN BELOW. (UNLESS NOTED OTHERWISE)

PRELIMINARY

BAR	HORIZ	VERT
Y12	400	300
Y16	500	400
Y20	650	500
Y24	750	600
Y28	900	700
Y32	1150	900
Y36	1400	1100

SCALES

A 0 1000 2000 3000 4000 5000 MILLIMETRES 1:100

B 0 500 1000 1500 2000 2500 MILLIMETRES 1:50

DATE | REMARKS | CKD | PSD | REFERENCE DRAWINGS | A3-208487 PRELIMINARY ARRANGEMENT SHEET 1

DRAFTING M.E. | RECOMMENDED | DRAFTING CHK | DESIGN | APPROVED | DESIGN CHK

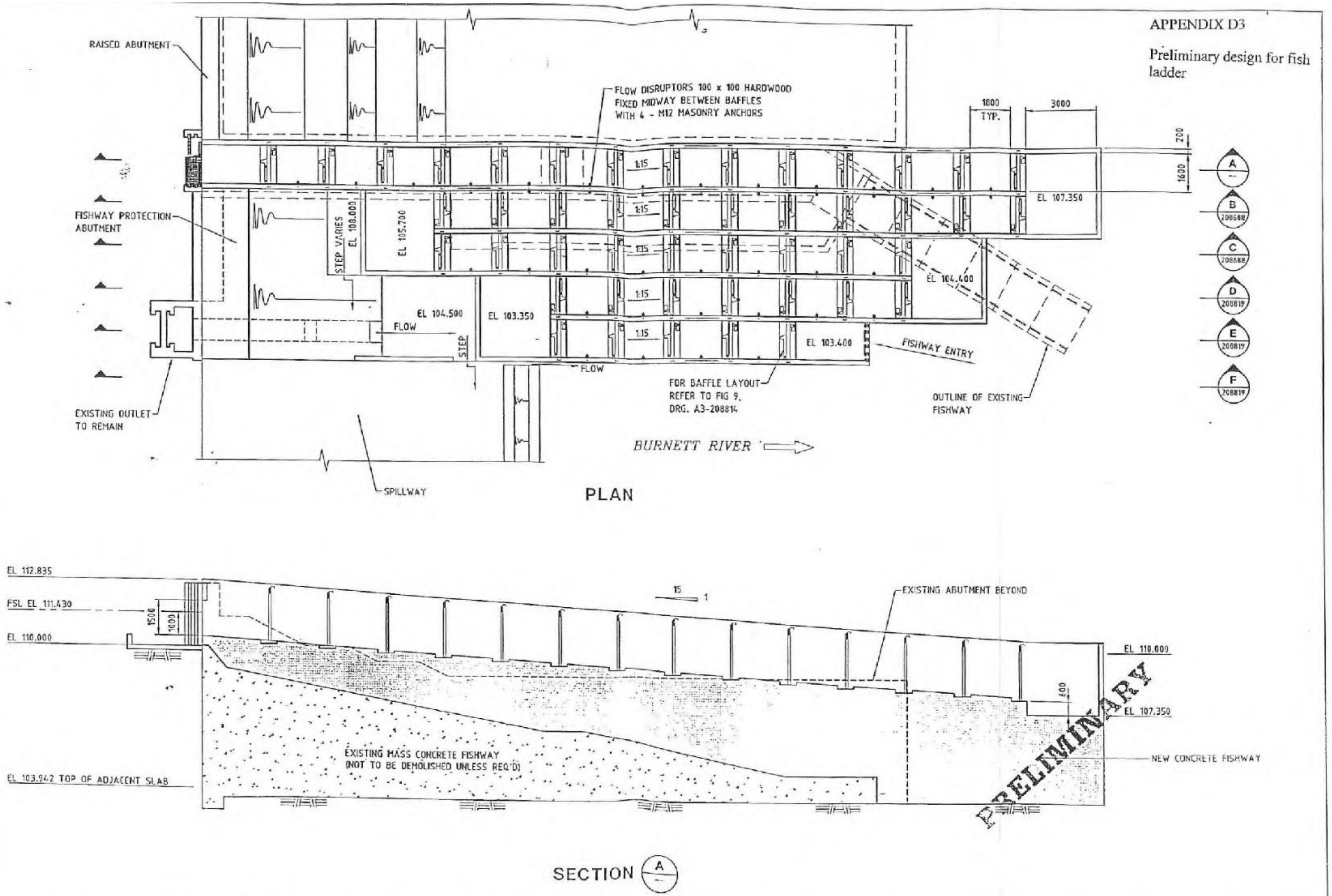
Engineering Services | NATURAL RESOURCES

BURNETT RIVER AMTD 240.1 km
JONES WEIR RAISING
PRELIMINARY ARRANGEMENT

CONTRACT NUMBER | DRAWING NUMBER A3-208656 | DATE JAN 1998

APPENDIX D3

Preliminary design for fish ladder



SCALES 0 2500 5000 7500 MILLIMETRES 1:150

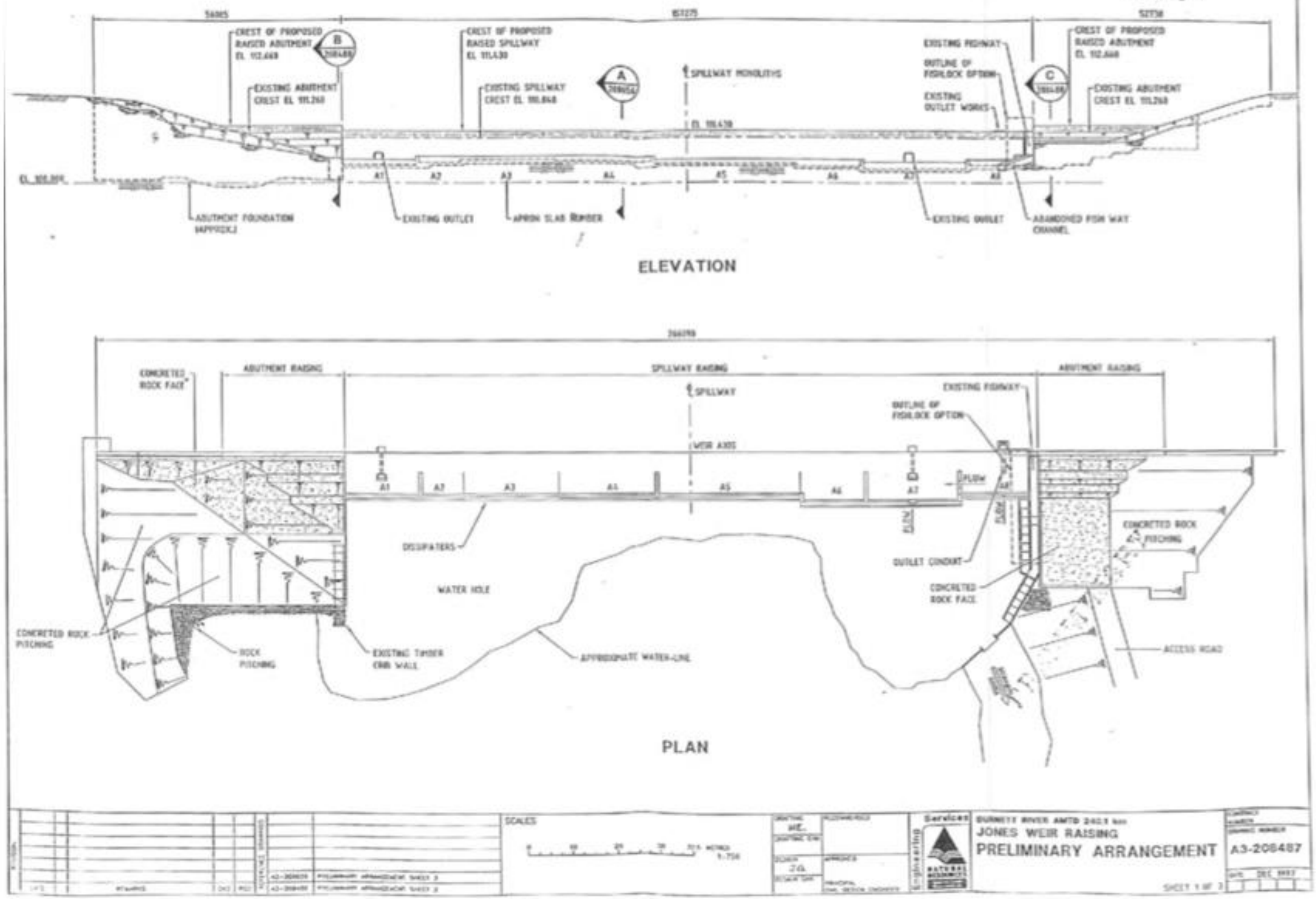
DRAFTING M.E.

BURNETT RIVER AMTD 240.1 km
JONES WEIR RAISING
FISH LADDER
PRELIMINARY ARRANGEMENT

DRAWING NUMBER A3-208687

APPENDIX D1

Preliminary layout for Jones Weir Stage 2



The quantities from the year 1998 design are shown below. The rates have been escalated using individual ABS cost escalation data from 1998 to 2020.

Table H.1: Jones Weir Raisng costs

Item	Description	Unit	Quantity	Rate ($)	Amount ($2000)	Escalation category	Amount ($2020)
1.0	General						-
1.1	Mobilisation	LS			75,000	Labour	143,000
1.2	Demobilisation	LS			40,000	Labour	76,000
1.3	Diversion and care of river	LS			25,000	Labour	48,000
1.4	Access Roads	LS			10,000	Road and Bridge Construction index	21,000
2.0	Demolition and disposal of existing concrete works						-
2.1	Concrete Sill	LS			3,500	Concrete	12,000
2.2	Fish Ladder	LS			15,000	Concrete	28,000
2.3	Existing Apron	LS			30,000	Concrete	57,000
3.0	Concrete in weir						-
3.1	Concrete in weir spillway fixed crest	m3	3,150	350	1,102,500	Concrete	2,086,000
3.2	Concrete in weir abutments	m3	70	350	24,500	Concrete	46,000
3.3	concrete in weir outlet works	LS			10,000	Concrete	19,000
3.4	Concrete in weir apron slabs	m3	500	250	125,000	Concrete	236,000
4.0	Reinforcement						-
4.1	Abutments	tonne	2	2,000	4,400	Steel	9,000
4.2	Weir Apron Slabs	tonne	25	2,000	50,000	Steel	100,000
5.0	Drill holes for anchor bars and grout in place						-
5.1	spillway	No	640	55	35,200	Labour	67,000
5.2	Abutments	No	350	55	19,250	Labour	37,000
5.3	Apron	No	640	55	35,200	Labour	67,000
6.0	Pump Relocations						-
6.1	Farm relocations	No	50	2000	100,000	Land	475,000

Item	Description	Unit	Quantity	Rate ($)	Amount ($2000)	Escalation category	Amount ($2020)
6.2	Town water	LS			20,000	PPI	30,000
7.0	Miscellaneous						-
7.1	Water stop modifications	LS			10,000	PPI	15,000
7.2	Metal work	LS			10,000	Steel	20,000
7.3	Modifications to existing outlet	LS			20,000	PPI	30,000
8.0	Fish ladder						-
8.1	Concrete	m3	600	650	390,000	Concrete	738,000
8.2	Reinforcement	Tonne	20	2250	45,000	Steel	90,000
8.3	Per stock gates	LS			25,000	PPI	38,000
9.0	Modifications to crossings						-
9.1	Cooper Crossing	LS			350,000	Road and Bridge Construction index	679,000
9.2	Dykehead Crossing	LS			150,000	Road and Bridge Construction index	291,000
10.0	Contingencies	%		5	136,228	Road and Bridge Construction index	264,000
11.0	Engineering	LS			300,000	Labour	574,000
Total					**3,160,778**		**6,296,000**

The above costs are subject to considerable uncertainty. The above costs are considered 'low' and the estimated range of costs follows:

Table H.2: Jones Weir Raisng costs

Item	Description	Low estimate	Medium estimate	High estimate
1.0	General			
1.1	Mobilisation	143,000	178,750	214,500
1.2	Demobilisation	76,000	95,000	114,000
1.3	Diversion and care of river	48,000	60,000	72,000
1.4	Access Roads	21,000	26,250	31,500
2.0	Demolition and disposal of existing concrete works			
2.1	Concrete Sill	12,000	15,000	18,000
2.2	Fish Ladder	28,000	35,000	42,000
2.3	Existing Apron	57,000	71,250	85,500
3.0	Concrete in weir			
3.1	Concrete in weir spillway fixed crest	2,086,000	3,150,000	4,214,000
3.2	Concrete in weir abutments	46,000	70,000	94,000
3.3	concrete in weir outlet works	19,000	23,750	28,500

Item	Description	Low estimate	Medium estimate	High estimate
3.4	Concrete in weir apron slabs	236,000	295,588	355,175
4.0	Reinforcement			
4.1	Abutments	9,000	11,019	13,037
4.2	Weir Apron Slabs	100,000	125,213	150,426
5.0	Drill holes for anchor bars and grout in place			
5.1	spillway	67,000	84,133	101,265
5.2	Abutments	37,000	46,010	55,020
5.3	Apron	67,000	84,133	101,265
6.0	Pump Relocations			
6.1	Farm relocations	475,000	593,217	711,434
6.2	Town water	30,000	37,500	45,000
7.0	Miscellaneous			
7.1	Water stop modifications	15,000	18,750	22,500
7.2	Metal work	20,000	25,000	30,000
7.3	Modifications to existing outlet	30,000	37,500	45,000
8.0	Fish ladder			
8.1	Concrete	738,000	1,200,000	2,200,000
8.2	Reinforcement	90,000	112,692	150,000
8.3	Per stock gates	38,000	47,500	150,000
9.0	Modifications to crossings			
9.1	Cooper Crossing	679,000	848,750	1,018,500
9.2	Dykehead Crossing	291,000	363,750	436,500
10.0	Contingencies	264,000	1,913,938	3,563,877
11.0	Engineering	574,000	717,500	861,000
Total		**6,296,000**	**10,287,192**	**14,924,000**

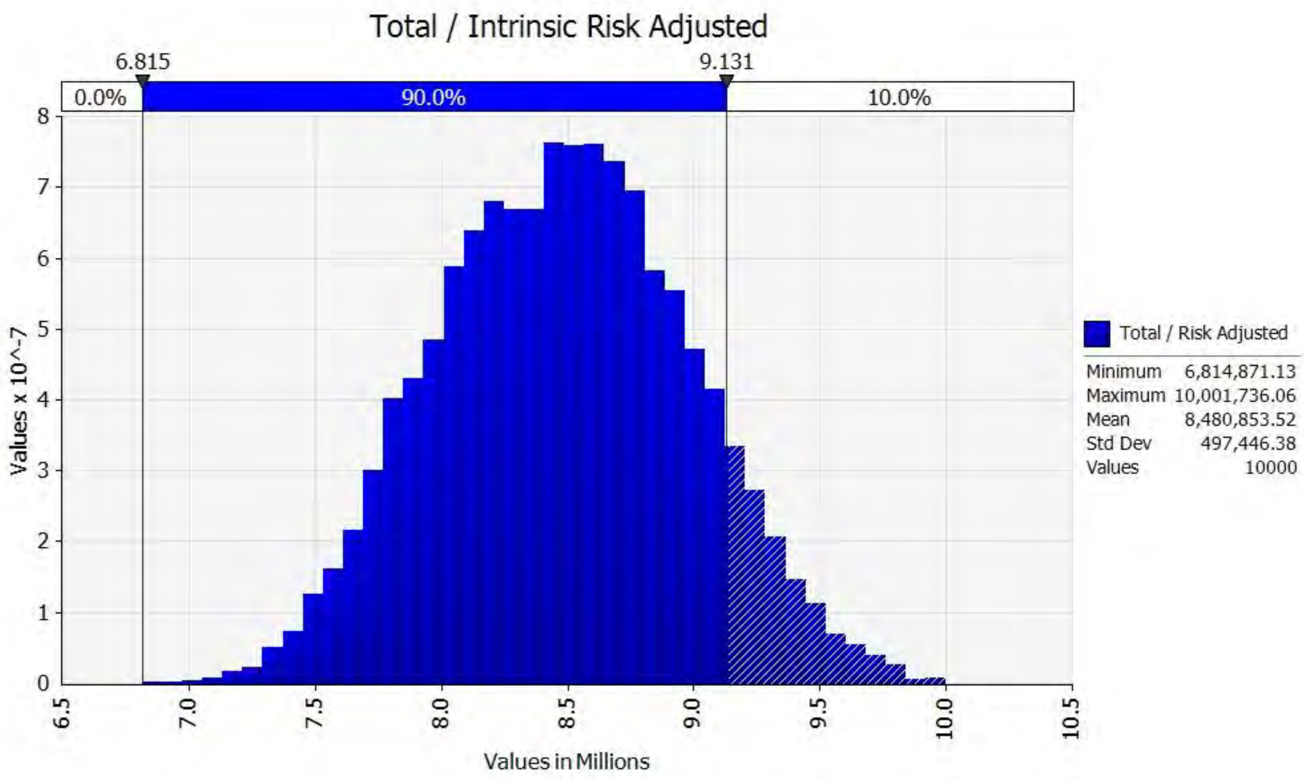
We have identified the major cost risks and contingent risks. The contingent risks include:

- cost of environmental approvals and offsets
- Design growth
- Labour availability
- Geotechnical
- Wet weather
- Availability of materials
- Flood
- Competition with other projects
- Project delays

On the basis of the low, medium and high cost estimates, and the identified risks, the probabilistic costs are summarised in the table below, and presented in the figure further below.

Table H.3: Capital cost estimates ($ millions)

Item	Low cost estimate (P10)	Medium cost estimate (P50)	High cost estimate (P90)
Risk adjusted total	7.8	8.5	13.2

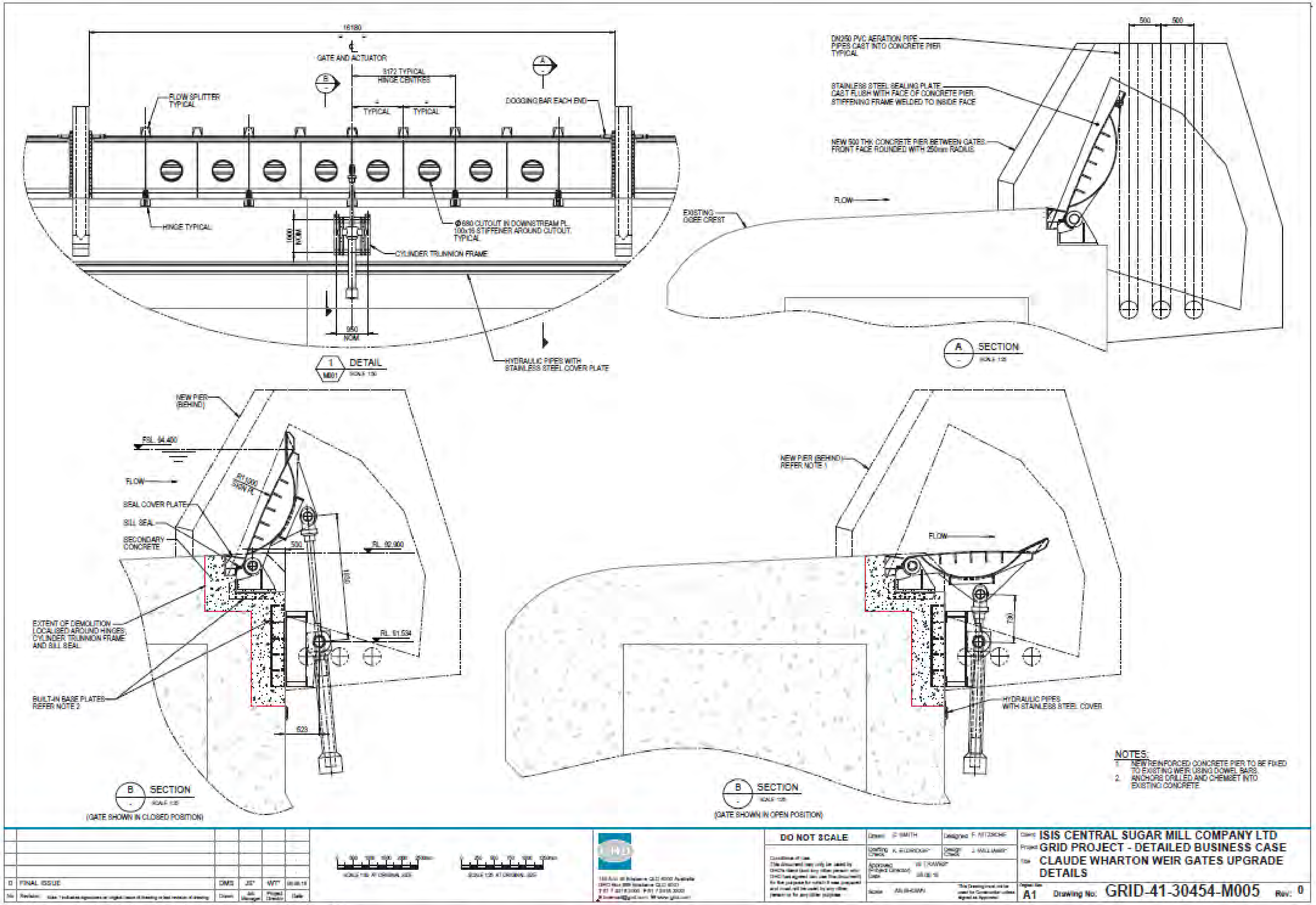


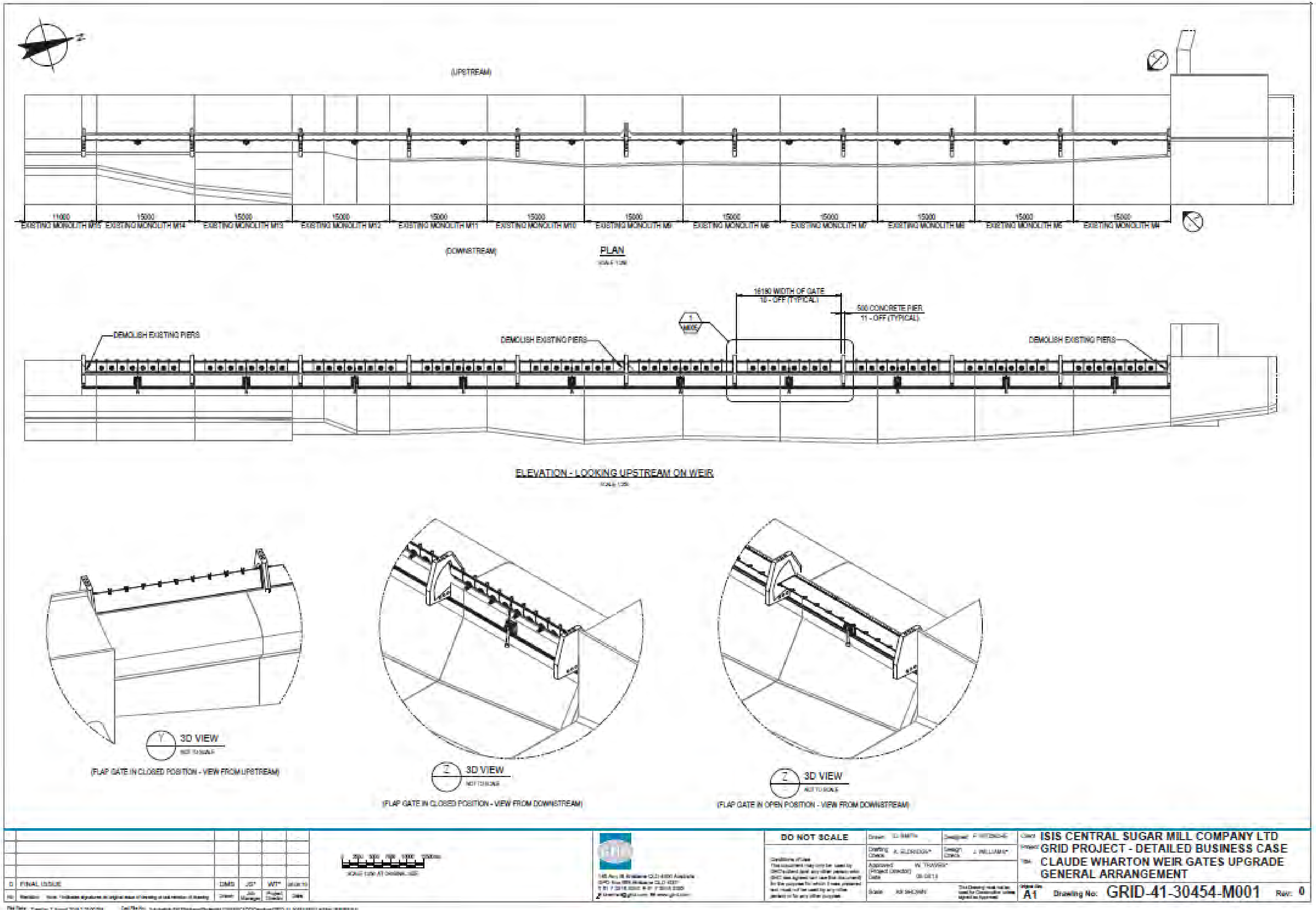
H.6.3 Claude Wharton Weir raising

The costs for the raising Claude Wharton Weir have been estimated by doing the following

1) Reviewing the existing information, including the Gayndah Regional Irrigation Development (GRID) Project Detailed Business Case
2) Considered the appropriateness of the design and considered whether any adjustments are needed to reflect contemporary design approaches.
3) Considered additional components / risks not included and added appropriate contingent risks.

The below drawings were completed by GHD as part of the GRID project


16180
GATE AND ACTUATOR
3172 TYPICAL HINGE CENTRES
TYPICAL
TYPICAL
FLOW SPLITTER TYPICAL
DOGGING BAR EACH END
HINGE TYPICAL
Φ680 CUTOUT IN DOWNSTREAM PL. 100x16 STIFFENER AROUND CUTOUT. TYPICAL
CYLINDER TRUNNION FRAME
1000 NOM
950 NOM
HYDRAULIC PIPES WITH STAINLESS STEEL COVER PLATE
DETAIL
DN250 PVC AERATION PIPE PIPES CAST INTO CONCRETE PIER TYPICAL
STAINLESS STEEL SEALING PLATE CAST FLUSH WITH FACE OF CONCRETE PIER. STIFFENING FRAME WELDED TO INSIDE FACE
NEW 500 THK CONCRETE PIER BETWEEN GATES. FRONT FACE ROUNDED WITH 250mm RADIUS.
FLOW
EXISTING OGEE CREST
500
500
SECTION
NEW PIER (BEHIND)
FSL 94.400
FLOW
SEAL COVER PLATE
SILL SEAL
SECONDARY CONCRETE
RL 92.900
RL 91.534
EXTENT OF DEMOLITION LOCALISED AROUND HINGES, CYLINDER TRUNNION FRAME AND SILL SEAL
BUILT-IN BASE PLATES REFER NOTE 2
SECTION
(GATE SHOWN IN CLOSED POSITION)
NEW PIER (BEHIND) REFER NOTE 1
FLOW
HYDRAULIC PIPES WITH STAINLESS STEEL COVER
SECTION
(GATE SHOWN IN OPEN POSITION)
NOTES:
1. NEW REINFORCED CONCRETE PIER TO BE FIXED TO EXISTING WEIR USING DOWEL BARS.
2. ANCHORS DRILLED AND CHEMSET INTO EXISTING CONCRETE.
0 FINAL ISSUE
DO NOT SCALE
ISIS CENTRAL SUGAR MILL COMPANY LTD
GRID PROJECT - DETAILED BUSINESS CASE
CLAUDE WHARTON WEIR GATES UPGRADE DETAILS
A1
Drawing No: GRID-41-30454-M005
Rev: 0


(UPSTREAM)
11000
15000
EXISTING MONOLITH M15
EXISTING MONOLITH M14
EXISTING MONOLITH M13
EXISTING MONOLITH M12
EXISTING MONOLITH M11
EXISTING MONOLITH M10
EXISTING MONOLITH M9
EXISTING MONOLITH M8
EXISTING MONOLITH M7
EXISTING MONOLITH M6
EXISTING MONOLITH M5
EXISTING MONOLITH M4
(DOWNSTREAM)
PLAN
16180 WIDTH OF GATE
10 - OFF (TYPICAL)
500 CONCRETE PIER
11 - OFF (TYPICAL)
DEMOLISH EXISTING PIERS
ELEVATION - LOOKING UPSTREAM ON WEIR
3D VIEW
(FLAP GATE IN CLOSED POSITION - VIEW FROM UPSTREAM)
3D VIEW
(FLAP GATE IN CLOSED POSITION - VIEW FROM DOWNSTREAM)
3D VIEW
(FLAP GATE IN OPEN POSITION - VIEW FROM DOWNSTREAM)
0 FINAL ISSUE
DO NOT SCALE
ISIS CENTRAL SUGAR MILL COMPANY LTD
GRID PROJECT - DETAILED BUSINESS CASE
CLAUDE WHARTON WEIR GATES UPGRADE
GENERAL ARRANGEMENT
A1
Drawing No: GRID-41-30454-M001
Rev: 0

The quantities from the year 2018 design undertaken by GHD are shown below. Unit rates have been slightly adjusted to reflect current conditions.

Table H.4: Claude Wharton Weir costs

Description	Unit	Quantity	Unit rate	Amount
Flap gates - 16m x 1.5m high	kg	4,700	200	940,000
Built in parts - SS seal plates and ms hinge parts	kg	1,200	200	240,000
Installation - Gates and BIP	kg	5,900	100	590,000
Gate piers - 11 No piers, 0.5m thick	m3	6	160,000	960,000
Stoplogs - One set of mild steel stoplogs	kg	3,800	200	760,000
Built in parts for stoplogs - SS guides	kg	500	200	100,000
Installation of BIP - BIP only	kg	500	200	100,000
Hydraulic cylinders - 280 kN with 1m stroke, ss rod and ms barrel	No	1	500,000	500,000
Hydraulic piping and installation - 1800 m ss pipe	LS	1	500,000	500,000
HPU - 0.9 kW Hydraulic power unit including 600 L oil reservoir	LS	1	100,000	100,000
Control system for HPU - PLC control system and programming	LS	1	250,000	250,000
Backup generator - 12 kVa diesel generator	LS	1	60,000	60,000
Electrical installation - Electrical installation for above works	LS	1	100,000	100,000
Mobilisation and demobilisation	%	5		260,000
Preliminaries and general	%	15		780,000
Contingency	%	30		1,560,000
Total				**7,800,000**

The above costs are subject to considerable uncertainty and a range of costs have been developed.

Table H.5: Claude Wharton Weir raising costs ($)

Description	Low	Medium	High
Flap gates - 16m x 1.5m high	720,000	940,000	1,085,700
Built in parts - SS seal plates and ms hinge parts	180,000	240,000	277,200
Installation - Gates and BIP	450,000	590,000	713,900
Gate piers - 11 No piers, 0.5m thick	864,000	960,000	1,020,000
Stoplogs - One set of mild steel stoplogs	576,000	760,000	919,600
Built in parts for stoplogs - SS guides	72,000	100,000	115,500
Installation of BIP - BIP only	72,000	100,000	115,500
Hydraulic cylinders - 280 kN with 1m stroke, ss rod and ms barrel	450,000	500,000	525,000
Hydraulic piping and installation - 1800 m ss pipe	460,000	500,000	525,000
HPU - 0.9 kW Hydraulic power unit including 600 L oil reservoir	90,000	100,000	110,000
Control system for HPU - PLC control system and programming	225,000	250,000	275,000
Backup generator - 12 kVa diesel generator	54,000	60,000	66,000
Electrical installation - Electrical installation for above works	90,000	100,000	110,000
Mobilisation and demobilisation	215,150	260,000	878,760
Preliminaries and general	645,450	780,000	878,760
Contingency	1,075,750	1,560,000	1,757,520
Total	**6,239,350**	**7,800,000**	**9,373,440**

We have identified the major cost risks and contingent risks. The contingent risks include:

- cost of environmental approvals and offsets
- Design growth
- Labour availability
- Geotechnical
- Wet weather
- Availability of materials
- Flood
- Competition with other projects
- Project delays

On the basis of the low, medium and high cost estimates, and the identified risks, the probabilistic costs are summarised in the table below, and presented in the figure further below.

Table 19.6 Capital cost estimates ($ millions)

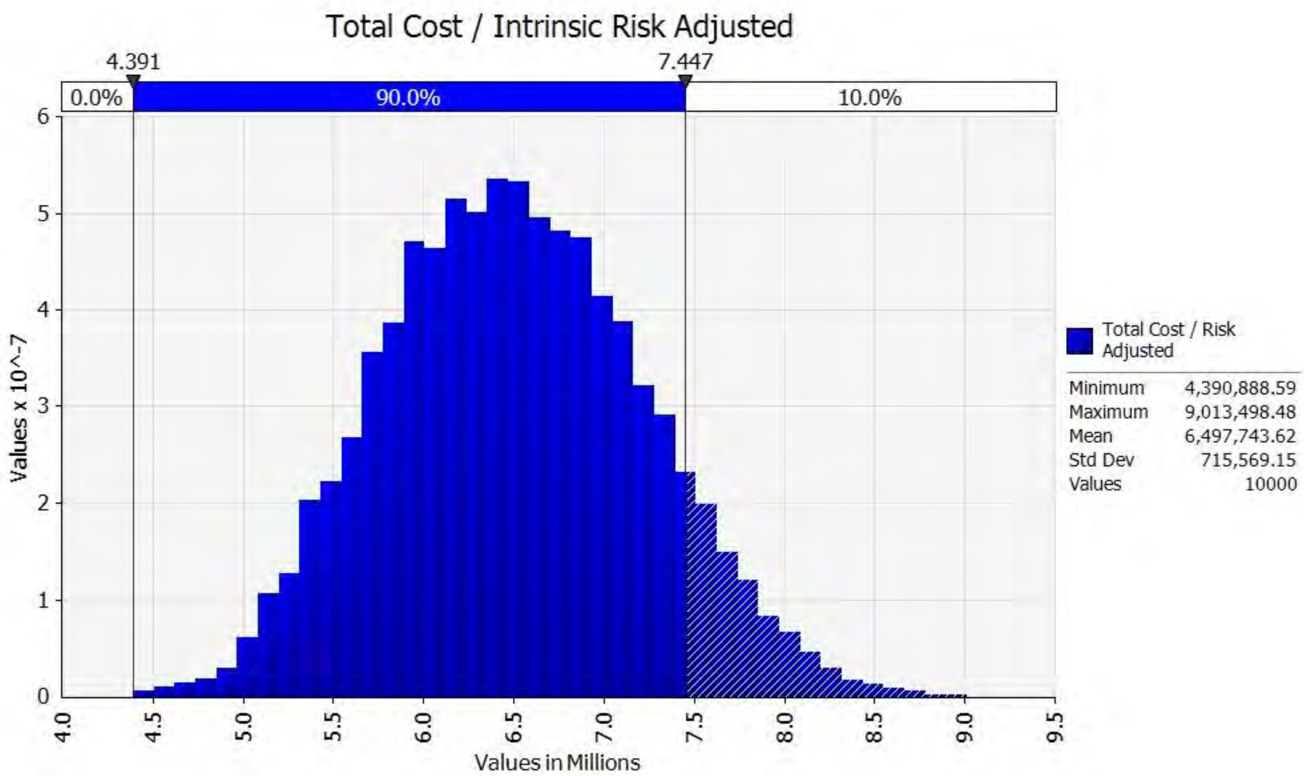
Item	Low cost estimate (P10)	Medium cost estimate (P50)	High cost estimate (P90)
Risk adjusted total	6.1	6.3	8.9

H.6.4 New weir on the Burnett River

The costs of the new weir have been calculated, noting that very limited design work has been undertaken to date.

Table H.7: Cost of new Weir on the Burnett River

Item	Low	Medium	High
General	323,100	359,000	558,162
Weir Construction	554,400	616,000	1,200,000
Outlet works	243,000	270,000	471,179
Control Building	35,100	39,000	93,662
Protection	132,300	147,000	200,000
Landscaping	14,400	16,000	45,280
Upstream effects	615,600	684,000	1,029,954
Fish Lock	-	1,200,000	2,000,000
Investigation and Design	252,900	281,000	781,714
Project and Contract Management	115,200	128,000	200,000
Site Supervision and Administration	115,200	128,000	240,000
Land Resumption	200,000	400,000	600,000
Approvals	250,000	863,100	1,190,873
Offsets	-	1,000,000	3,000,000
Contingency	712,800	1,532,775	2,902,706
Total Cost	3,564,000	7,663,875	14,513,529


Total Cost / Intrinsic Risk Adjusted
4.391
7.447
0.0%
90.0%
10.0%
Values x 10^-7
Values in Millions
Total Cost / Risk Adjusted
Minimum 4,390,888.59
Maximum 9,013,498.48
Mean 6,497,743.62
Std Dev 715,569.15
Values 10000

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Water supply requirements in the North and South Burnett

Appendix I

Options Analysis

Appendix I. Next steps by project

I.1 Construct a re-regulating weir on the Boyne River

The table below sets out the actions required to continue to assess the viability of this project, to provide sufficient information to enable all stakeholders to consider if the project represents a worthwhile investment and advance towards construction.

General outline:

- Actions 1 to 4 are early and low-cost activities that will address gaps in current knowledge and identify any potentially significant challenges, thereby enabling stakeholders to determine whether the project should proceed to a detailed business case stage.

- Action 5 includes more detailed assessment of technical, environmental, financial and economic matters for the preferred option, in order to support robust consideration of potential investment options by stakeholders.

- Actions 6 and 7 may occur depending on requirements that will become apparent as work proceeds through a detailed business case.

At the conclusion of these actions, stakeholders should be in a position to consider whether the project is viable and represents a value for money investment. At this point, stakeholders may choose to invest in the project in order to progress it through final design stages, tendering and ultimately to construction.

Actions 1 to 4 may be conducted as stand-alone projects or as early stage work of the detailed business case. Conducting Actions 1 to 4 simultaneously, as part of a detailed business case, would create time and cost efficiencies. However, there is a risk that Actions 1 to 4 could demonstrate that the project is not viable. This risk can be managed through an early review trigger that allows the project to be independently assessed prior to proceeding further.

Table I.1: Boyne River weir implementation

Action 1	**Conduct demand assessment**
Description	A demand assessment should be conducted with the prospective water customers, being the Boyne River irrigators. The purpose of this demand assessment is to validate the demand for water and confirm the water price that would maximise the affordability of the project. This demand assessment would seek non-binding commitments from irrigators. As this project increases the reliability for all irrigators, rather than additional water for some irrigators, it is very important that all current irrigators are consulted, as all will be impacted.
Dependencies	This action will impact on and influence decisions regarding the design of the weir. Subsequent activities could be contingent on the identification of sufficient demand and the willingness of water users to meet the associated costs. It should be noted that a secondary demand assessment will be required as part of the detailed business case to confirm final demand at the water price set by the infrastructure design.
Timeframe	This would take approximately 2 months
Indicative estimated costs	$60,000 to $80,000
Stakeholder consultations	This action would involve significant stakeholder consultations with the water customers, BEIDO, North Burnett Regional Council and the Department of State Development.

Action 2	Identify optimal location for weir on the Boyne River
Description	Geotechnical, hydrological and stakeholder investigation should be conducted to determine the optimal location on the Boyne River for the weir. The site should maximise and balance the safety, efficiency and performance of the weir.
Dependencies	Preliminary site investigations have been undertaken and three sites have been identified. The availability and any constraints associated with a suitable site for a weir will influence the volume of water that can be supplied and the costs of constructing, operating and maintaining a weir and associated infrastructure.
Timeframe	Approximately 3-5 months.
Indicative estimated costs	$150,000 to $250,000
Stakeholder consultations	Consultations should be conducted with the water customers, BEIDO and South Burnett Regional Council, and Sunwater.
Action 3	**Identify any impediments in the Water Act or associated instruments**
Description	Assessment of the project's ability to comply with the Burnett Basin Water Plan and associated instruments is needed to identify any potential constraints on construction and operation of a weir and if/how any such constraints can be addressed.
Dependencies	If there are any constraints due to compliance issues with the Burnett Basin Water Plan these may affect the viability of the project or may need to be addressed through particular design features and/or operational aspects.
Timeframe	Approximately 1-2 months.
Indicative estimated costs	$50,000
Stakeholder consultations	Consultations should be conducted with DNRME.
Action 4	**Environmental approvals**
Description	Identify constraints in obtaining environmental approvals: ▪ Conduct a' self-assessment' of the project on MNES in accordance with the Matters of National Environmental Significance to determine if the project is likely to involve a controlled action. ▪ In conjunction with the self- assessment, conduct a gap analysis of available project information relating to environmental impacts to identify additional technical investigations required to inform understanding of the nature and extent of project impacts on MNES and enable the self- assessment to be completed (e.g. aquatic and terrestrial ecology surveys of project impact area) ▪ Complete the additional technical investigation required to complete the self-assessment ▪ Refer the project to Department of Agriculture, Water and the Environment, if required ▪ Engage with the Office of the Coordinator General to determine the need for an EIS and most appropriate assessment pathway.
Dependencies	The environmental approvals are influenced by the design of the project and vice-versa. Whilst an early assessment will identify any critical issues, subsequent applications for the required approvals will need to occur in concert with design works and other considerations.
Timeframe	Six months
Indicative estimated costs	$200,000 to $300,000

Stakeholder consultations	Consultations should be conducted with DNRME, DAWE, Coordinator-general
Action 5	**Detailed Business Case**
Description	A Building Queensland compliant detailed business case will clarify the viability of the project and support consideration by all stakeholders as to whether the project represents value for money. This will include, at least: • engineering design and comprehensive engineering requirements, • final P90 cost estimate, • final stage demand assessment (with solid commitments from water customers), • final determination of necessary changes (if any) to the Water Plan, Resource Operations Licence, Operations Manual and the Water Management Protocol, and • all other economic, financial and environmental investigations required as part of the detailed business case.
Dependencies	Actions 1 to 4 will highlight any early stage issues that may impact the viability of the project and influence whether a DBC is undertaken. A DBC will itself influence potential involvement by stakeholders should the project proceed to final design, costing and beyond.
Timeframe	9-12 months
Indicative estimated costs	$2.5 to $3.0 million. Estimated cost breakdown: A. Proponent budget - $250,000 • Appointment of consultant – $10,000 • Client project manager - $110,000 • Technical reviews and general costs and expenses – $120,000 B. Lead consultant for business case - $1.75 to $2.69 million • Secondary demand Assessment to project design and stakeholder engagement - $120,000 to $160,000 • Geotechnical investigation - $560,000 to $620,000 • Environmental assessment - $100,000 to $130,000 • Detailed design - $350,000 to $500,000 • Detailed business case - $700,000 to $850,000 • Project management, legal analysis, travel and contingency - $330,000 to $400,000 These indicative cost estimates do not include the amounts for items in Actions 1 to 4.
Stakeholder consultations	The detailed business case would involve considerable stakeholder engagement with water customers, BEIDO and South Burnett Regional Council, Sunwater, the Department of Natural Resources, Mining and the Environment and other State Government bodies.
Action 6	**Environmental Impact Statement**
Description	If the detailed business case determines that an EIS is required, then this investigation will satisfy the regulatory requirements for environmental reviews and approvals
Dependencies	If required, this would occur after the completion of the detailed business case

Timeframe	9-15 months. While some environmental impact statements can take up to 24 months, it is not anticipated that length of time will be required for a project of this size.
Indicative estimated costs	$2.5 million
Stakeholder consultations	This will involve necessary consultations with community, environmental and government stakeholders.
Action 7	**Native title and cultural heritage**
Description	If the detailed business case determines that there are native title or cultural heritage application and approval requirements, then these will be required to allow the project to proceed.
Dependencies	If required, this would occur after the completion of the detailed business case
Timeframe	9-15 months.
Indicative estimated costs	$250,000
Stakeholder consultations	This will involve necessary consultations with indigenous, community, and government stakeholders.
Action 8	**Post DBC and Pre-construction activities**
Description	There are range of activities that will need to occur post DBC and following investment decision to finalise and get the project ready for construction. For example, the project proponent may need to engage a suitable owner's engineer and consultant to manage the final requirements to get the project ready for construction. This would include preparing managing the strict procurement requirements, binding water sales and management of approvals and potential changes to water regulations. The detailed business case will have indicated if amendments are required to the Water Plan and other legal instruments.
Dependencies	After completion of the detailed business case and confirmation from stakeholders that they are willing to invest sufficient funding to meet construction costs for the project.
Timeframe	12 months
Indicative estimated costs	$1 million to 1.4 million Estimated cost breakdown: A. Proponent budget - $350,000 • Engagement of project manager – $100,000 • Project tender specification and management – $250,000 B. Lead consultant for pre-construction activities - $750,000 to $1.05 million • Water sales - $80,000 to $150,000 • Owners engineer - $550,000 to $700,000 • Other approvals and legal requirements - $120,000 to $200,000
Stakeholder consultations	The detailed business case would involve considerable stakeholder engagement with water customers, BEIDO and South Burnett Regional Council, Sunwater, the Department of Natural Resources, Mining and the Environment and other State Government bodies.

I.2 Construct a re-regulating weir on Barambah Creek (Barlil Weir)

The table below sets out the actions required to continue to assess the viability of this project, to provide sufficient information to enable all stakeholders to consider if the project represents a worthwhile investment and advance towards construction.

General outline:

- Actions 1 to 3 are early and low-cost activities that will address gaps in current knowledge and identify any potentially significant challenges, thereby enabling stakeholders to determine whether the project should proceed to a detailed business case stage.
- Action 4 includes more detailed assessment of technical, environmental, financial and economic matters for the preferred option, in order to support robust consideration of potential investment options by stakeholders.
- Actions 5 and 6 may occur depending on requirements that will become apparent as work proceeds through a detailed business case.

At the conclusion of these actions, stakeholders should be in a position to consider whether the project is viable and represents a value for money investment. At this point, stakeholders may choose to invest in the project in order to progress it through final design stages, tendering and ultimately to construction.

Actions 1 to 3 may be conducted as stand-alone projects or as early stage work of the detailed business case. Conducting Actions 1 to 3 simultaneously, as part of a detailed business case, would create time and cost efficiencies. However, there is a risk that Actions 1 to 3 could demonstrate that the project is not viable. This risk can be managed through a mid-project review that allows the project to be independently assessed prior to proceeding further.

Table I.2: Barlil Weir implementation

Action 1	**Conduct demand and willingness to pay assessment**
Description	A demand assessment should be conducted with the prospective water customers on Barambah Creek. The purpose of this demand assessment is to validate the demand for water and confirm the water price that would maximise the affordability of the project. This demand assessment would seek non-binding commitments from irrigators.
Dependencies	This action will impact on and influence decisions regarding the design of the weir. Subsequent activities could be contingent on the identification of sufficient demand and the willingness of water users to meet the associated costs. It should be noted that a secondary demand assessment will be required as part of the detailed business case to confirm final demand at the water price set by the infrastructure design.
Timeframe	This would take approximately 2 months
Indicative estimated costs	$60,000 to $80,000
Stakeholder consultations	This action would involve significant stakeholder consultations with the water customers, South Burnett Regional Council and the Department of State Development.
Action 2	**Consultation with Sunwater**
Description	As a critical stakeholder there should be intensive and direct consultation with Sunwater to identify project viability, including in relation to the interaction with existing infrastructure within the scheme.
Dependencies	This action will influence viability of the project and so should be undertaken as early in the process as possible.
Timeframe	Approximately 2 months.

Indicative estimated costs	$50,000 to $100,000
Stakeholder consultations	Sunwater, South Burnett Regional Council, State Government
Action 3	**Environmental approvals**
Description	Barlil Weir received State and Commonwealth approval in 2002, including approval of the findings of the Review of Environmental Factors (1998). This action will identify the most efficient and effective mechanism to update, or obtain new, environmental approvals. This would include: ▪ Engage with the Office of the Coordinator General to determine the need for an EIS and most appropriate assessment pathway. ▪ (If required) Conduct a' self-assessment' of the project on MNES in accordance with the Matters of National Environmental Significance to determine if the project is likely to involve a controlled action. ▪ (If required) In conjunction with the self- assessment, conduct a gap analysis of available project information relating to environmental impacts to identify additional technical investigations required to inform understanding of the nature and extent of project impacts on MNES and enable the self- assessment to be completed (e.g. aquatic and terrestrial ecology surveys of project impact area) ▪ (If required) Complete the additional technical investigation required to complete the self-assessment ▪ (If required) Refer the project to Department of Agriculture, Water and the Environment
Dependencies	The environmental approvals are influenced by the design of the project and vice-versa. Whilst an early assessment will identify any critical issues, subsequent applications for the required approvals will need to occur in concert with design works and other considerations.
Timeframe	3 months
Indicative estimated costs	$50,000 to $300,000
Stakeholder consultations	Consultations should be conducted with DNRME, DAWE, Coordinator-general
Action 4	**Detailed Business Case**
Description	A Building Queensland compliant detailed business case will clarify the viability of the project and support consideration by all stakeholders as to whether the project represents value for money. This will include, at least: • engineering design and comprehensive engineering requirements, • final P90 cost estimate, • final stage demand assessment (with solid commitments from water customers), • final determination of necessary changes (if any) to the Water Plan, Resource Operations Licence, Operations Manual and the Water Management Protocol, and • all other economic, financial and environmental investigations required as part of the detailed business case.
Dependencies	Actions 1 to 3 will highlight any early stage issues that may impact the viability of the project and influence whether a DBC is undertaken. A DBC will itself influence potential involvement by stakeholders should the project proceed to final design, costing and beyond.

Timeframe	9-12 months
Indicative estimated costs	$2.2 to $2.74 million. Estimated cost breakdown: Proponent budget - $300,000 • Appointment of consultant – $30,000 • Client project manager - $160,000 • Technical reviews and general costs and expenses – $110,000 Lead consultant for business case - $1.90 to $2.44 million • Secondary demand Assessment to project design and stakeholder engagement - $120,000 to $160,000 • Geotechnical investigation - $350,000 to $450,000 • Environmental assessment - $100,000 to $130,000 • Detailed design - $300,000 to $450,000 • Detailed business case - $700,000 to $850,000 • Project management, legal analysis, travel and contingency - $330,000 to $400,000 These indicative cost estimates do not include the amounts for items in Actions 1 to 4.
Stakeholder consultations	The detailed business case would involve considerable stakeholder engagement with water customers, South Burnett Regional Council, Sunwater, the Department of Natural Resources, Mining and the Environment and other State Government bodies.
Action 5	**Environmental Impact Statement (if required – see Action 3)**
Description	If the detailed business case determines that an EIS is required, then this investigation will satisfy the regulatory requirements for environmental reviews and approvals. Action 3 may identify that more limited environmental assessment or review is required to update the existing environmental approvals. This would be expected to require less time and cost than the full EIS.
Dependencies	If required, this would occur after the completion of the detailed business case
Timeframe	9-15 months. While some environmental impact statements can take up to 24 months, it is not anticipated that length of time will be required for a project of this size. This time period would be expected to be less if a full EIS is not required.
Indicative estimated costs	$2.5 million. This amount would be expected to be less if a full EIS is not required
Stakeholder consultations	This will involve necessary consultations with community, environmental and government stakeholders.
Action 6	**Native title and cultural heritage**
Description	If the detailed business case determines that there are native title or cultural heritage application and approval requirements, then these will be required to allow the project to proceed.
Dependencies	If required, this would occur after the completion of the detailed business case
Timeframe	9-15 months.

Indicative estimated costs	$250,000
Stakeholder consultations	This will involve necessary consultations with indigenous, community, and government stakeholders.
Action 7	**Post DBC and Pre-construction activities**
Description	There are range of activities that will need to occur post DBC and following investment decision to finalise and get the project ready for construction. For example, the project proponent may need to engage a suitable owner's engineer and consultant to manage the final requirements to get the project ready for construction. This would include preparing managing the strict procurement requirements, binding water sales and management of approvals and potential changes to water regulations. The detailed business case will have indicated if amendments are required to the Water Plan and other legal instruments.
Dependencies	After completion of the detailed business case and confirmation from stakeholders that they are willing to invest sufficient funding to meet construction costs for the project.
Timeframe	12 months
Indicative estimated costs	$1.9 million to 2.7 million Estimated cost breakdown: C. Proponent budget - $650,000 • Engagement of project manager – $100,000 • Legal and contracts - $300,000 • Project tender specification and management – $250,000 D. Lead consultant for pre-construction activities - $1,250,000 to $2.05 million • Water sales - $80,000 to $150,000 • Owners engineer - $550,000 to $700,000 • Environmental approvals – 500,000 1,000,000 • Other approvals and legal requirements - $120,000 to $200,000
Stakeholder consultations	The detailed business case would involve considerable stakeholder engagement with water customers South Burnett Regional Council, Sunwater, the Department of Natural Resources, Mining and the Environment and other State Government bodies.

I.3 Coalstoun Lakes options

This section applies to the next steps for:

- Up to 65,000ML storage on Barambah Creek and irrigation network primarily for Coalstoun Lake.
- Build a pipeline from Paradise Dam to Coalstoun Lakes.
- Raise Jones Weir, Raise Claude Wharton Weir and build a weir on the Burnett River, downstream of the confluence with the Barambah Creek irrigation network primarily for Coalstoun Lakes.

The table below sets out the actions required to continue to assess the viability of these projects, to provide sufficient information to enable all stakeholders to consider if the project represents a worthwhile investment and advance towards construction. It is noted that funding has already been provided under the NWIDF scheme for a detailed business case, and so the cost estimates in this section have been framed to fit within the scope of that funding.

General outline:

- Action 1 is a set of early and low-cost activities that will determine the direction and scope of the detailed business case.
- Action 2 includes is the detailed assessment of technical, environmental, financial and economic matters for the preferred option, in order to support robust consideration of potential investment options by stakeholders.
- Actions 3 and 4 may occur depending on requirements that will become apparent as work proceeds through a detailed business case.

At the conclusion of these actions, stakeholders should be in a position to consider whether the project is viable and represents a value for money investment. At this point, stakeholders may choose to invest in the project in order to progress it through final design stages, tendering and ultimately to construction.

Action 1 may be conducted as stand-alone project or as early stage work of the detailed business case.

Table I.3: Coalstoun Lakes options implementation

Action 1	**Determine the option(s) for detailed business case**
Description	The three potential options for Coalstoun Lakes should be further assessed to determine which option or options are suitable for a detailed business case based on a cost benefit, and affordability, assessment. This Action should include some, or all of: ▪ Demand assessment. ▪ Preliminary economic analysis. ▪ Geotechnical risk assessment. ▪ Infrastructure optimisation and costing. ▪ Operational costs optimisation and costing.
Dependencies	This action will impact and influence the analysis in the detail business case and direct the investigations to the option or options that are most viable for Coalstoun Lakes.
Timeframe	This would take approximately 3 months
Indicative estimated costs	$225,000 to $350,000

Stakeholder consultations	This action would involve significant stakeholder consultations with the water customers, North Burnett Regional Council, the Department of State Development and other State Government bodies.
Action 2	**Detailed Business Case**
Description	A Building Queensland compliant detailed business case will clarify the viability of the project and support consideration by all stakeholders as to whether the project represents value for money. This will include, at least: • engineering design and comprehensive engineering requirements, • final P90 cost estimate, • final stage demand assessment (with solid commitments from water customers), • final determination of necessary changes (if any) to the Water Plan, Resource Operations Licence, Operations Manual and the Water Management Protocol, and • all other economic, financial and environmental investigations required as part of the detailed business case.
Dependencies	Actions 1 will focus the detailed business case on 1 or 2 options for Coalstoun Lakes. There will be some differences in the required works under a detailed business case depending on which option or options progress to the detailed business case.
Timeframe	9-12 months
Indicative estimated costs	$1.52 to $2.28 million. Estimated cost breakdown: A. Proponent budget - $400,000 • Appointment of consultant – $30,000 • Stakeholder engagement and education - $50,000 • Client project manager - $200,000 • Technical reviews and general costs and expenses – $120,000 B. Lead consultant for business case - $1.15 to $1.88 million • Secondary demand Assessment to project design and stakeholder engagement - $80,000 to $120,000 • Geotechnical investigation - $200,000 to $450,000 • Environmental assessment - $100,000 to $140,000 • Detailed design - $170,000 to $270,000 • Detailed business case - $400,000 to $600,000 • Project management, legal analysis, travel and contingency - $200,000 to $300,000 These indicative cost estimates do not include the amounts for items in Action 1. The cost estimates in this section have been developed in the context of the cost limit set by the NWIDF funding. As a result, the costs in this section are below the amount for similar tasks for other options in this Options Analysis. This will invariably mean that the scope for these works will need to be agreed with the appointed consultant to ensure Building Queensland requirements are satisfied.
Stakeholder consultations	The detailed business case would involve considerable stakeholder engagement with water customers, North Burnett Regional Council, Sunwater, the Department of Natural Resources, Mining and the Environment and other State Government bodies.

Action 6	Environmental Impact Statement
Description	If the detailed business case determines that an EIS is required, then this investigation will satisfy the regulatory requirements for environmental reviews and approvals.
Dependencies	If required, this would occur after the completion of the detailed business case
Timeframe	9-15 months. While some environmental impact statements can take up to 24 months, it is not anticipated that length of time will be required for a project of this size. This time period would be expected to be less if a full EIS is not required.
Indicative estimated costs	$2.5 million.
Stakeholder consultations	This will involve necessary consultations with community, environmental and government stakeholders.
Action 7	**Native title and cultural heritage**
Description	If the detailed business case determines that there are native title or cultural heritage application and approval requirements, then these will be required to allow the project to proceed.
Dependencies	If required, this would occur after the completion of the detailed business case
Timeframe	9-15 months.
Indicative estimated costs	$250,000
Stakeholder consultations	This will involve necessary consultations with indigenous, community, and government stakeholders.
Action 8	**Post DBC and Pre-construction activities**
Description	There are range of activities that will need to occur post DBC and following investment decision to finalise and get the project ready for construction. For example, the project proponent may need to engage a suitable owner's engineer and consultant to manage the final requirements to get the project ready for construction. This would include preparing managing the strict procurement requirements, binding water sales and management of approvals and potential changes to water regulations. The detailed business case will have indicated if amendments are required to the Water Plan and other legal instruments.
Dependencies	After completion of the detailed business case and confirmation from stakeholders that they are willing to invest sufficient funding to meet construction costs for the project.
Timeframe	12 months
Indicative estimated costs	$2.9 million to 3.7 million Estimated cost breakdown: E. Proponent budget - $650,000 • Engagement of project manager – $100,000 • Legal and contracts - $300,000 • Project tender specification and management – $250,000 • Compliance and operations requirements - $1,000,000 F. Lead consultant for pre-construction activities - $1,250,000 to $2.05 million • Water sales - $80,000 to $150,000

	• Owners engineer - $550,000 to $700,000 • Environmental approvals – 500,000 to 1,000,000 • Other approvals and legal requirements - $120,000 to $200,000
Stakeholder consultations	The detailed business case would involve considerable stakeholder engagement with water customers South Burnett Regional Council, Sunwater, the Department of Natural Resources, Mining and the Environment and other State Government bodies.

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