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Lockyer Valley & Somerset Water Security Scheme

Detailed Business Case

November 2020

Project Partners

Water for the Lockyer Detailed Business Case

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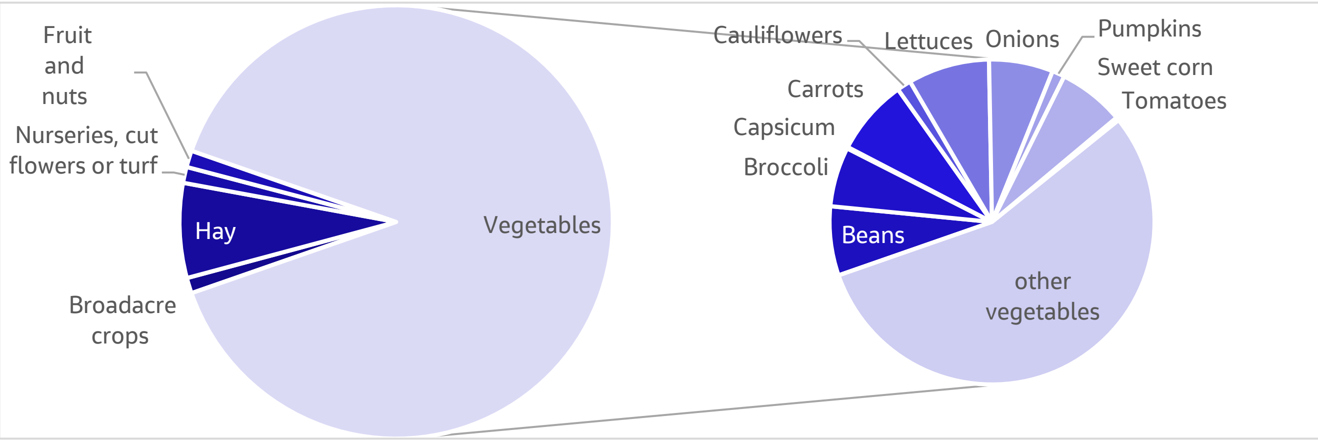
Executive Summary

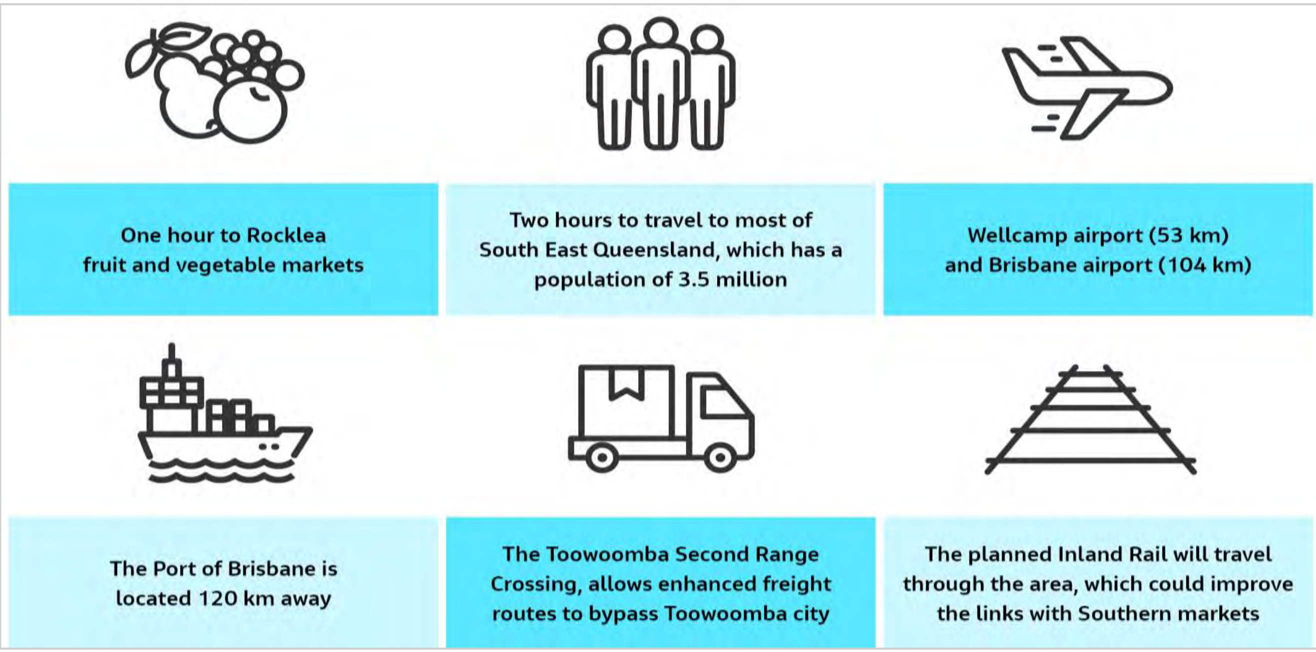
The Lockyer Valley in South East Queensland, located 90 km west of Brisbane, is a highly productive agricultural area. This business case defines the Lockyer Valley as including both the Lockyer Valley Regional Council and Somerset Regional Council local government areas. In recognition of Lockyer Valley's potential to increase its agricultural production significantly, this detailed business case investigates an option for making more water available for irrigation and other high value uses throughout the valley. More water availability and security will deliver major benefits to the region.

The detailed business case provides support supplementing the existing poor performing water supplies and demonstrates that the economic benefits of doing so outweigh the costs. It recommends a project that consists of 297 km of new pipeline to deliver 34,000 ML of Wivenhoe Dam water. This will create an additional $210 million of annual agricultural production and 2,000 extra ongoing jobs. **The Benefit Cost ratio is 1.2.**

The value of crops produced in 2018-19 was $351 million. Vegetable production dominates the Lockyer Valley including beans, carrots, tomatoes and broccoli; however, the crop mix is dynamic and responds to changing market conditions. Export is a feature and can expand.

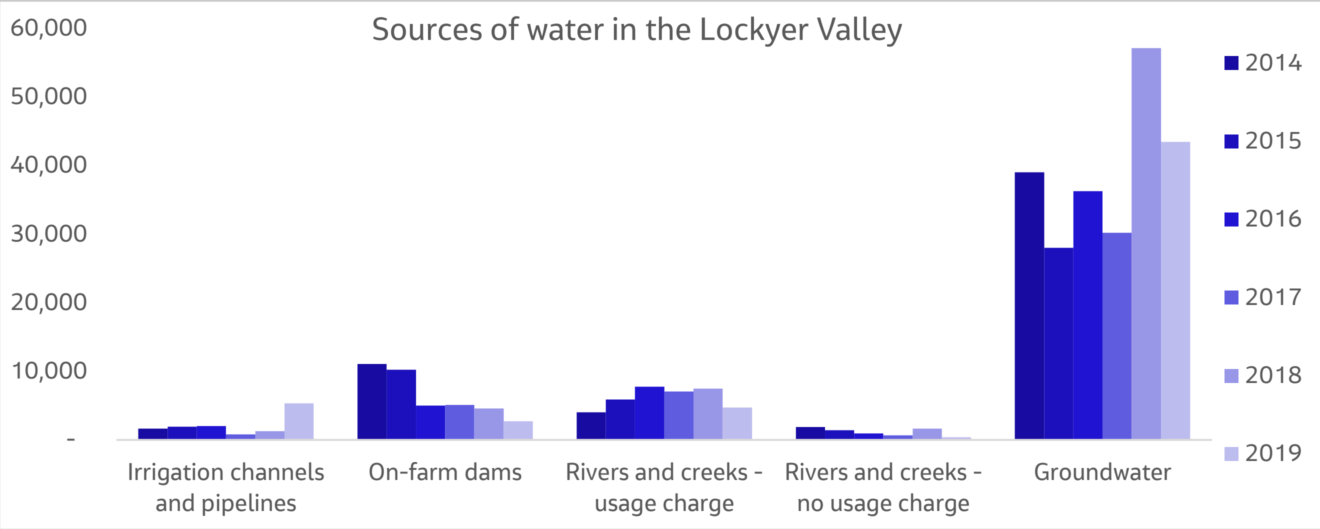


Significant industry opportunities continue to emerge in the region, including specialist food processing, food packaging, transport, and storage and new agritourism developments. The Lockyer Valley is strategically located in terms of transport with significant markets and transport links within easy access.



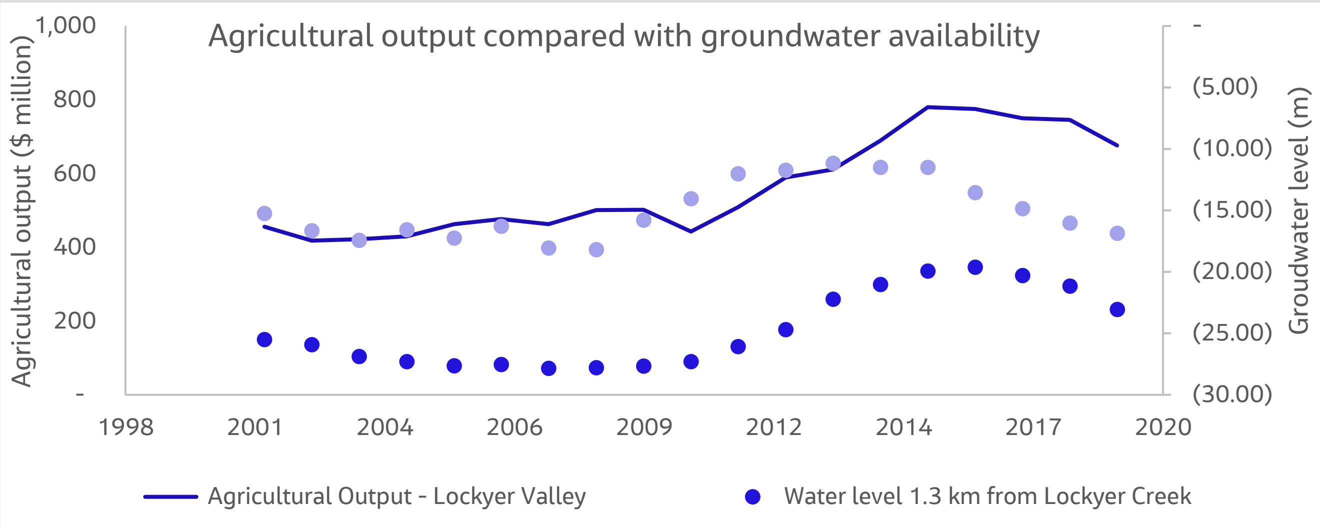
Existing water sources

Groundwater is the dominant water source in the region and is accessed through a series of private bores located on individual farms. The limiting factor to increasing agricultural growth and export is the availability of water.



There is a strong relationship between the water available in bores and agricultural production levels in the area. When water is available, production increases. When water availability decreases, production decreases.

Recent wet years, including the flood events in 2011 and 2013, resulted in a major recharge of the groundwater system, which was followed by a significant uplift in total agricultural production.



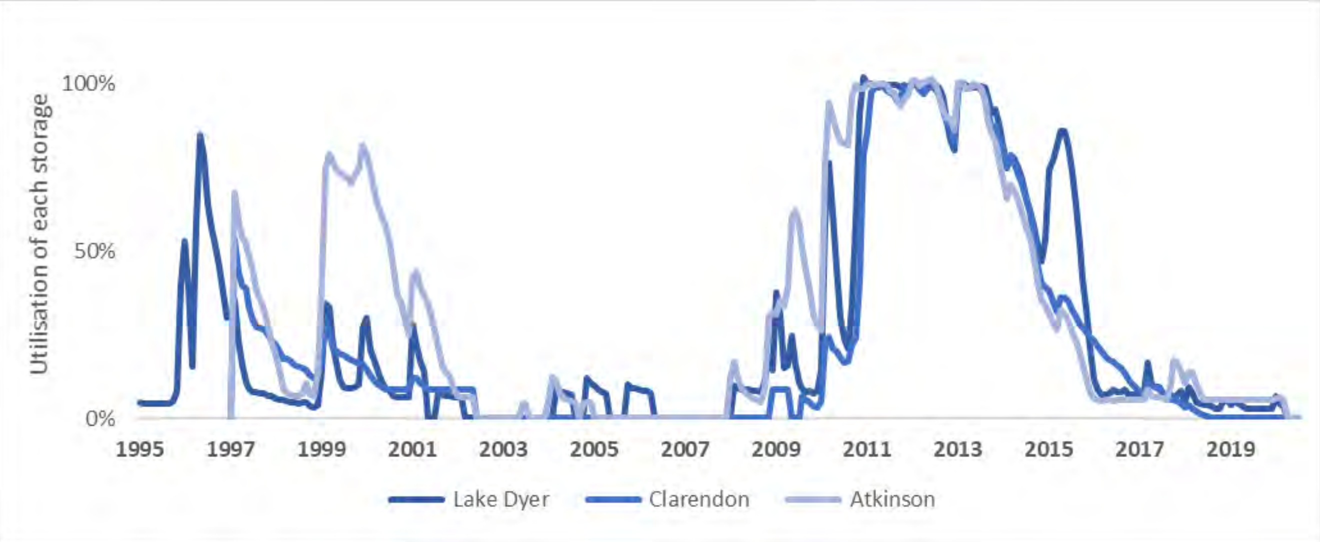
The figure above shows that as the groundwater near the creek is recharged (2009 to 2013), agricultural production increases. As the groundwater is recharged further from the creek (2010 to 2016), agricultural production continues to increase. In recent years, the drop in groundwater has resulted in a decrease in agricultural output. The impact of water availability is to increase total agricultural production from $400 million (2001 to 2010) to $800 million (2015).[1]

This relationship between groundwater availability and production is much stronger than the relationship between rainfall and production. This is likely because groundwater can be applied as it is needed and the

[1] Total agricultural production includes the value from all production sources, including cropping, livestock and value-added production.

availability of groundwater allows for planting to occur, with growers having confidence that the water needed to finish the crop is available. There is a strong benefit to be had, therefore, from increasing water security.

Seqwater owns and operates the Lower Lockyer and Central Lockyer Water Supply Schemes which include three off-stream dams. Since 1997, the dams have been 26% full on average, with prolonged periods of no water availability. There was very little water available between 2002 and 2008, and also since 2017.



These fluctuations result in variations in medium priority announced allocations. For example, in the Lower Lockyer water supply scheme (Atkinson Dam), since the last major drought, during the past 10 years, the announced allocation has averaged 52 per cent. Four years have started with a zero per cent announced allocation, while four years started with a 100 per cent allocation. The last four years have seen very limited water availability for local irrigators / Seqwater's customers.

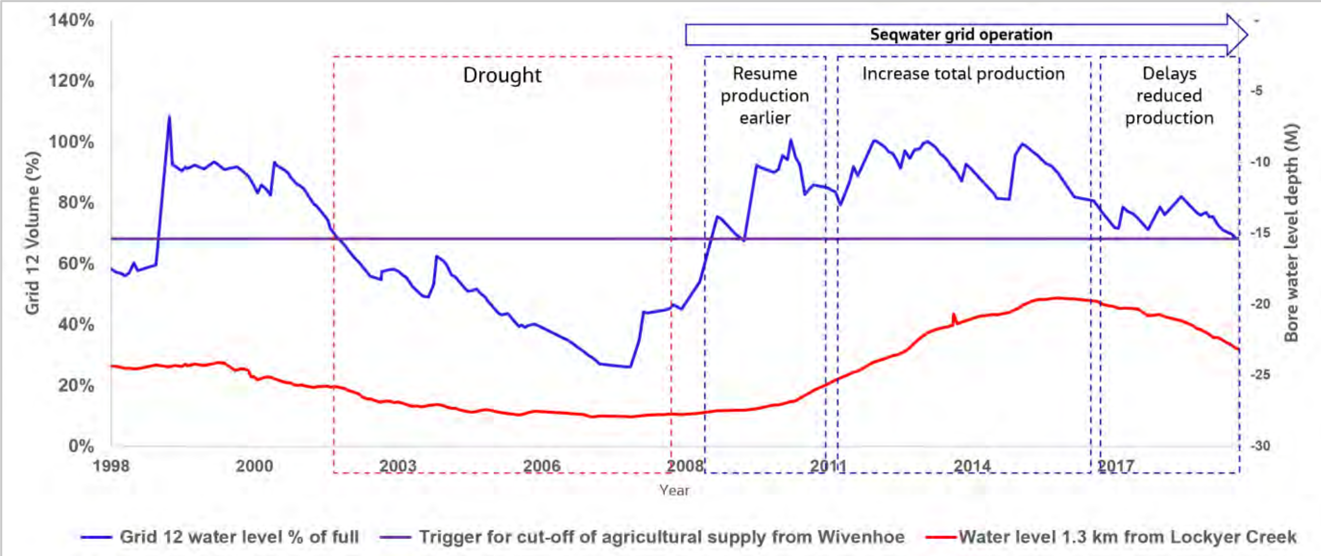
Benefits of additional water

The key benefit of this project is to supplement the existing water sources and to add to or complement the portfolio of water products. Water that is secure and reliable will allow irrigators to plan and plant with confidence and provides the greatest returns. It also enables intensive production and investment including in plant nurseries, turf farms, meat production and processing, quarrying and education and research.

As groundwater is the dominant water source, feedback from irrigators indicated that new water would be most valued if it were available when existing water sources were restricted or not available.

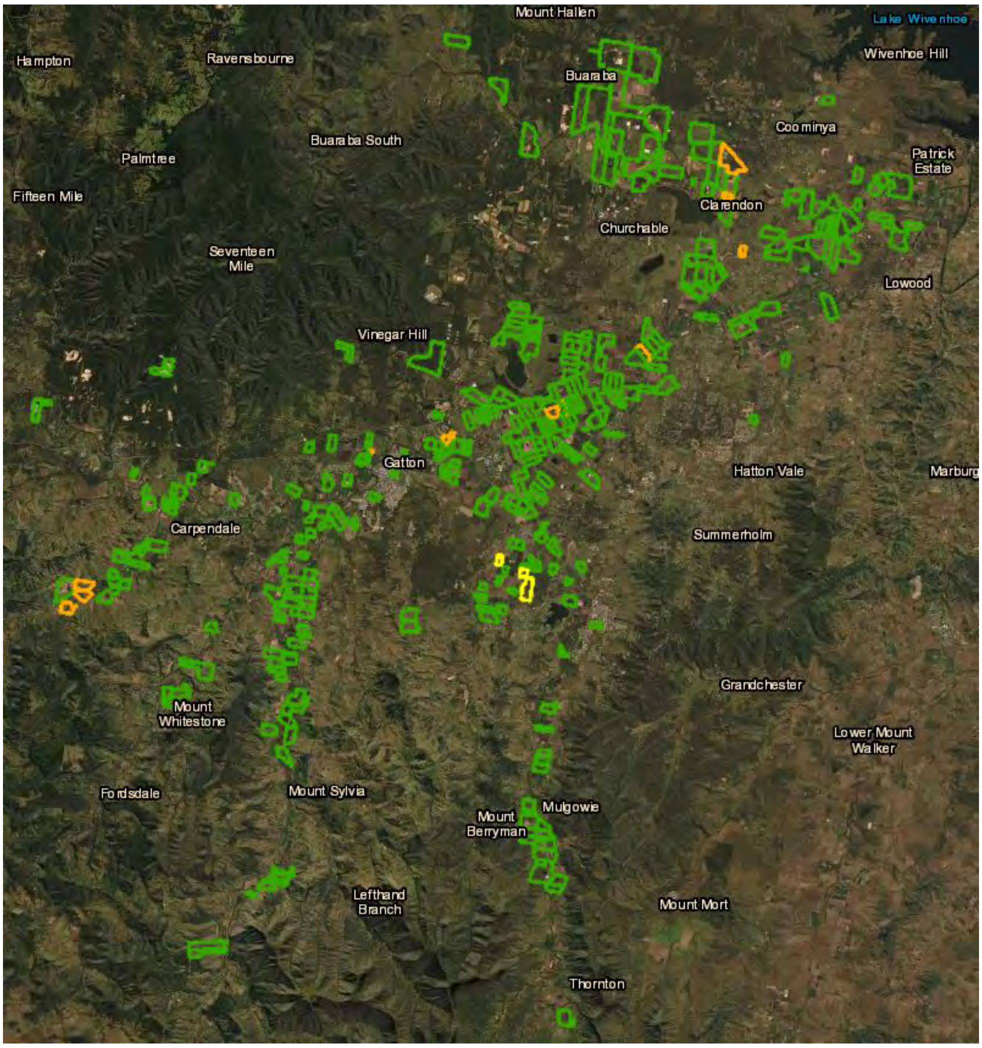
A review of the past 20 years shows when new water would be available from the project. There are four phases that would be experienced by customers, which are described here and depicted in the figure below:

- Drought – during the 2002 to 2008 millennium drought, groundwater levels were low. The South East Queensland Grid's 12 storages were also below 70 per cent. This means that water would not have been available for irrigators from the Seqwater storages. The project would not assist in deep drought.
- Production is resumed earlier – when the drought broke in 2009, the Seqwater dams filled much more quickly than the groundwater recharges. The new water will become available more quickly than the groundwater after a drought breaks and production can resume more rapidly after a drought. The benefit is for about two years of extra production, significantly helping the community to get back on its feet.
- Total production is increased – during a wet period, total production may opportunistically increase as the additional water can be used in addition with existing sources. This is the stacking impact of more water.
- Reduced production is delayed – when a new dry period starts, and groundwater levels decrease and salinity increases, water will still be available from Seqwater storages. This will allow additional groundwater use as the new water can be used to dilute the groundwater as salinity increases. This will allow irrigators to delay the impacts of a new drought and shorten its length. This benefit period lasts one or more years.



Demand for additional water

Jacobs ran a demand assessment process in two stages. This was necessary as the first-round tested demand at a wide range of prices. A design and costing processes were then undertaken to match demand and develop more accurate costs and prices. The second round of demand tested demand at a single capital price point and identified 34,000 ML of likely demand. These were mapped to individual blocks to inform scheme design.



Additional water security

The project will source water directly from Wivenhoe Dam, via a pump and pipeline network.

The project will also be connected to the three Lockyer storages (Lake Clarendon, Atkinson dam and Lake Dyer) to temporarily store any water that is taken from Wivenhoe but not immediately used by the project's customers. Any water stored in the airspace of the three Lockyer Valley storages will be accounted separately to, and not change (improve or diminish) hydrologic performance of, the water supplies of existing water entitlements in the Lower Lockyer and Central Lockyer Water supply schemes.

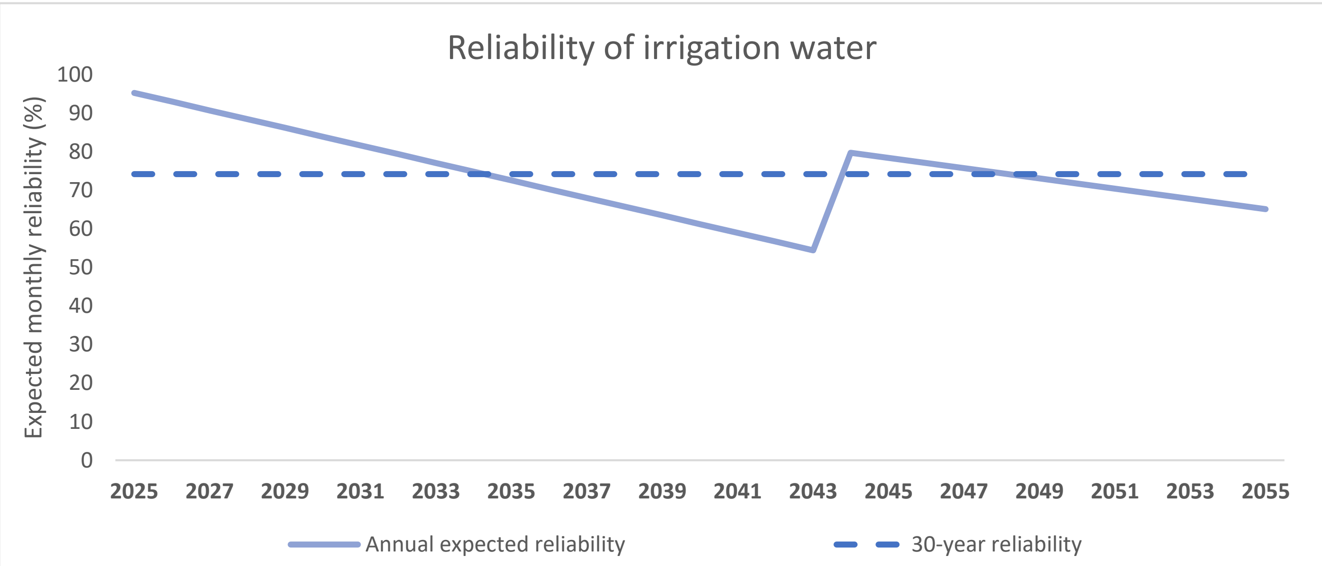
This detailed business case has undertaken modelling to confirm that taking water for irrigation from Wivenhoe Dam will not have an impact on South East Queensland's urban water security. This is done by increasing the triggers for when the manufactured water products are utilised to supplement South-East Queensland's urban water supply. The additional costs of the manufactured water will be paid for by irrigators.

Jacobs worked with Seqwater to understand hydrologic modelling (using WATHNET) that was commissioned by Seqwater and undertaken by WREMA to explore the average hydrologic performance of the project over time. This modelling also examined potential implications of the project's operations on the average hydrologic performance of South East Queensland's bulk water supply system over the long term.

For the proposed project, when the combined South East Queensland water storage volume (as represented by the water grid storage level) falls below a defined 'trigger level' then the manufactured water plants (i.e. the Tugun / Gold Coast desalination plant and the Western Corridor Recycled Water pipeline are assumed to be turned on at which time irrigation transfers from Wivenhoe Dam to the Lockyer Valley will reduce or cease.

This means that water supply for the Lockyer will be interrupted to prioritise urban water security.

The new water will have a long-term average monthly reliability of 75 per cent. However, this is expected to vary over time as shown below.



The underlying average hydrologic performance of the project is not static but instead fluctuates over time. As the existing assets need to continue to provide priority and water supply security to urban users, the growth in urban demand (due to population growth) will reduce the reliability for irrigation.

Seqwater is charged with meeting the urban water security objectives specified by the Queensland Government. Even without the addition of the project, as population and urban water demand increases over time, Seqwater will need to increase the capacity of South-East Queensland's bulk water supply system. For the purpose of this modelling exercise, this is assumed to occur in 2043.

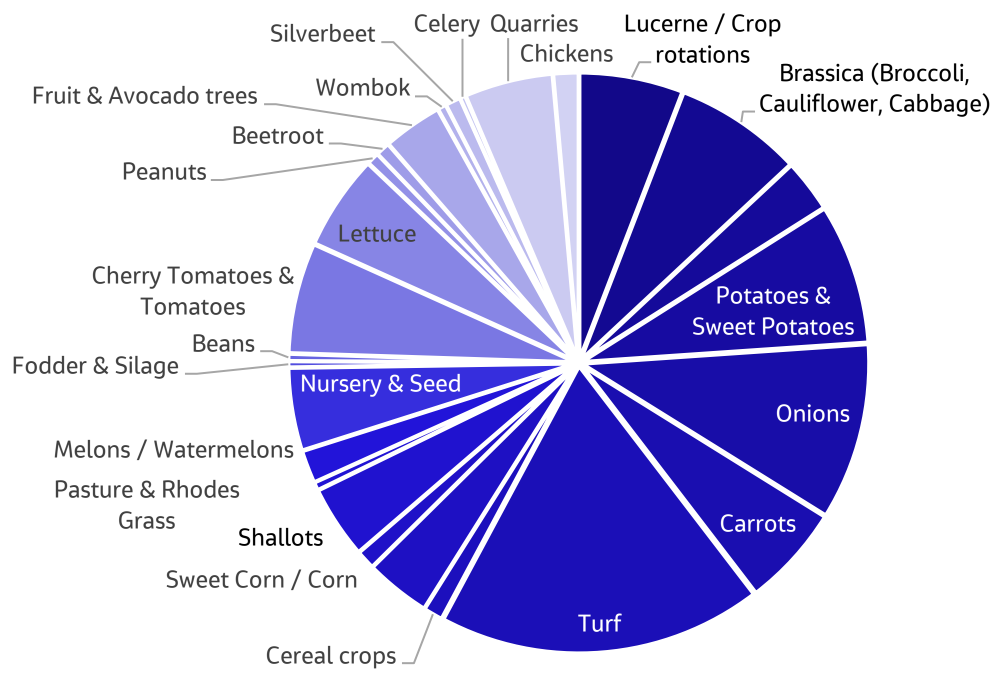
Consequently, the availability of water to Lockyer irrigators will decrease slowly over time until the urban capacity is increased in 2043. Once this occurs, reliability for irrigators is assumed to also increase. We have modelled a 30-year period; however, this pattern of irrigation reliability is assumed to vary between 55 per cent and 80 per cent beyond this period.

Additional economic benefits

This additional water will increase total agricultural production by **$210 million per year**. We have forecast the likely future crop mix based on:

- stated customer preference
- domestic market capacity
- export opportunities
- net margin.

This results in a broad crop mix as shown in the figure below.

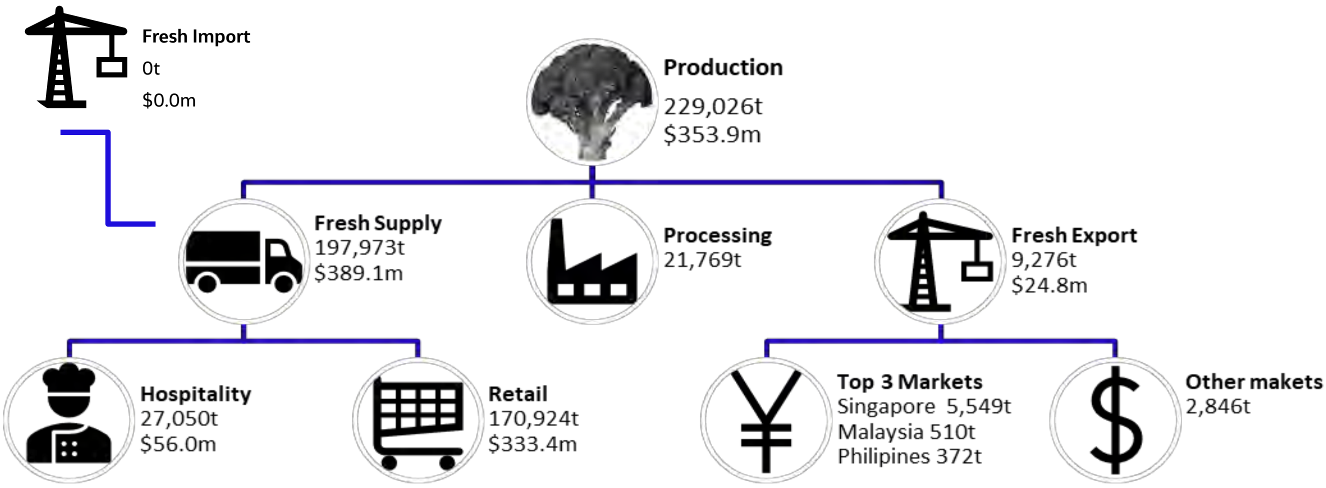


Economic benefits presented in this detailed business case are driven by net margins per ML of irrigation water applied, based on the production data collected during round-one of the demand assessment. The data informed likely future use (crop mix) for the new water. Net margins are driven by farm gate prices and in some cases an increase in production volumes (due to new water) can negatively impact those prices, particularly in our relatively small domestic market. To ensure the estimated economic benefits are realistic – and do not fail to materialise in the real world – Jacobs assessed all 24 enterprises (mainly crops) that will use the new water. After a multi-criteria assessment we identified the 15 crops with the most material impact on economic benefits. The results strongly support and were integrated with our crop mix and economic benefits assessment. The following is an example of this work (15 are available in the report).

Brassica exports – a case study

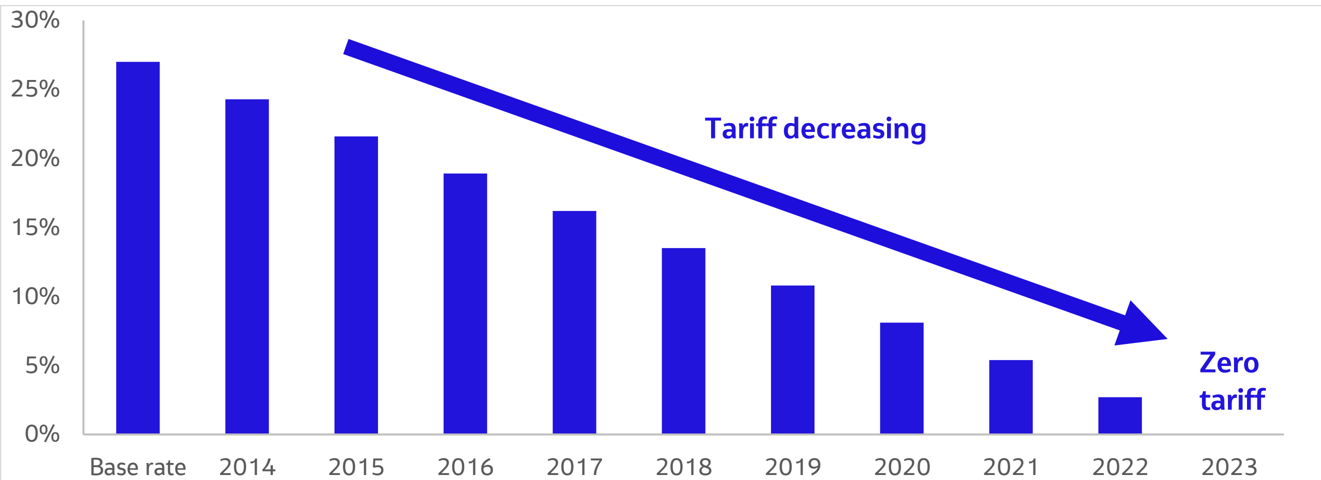
The additional agricultural production will allow for a substantial increase in exports. The brassica is a collective term for broccoli, broccolini, cabbage and cauliflower. In FY2019, about 229,026 tonnes of brassica were grown across Australia – with approximately 25 per cent grown in Queensland.

The Australia brassica market is dominated by retail trade, with over 75 % sold in retail supermarkets. Australian production volume of brassicas has grown by 6 % since 2017, while the value has increased by 34%. The following figure sets out Australia's brassica market supply chain and production characteristics in FY2019.[2]



It is estimated, that the project will increase production of brassica by 16,960 tonnes, which is 7.4 per cent of existing national production. Currently, only 4 per cent of brassicas are exported. However, there is potential for this to grow. The global market for brassica is $1.62 billion, and Australia only holds 1.34 per cent of that market. Australian exports of brassicas has increased by 14.8 per cent since 2017. Key markets include:

- Singapore: Australia exported 4,660 tonnes of brassica to Singapore in 2019, which has increased by 11per cent since 2017. Singapore was the 10th largest importer of brassica in the world in 2018, with $42.5 million of imports in that year. Australia has a good opportunity to increase its brassica exports to Singapore, as Australia is not subject to any import tariffs in Singapore under the Comprehensive and Progressive Agreement for Trans-Pacific Partnership.
- Malaysia: Australia exported 409 tonnes of brassica to Malaysia in 2019, which was a 94 per cent increase since 2017. Malaysia was the fifth largest importer of brassica in the world in 2018, with $89.2 million of imports in that year. Australia has a good opportunity to increase its brassica exports to Malaysia. Australian brassica is not subject to any import tariffs in Malaysia under the Malaysia-Australia Free Trade Agreement.
- South Korea: In 2018, Australia began exporting brassica to South Korea, a growing market for imported brassica. Under the Korea Australia Free Trade Agreement (KAFTA), the tariffs on Australian brassica in South Korea have reduced from 27 per cent in 2014 to 8 per cent in 2020. Tariffs on Australian brassica will reduce to zero at the beginning of 2023, giving a significant competitive advantage to Australian produce.



[2] The value of processed brassica cannot be accurately identified here due to the way the domestic and international data is collected and reported.

Jobs

This project will create a significant number of local jobs – both during construction and during operation. The project can be constructed using local contractors and local labour.

	Direct	Indirect	Total
Agricultural jobs (FTE)	584	1,339	**1,923**
Construction jobs (FTE)	109	264	**373**

Recreational benefits

Using the irrigation dams to store water will increase the utilisation of these storages, and therefore these storages will have more water in them. This will increase the opportunity for additional recreational activities (camping, fishing, boating, BBQ areas).

A storage with water in it is much more likely to attract visitors than an empty one and these lakes are expected to be significant regional tourism hub. Other regional dams have high visitor numbers and creates economic activity. For example, Moogerah Dam hosts a number of boating activities, when it is full. The local economic benefits include additional overnight stays, and increased spending at local businesses such as petrol, restaurants and take-away businesses.

Accordingly, we forecast that a further 5,500 visitors will visit annually, across Atkinson, Clarendon Dams and Lake Dyer. The increased visitors across three locations means that the benefits will be spread across the region. It is forecast that these visitors will inject a further $500,000 into the local economy each year.

What is needed to achieve these benefits?

To achieve the benefits of an additional 34,000 ML of supply, a pipe and pump network is required.

Lockyer Valley irrigation project snapshot	
Project volume	34,000 ML per annum
Delivery period	Project will operate 11 months of the year, with capacity to delivery all demand over 9 months
Number of customers	152
Number of properties connected	251
Length of pipeline	297 km
Number of pump stations	10
Total costs (P90)	**$186 million**

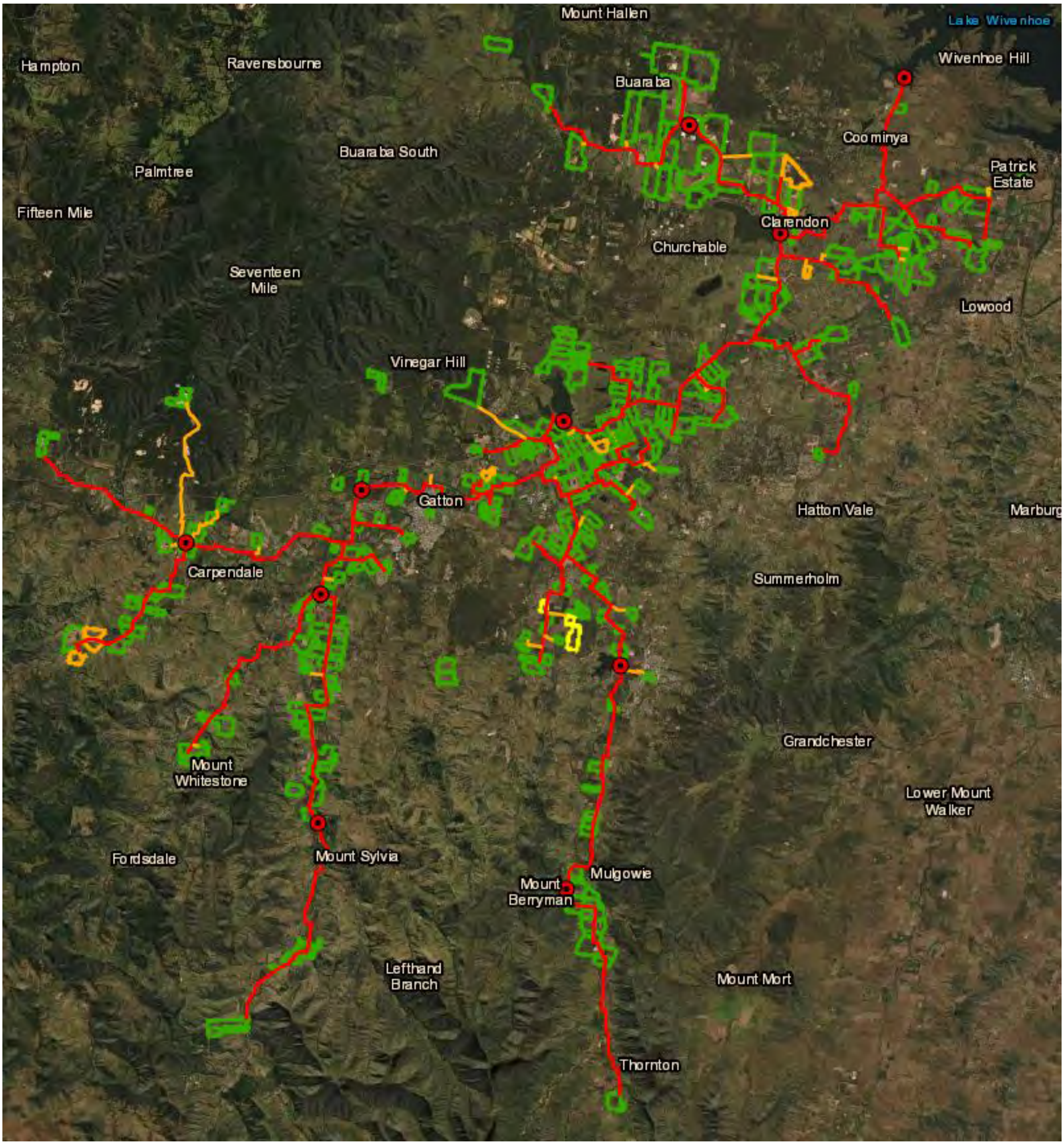
The core scheme design include 7MW of solar generation to power the pumping station during daylight hours. This reduces the ongoing prices for irrigators. During the two rounds of demand assessment, strong feedback was received regarding the sensitivity of ongoing annual charges.

Additional solar opportunity

To further reduce the ongoing or annual water charges paid by customers of the new scheme, an option considered was to increase the amount of solar generation up to a total project P90 capital cost cap of $200 million. This additional expenditure will double the amount of solar generation and reduce ongoing annual fixed prices by 20 per cent. This would help ensure against future cost increases, noting that the P90 of $186 million was robust and incorporated learnings from other projects (including the current Granite Belt post DBC phase).

Engineering design

Based on the 34,000 ML of likely demand identified during round-two demand assessment, the updated proposed pipeline route and the pump stations are shown below directly connecting all but three of the properties that expressed non-binding demand. Those that are not yet directly connected are working with the project team on cost-effective solutions and are supportive of the design. The scheme will be a 270-day scheme with water available 330-days of the year. This is a modest increase in flow rates from the 330-day scheme presented in Round 2. Substantial data collected from 90 irrigators after round-two demand assessment suggest that the increased flow rates could have increased likely demand to 35,000 ML, but this is uncertain.



Even if demand had been 35,000 ML, experience in other jurisdictions in the past ten years has shown that at round-three binding water sales, demand may fall (relative to non-binding demand).

A rule of thumb is:

- Up to 10% reduction in likely demand if confidence is high
- Up to 20% reduction in likely demand if confidence is moderate
- Up to 30% reduction in likely demand if confidence is low.

To mitigate the risk of demand falling, government may consider increased funding to enable the capital charge to be $1,500/ML (rather than $1,600/ML) and increase the investment in solar, resulting in lower annual charges. Such considerations are a matter for discussion between the Collaborative and the relevant levels of government.

Summary of economic outcomes

All scenarios result in a benefit cost ratio above one (1). There is a core scenario and an extra solar scenario.

Item	Core – 7MW solar	Additional solar – 14MW
Total benefits ($m)	304.5	304.5
Total costs – P90 ($m)	244.5	257.5
Net benefits NPV ($m)	**60.1**	**47.0**
BCR	**1.25**	**1.18**

The water product

Customers will pay upfront to purchase a right to take water. This is forecast to be $1,500 per ML. Customers will be a shareholder of the locally managed entity. Key aspects of the water product include:

- This is not a water allocation. Rather, it is a 25- or 30-year supply contract with an option to extend.
- The water product will be tradeable.
- The minimum guaranteed pressure is 5 meters of head or 50kpa (7psi) at the outlet.
- The water will be available over 24 hours a day, 7 days a week for 11 months (one month for shutdown). The capacity of the scheme is designed to allow irrigators to take all of their water over nine months, which aligns with optimal irrigation practices.

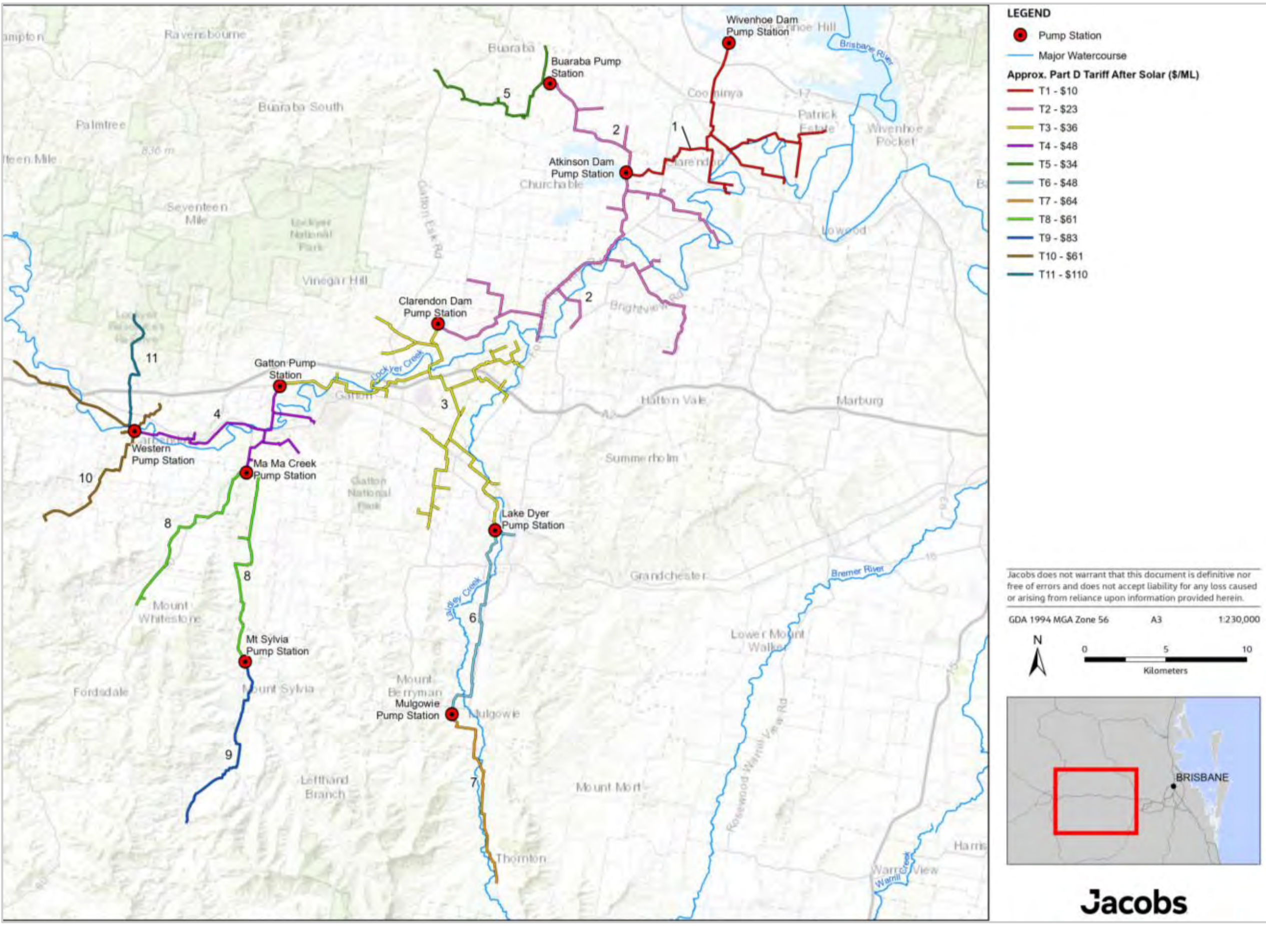
Financial contributions

To realise these substantial economic and wider benefits, there will need to be a contribution from irrigators, the Commonwealth and State Governments. Irrigators will fund all of the ongoing operating costs and the costs of replacing and renewal the asset over time.

A significant ongoing cost is for electricity to the 10 pumping stations. The inclusion of solar will reduce the grid energy required, and a significant amount of energy will be exported, benefitting the South East Queensland network.

The geography of the project means that some customers require a significant lift and water is pumped up to six times. Given the range of energy and cost requirements, the variable pumping charge will be differentiated according to the location of the customers' offtake.

The variable tariffs depend on the location of the outlet, as shown below.



Part of the ongoing costs relate to paying Seqwater for access to water from Wivenhoe Dam, based on the additional costs of producing more manufactured water. Jacobs has engaged with Seqwater to understand and model the costs; however, these prices have not been endorsed by Seqwater and will be considered by Seqwater in response to the full detailed business cases amongst all of the issues raised, including an assessment of any additional risk and how it is managed. These details can be negotiated between Seqwater and a company formed to build and run the project on behalf of irrigators.

Best practice is to align the costs with the recovery of that cost through prices. However, as water for irrigators are turned off when the manufactured water is being produced (and costs are incurred), there is misalignment between irrigation water use and Seqwater incurring costs. Therefore, a number of scenarios have been developed. Seqwater has not expressed a preference of any scenario at this stage. Irrigators have a strong preference for scenario 2 or scenario 3, as it aligns the cost with water use, and therefore revenue. This matter will need to be resolved subsequent to the conclusion of the business case.

	Scenario 1 (Seqwater charge all fixed)	Scenario 2 (Seqwater charge all variable)	Scenario 3 (Seqwater charge fixed and variable)
Part A (Seqwater bulk charge)	$210		$100
Part B (Seqwater variable charge)		$287	$161
Part C (fixed distribution costs) *	$65	$65	$65
Part D (variable distribution network electricity costs)	$10–$110 (weighted average is $39)	$10–$110 (weighted average is $39)	$10–$83 (weighted average is $39)

**Note: Part C costs reduce to $54 when 14 MW of solar is included. These costs have changed since round 2 demand assessment, reflecting the change in overall demand from 50,000 ML to 34,000 ML. This has resulted in fixed costs been recovered from a smaller volume of water, which has resulted in an increase to the Part C charge.*

Irrigators will also make a substantial contribution to the upfront capital cost of the project. However, the full costs will need to be shared between customers and government.

Party	Contribution for core project	Contribution for additional solar project (preferred)
Irrigators	$51 million	$51 million
State Government	$42 million	$49 million
Commonwealth Government	$93 million	$100 million
Total	**$186 million**	**$200 million**

Recommendations

The detailed business case makes the following four recommendations, subject to the Queensland Government deciding to recommission the Western Corridor Recycled Water Scheme to supplement urban water supplies:

Recommendation 1: Form a business entity and commence negotiations with Seqwater

It is recommended that an irrigation entity be established. This entity can negotiate with Seqwater the supply arrangements including:

- delivery regime and supply conditions, including triggers, which provides binding legal and operational protections that prioritise Seqwater's mandate to provide and protect urban water supply security in South-East Queensland.
- price and other contractual conditions that provide appropriate compensation for costs and risks incurred by Seqwater in the provision of water to the locally managed entity.

Recommendation 2: Commence pre-construction activities

It is recommended that the established irrigation entity commence pre-construction activities for the development of the preferred project model, including procuring an environmental assessment, undertaking formal water sales and all management, design, engineering and approvals required to prepare the project for construction.

Recommendation 3: Commonwealth and State governments provide in-principle financial support

It is recommended that the Commonwealth and State governments provide in-principle financial support subject to:

- Binding water sales
- Successful negotiation with Seqwater to contract for the supply of water
- Receiving the necessary permits and authorisations.

The Commonwealth should provide $100 million during the construction of the project. The State Government should provide $50 million, including an initial $10 million to fund pre-construction activities to become rapidly shovel-ready.

Recommendation 4: Proceed with construction of direct pipeline and irrigation network

It is recommended that the locally managed entity proceed with financing and construction of the preferred project model of purchasing water from Seqwater to be supplied from Wivenhoe Dam via a new trunk main and distribution network that utilises existing irrigation dams.

Next steps

Once the Australian and Queensland governments have approved this detailed business case and provided funding for the project there are several preconditions that must be met prior to construction commencing.

The pre-construction activities are likely to take between 15 and 24 months. The recommended implementation plan is outlined in Chapter 20. Due to the complexity and large volume of work required to manage the pre-construction activities, a qualified and experienced owner's engineer be engaged to oversee the activities, prepare necessary documentation and undertake key activities, such as binding water sales and various Government approvals. An EIS or IAR will be required and steps should be taken early in pre-construction as this is the activity that will take the longest time.

The WCWRS requires a decision by the Queensland Government in order to re-commission. While construction would not occur until the WCWRS is being re-commissioned, these negotiations should proceed. Negotiations between the LME and Seqwater are critical to the project and should be prioritised during pre-construction.

Binding water sales between the LME and water customers require careful management and stakeholder communication to maximise the value and efficiency of the water sales.

Acknowledgements

It is acknowledged the substantial knowledge, time and enthusiasm that has been contributed to the Detailed Business case by the Lockyer Valley and Somerset Water Collaborative (LV&SWC).

The LV&SWC membership consists of the Lockyer Valley Regional Council, Somerset Regional Council, Queensland Urban Utilities, Lockyer Valley Growers group and Lockyer Water Users Forum. In 2018, the LV&SWC appointed Mr Stephen Robertson as the independent Chair who has provided strategic guidance.

The representatives from each group on the LV&SWC are:

- Lockyer Valley Regional Council – Mayor Cr Milligan, Cr Michael Hagan, CEO Ian Church and Coordinator Special Projects Jason Harm
- Somerset Regional Council - Mayor Cr Graeme Lehmann, CEO Andrew Johnson and former CEO Bob Bain
- Queensland Urban Utilities – David Brooker and formerly Paul Belz
- Lockyer Growers Group Inc – Brock Sutton
- Lockyer Water Users Forum – Gordon Van Der Est and Greg Banff
- Lockyer Chamber of Commerce and Industry – Paul Emmerson and Alan McLucas

Throughout the development of the DBC the Collaborative received the invaluable support from LVRC's Stephen Hart and Helen McCraw.

The strength and success of the working collaborative is evident by its representation of over 300 potential irrigators, over 4000 businesses and two regional communities of Lockyer Valley & Somerset with a population base more than 50,000 residents. This group has collectively been driving the delivery of this project over the past two years for the greater benefit of their regions, Queensland and Australia through enabling better water and food security.

The extraordinary commitment to the project working group by Brock Sutton, Greg Banff and Gordon Van Der Est deserve special acknowledgement. They represented the interests of their individual organisations and contributed their vast local knowledge. Their commitment to the project enabled a true justification of the methodology, process used and the outcomes and recommendations contained in this Detailed Business case.

The Queensland Government contributed to the development of this business case through the Maturing the Infrastructure Pipeline Program.

1. Proposal background

1.1 Overview of detailed business case

This document is a detailed business case which is the final stage of the Building Queensland business case framework. It provides a rigorous and robust analysis necessary to fully inform investment decisions.

This business case follows the completion of a strategic business case in 2019 (findings summarised below) and builds on this analysis. A detailed business case provides in-depth analysis of the preferred options including social, environmental, sustainability, economic, financial and commercial considerations. In addition, a detailed business case sets up the implementation, governance and management arrangements for the successful procurement and final delivery of the proposal.

1.1.1 Previous studies

In 2018, a pre-feasibility study by Cardno estimated a potential additional demand for water of 15,000 to 45,000 ML per year, based on bringing currently unused high-quality land into production in the valley. Four options that were identified were water from Lake Wivenhoe; recycled water from local wastewater treatment plants; recycled water from the Western Corridor Recycled Water Scheme; and improved on-farm efficiency.

In 2018, The NuWater Project feasibility study investigated a proposed project to use recycled wastewater from the greater Brisbane area to reduce nutrient discharge to Moreton Bay, and expand agricultural production in the Lockyer Valley and the Darling Downs. GHD concluded that the project was not commercially viable and that the long-term costs outweighed the benefits. These poor economic and financial results were driven by the cost of pumping water over the Toowoomba Range to the Darling Downs, which is substantially further and higher than the Lockyer. A smaller-scale option of supplying just the Lockyer Valley was not assessed in detail.

In 2019, a strategic business case by Jacobs found that there was substantial opportunity for additional agricultural production and economic growth in the study area. The Water for the Lockyer strategic business case was developed under the Building Queensland Business Case guidelines and provides a strategic-level assessment of the opportunities, challenges, benefits and options of additional water supply.

1.1.2 Project opportunity

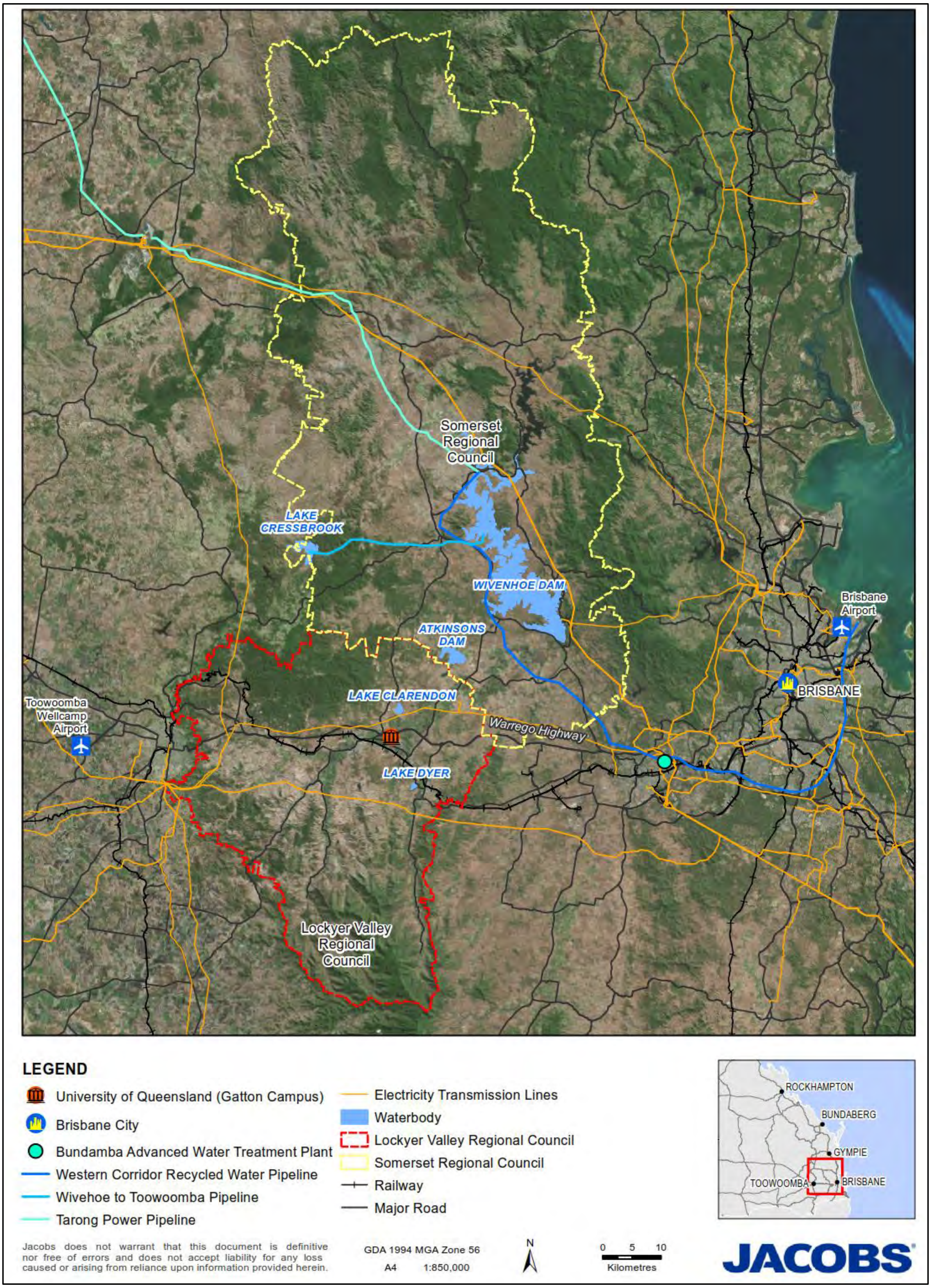
The Lockyer Valley in South East Queensland, located 90 km west of Brisbane, is a highly productive agricultural area. It is considered to be one of the 10 most fertile farming areas in the world, and has Australia's most diverse range of commercial fruit and vegetable production. The study area consists of the Lockyer Valley and Somerset regional council areas.

Total agricultural production in the study area is valued at over $523 million per year (2018-19), consisting almost entirely of vegetables and livestock production. The Lockyer Valley is one of Australia's most important food bowl areas. supplying most of Australia's vegetables during the winter months and accounting for 28 per cent of Queensland's total horticultural production. Significant industry opportunities continue to emerge in the region, including specialist food processing, food packaging, transport, and storage and new agritourism developments.

The irrigation water that underpins production in the region comes from a variety of sources, with groundwater currently being the major source. Seqwater operates two irrigation schemes in the valley, while some producers rely on farm storages and unsupplemented creeks for water.

The lack of sustainable and reliable water, rather than land availability, is the primary limiting factor in production within the Lockyer Valley. Groundwater and surface water sources are fully allocated. Existing water sources are unreliable. A significant expansion in production in the region will not be possible without the introduction of additional reliable water.

Figure 1.1: Map of Lockyer Valley—study area



1.2 Summary of the strategic business case

In 2019, Jacobs completed a strategic business case, which identified the following problems and opportunities:

- Lack of sustainable and reliable water limits opportunities for economic development and growth.
- Lack of cross-government (three-tier) policy coordination constrains investment.
- Leveraging the region's natural and competitive advantages would support economic growth.

The assessment and confirmation of the service need was informed through the development of a socio-economic baseline, investigations into the current reliability of supply, previous demand studies, stakeholder consultation, a land suitability assessment and consideration of market opportunities and policy objectives relevant to the area. Results confirmed that the lack of a sustainable and reliable water source was limiting the expansion of regional production, employment opportunities and broader economic development.

The service need was represented by an opportunity to significantly grow the economy and sustainability of the Lockyer region by 2030, with broader flow-on effects for South East Queensland, through:

- leveraging the region's natural and competitive advantages
- improving water reliability, supply, use and sustainability.

As part of this process, several workshops were held with the project working group. The workshops provided the opportunity to identify and develop the strategic responses. The following four strategic responses were identified to address the service need and clarify the benefits:

- Improve policy settings and coordination.
- Promote, attract and achieve regional economic growth, including addressing impediments to export.
- Improve water efficiency and innovation.
- Increase water supply and security.

1.2.1 Improve policy settings and coordination

Two benefits could be achieved by improving policy settings and coordination:

- Additional regional investment
- Encouraging commercially focused research and skill attainment.

This strategic response could attract additional regional investment by increasing investment certainty and improving the overall investment environment.

A related benefit is encouraging commercially focused research and skill attainment. This benefit could be realised if policy settings encouraged investment in regionally targeted research. Skills could also be developed if the research were undertaken in the region.

1.2.2 Promote, attract and achieve regional economic growth, including addressing impediments to export

Three benefits could be reached by promoting, attracting, and achieving regional economic growth, including addressing impediments to export:

- Increased sustainable agricultural production, value and economic activity
- Increased business and local value-add production, value and activity
- Additional regional investment.

Increased sustainable agricultural production would lead to increased business activity and opportunities for local value-add production. As economic activity increases, additional investment could follow.

1.2.3 Improve water efficiency and innovation

Three benefits could be delivered by improving water efficiency and innovation:

- Increased sustainable agricultural production, value and economic activity
- Additional regional investment
- Development of new markets.

It is critical that existing resources are used efficiently and effectively before additional resources are provided. If not, then it is more efficient to optimise existing resources. This relates both to on-farm water use and general agricultural productivity.

An increase in water efficiency and innovation will likely lead to an increase in agricultural production, value and economic activity. As the realisation of water efficiency often requires investment, additional water saving projects will result in regional investment. Further, as the extra production is realised, there will be investment in associated projects. Likewise, the additional production may allow for the development of new markets.

1.2.4 Increase water supply and security

Seven benefits could be realised by increasing water supply and security:

- Increased sustainable agricultural production, value and economic activity
- Additional regional investment
- Creation of local jobs and improving socio-economic outcomes
- Encouragement of commercially focused research and skill attainment
- Development of new markets
- Support for diversification, resilience, wellbeing and economic prosperity.

As identified in the service need, water availability is currently constrained. This limits the potential to increase economic activity—both on-farm and through the broader regional economy. Several significant benefits can be achieved if this constraint were addressed.

1.3 Potential initiatives

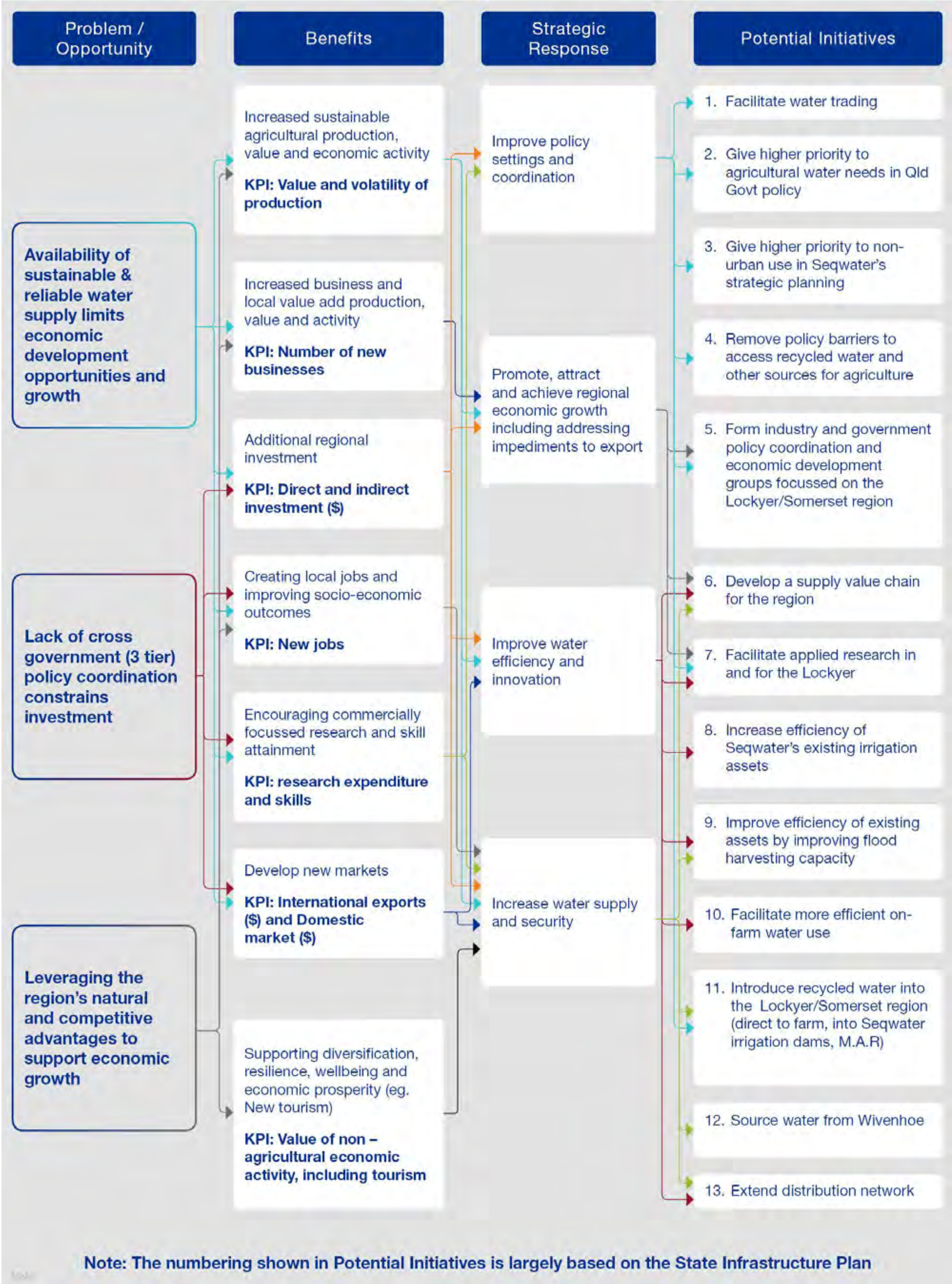
The options analysis for the project identified a range of initiatives that would potentially help meet the service need. They include:

- Water trading
- Better policy, planning and coordination
- Applied research
- Improved efficiency and operation of existing irrigation assets
- Increased flood-harvesting capacity and capacity to deliver water
- Local and regional wastewater reuse
- Sourcing additional water from the Wivenhoe Dam.

These initiatives were based on the Queensland's Government's State Infrastructure Plan (i.e. assessing options to reform, better use, improve existing and new) and were the foundations for the development of the longlist options.

The linkages between the problems and opportunity statements, benefits sought, strategic responses and potential initiatives are outlined in the Investment Logic Map, shown further below.

Figure 1.2: Investment Logic Map



1.4 Options analysis

This section provides an overview of the assessment undertaken in the strategic business case (options analysis) to determine the reference projects. The strategic business case was completed recently (July 2019). Therefore, the assumptions and conditions used to develop or assess options have not varied. As a result, there was no change in the results from the assessment in the options analysis.

1.4.1 Longlist options

A longlist of 39 options that aligned to the initiatives was developed. All of the options nominated needed to not have a negative impact on urban level of service, dam safety obligations or flood mitigation capacities.

These options were then assessed through a multicriteria analysis and ranked. The criteria used were capital cost, additional water volume, water supply reliability, economic and financial net present values, stakeholder support, technical feasibility, strategic alignment and levelised cost.

Following the multicriteria analysis of the 39 options, 22 options were not shortlisted, seven options were considered suitable to be included in a program of other complementary options that should be pursued without a formal business case, and four options were already underway. Of the remaining options, six were shortlisted for further consideration and analysis.

The seven options considered as suitable for a program of other complementary options included initiatives to identify market opportunities, promote research and research partnerships, improve industry and policy coordination, investigate supply chain improvements, implement on-farm initiatives and examine the feasibility of deep aquifer drilling.

The four options considered to be already underway were water trading improvements, irrigation efficiency improvements, investigations into increasing diversion capacity and local wastewater recycling.

1.4.2 Shortlist options

The six shortlisted options considered for further investigation were based on the supply of water to the Lockyer Valley either directly from Wivenhoe Dam, or from the Western Corridor Recycled Water Scheme (WCRWS). All six shortlisted options will not impact on urban water supply security (or level of service), flood mitigation outcomes or Seqwater's dam safety obligations.

The shortlisted options for the direct supply of water to the Lockyer Valley for water from the Wivenhoe Dam were:

- Water is pumped from Wivenhoe Dam and delivered to the Lockyer Valley's existing irrigation dams via a new trunk main and a new distribution network, and the existing irrigation dams are used to deliver water.
- Water is pumped from Wivenhoe Dam and delivered to the Lockyer Valley's existing irrigation dams via a new trunk main, and the existing distribution network is used to deliver water.
- Water is pumped from Wivenhoe Dam and delivered directly to customers in the Lockyer Valley, bypassing the existing irrigation dams.

A critical expectation from Seqwater, who owns and operates Wivenhoe Dam, is that the 'water from Wivenhoe Dam' options would need to ensure that South East Queensland urban water users be no worse off both in terms of bulk water charges and water security.

The 'water from the Wivenhoe Dam' options will increase the use of recycled water from the WCRWS into the dam, in order to ensure that those options have no impact on urban water security for SEQ. These options will require a change to the trigger levels of the WCRWS in order to supply more water to irrigators and maintain current levels of urban water security. Irrigators would also need to pay for the earlier costs of using the WCRWS to ensure that the urban supply charges remain unaffected.

The WCRWS is currently not supplying water and substantial costs are associated with recommissioning the scheme for the first time. Seqwater's position is for any supply to Lockyer Valley irrigators from Wivenhoe Dam to occur only after the WCRWS has been recommissioned for urban water supply purposes.

The shortlisted options for the direct supply of water to the Lockyer Valley from the WCRWS were:

- Purified recycled water (PRWP is sourced from the WCRWS and supplied to producers through a new distribution network (before the commissioning of the WCRWS)).
- PRW is sourced from the WCRWS and supplied to producers through existing irrigation dams and a new distribution network following the recommissioning of the scheme.
- PRW is sourced from the WCRWS and supplied to producers through a new distribution network following the recommissioning of the scheme.

Under these 'water to the Lockyer Valley from the WCRWS' options, irrigators would be required to pay for each megalitre produced for them. In contrast, the 'water from the Wivenhoe Dam' options would require irrigators to pay for the water delivered from Wivenhoe Dam along with the bring-forward costs of WCRWS, which would include incremental capital and operating costs. These bring-forward costs are therefore lower than the costs of the direct WCRWS supply options, as the WCRWS costs are not incurred the entire time during supply—rather irrigators only contribute at times when costs are brought forward so that the WCRWS can operate for urban water purposes.

All six options would not result in an increase in the water level of Wivenhoe Dam compared to current arrangements. These options would not have an adverse impact on flood mitigation outcomes downstream of Wivenhoe Dam; neither would they affect Seqwater's ability to meet its dam safety obligations.

Under all shortlisted options, irrigators would be able to be supplied with water when the WCRWS is not supplying water for urban purposes. However, when the scheme is needed for urban water use, irrigators' supply would be suspended until the scheme is not needed for urban water supply.

Table 1 1: Shortlisted options—assessment of options

Option	Present value of costs ($m)	Present value of benefits ($m)	Economic net present value ($m)	Economic benefit–cost ratio
Water from Wivenhoe Dam				
Option 19—Wivenhoe Dam water / new trunk main / new distribution network/ existing irrigation dams	440	523	83	1.2
Option 20—Wivenhoe Dam water / new trunk main / existing distribution network	390	240	−150	0.6
Option 23—Wivenhoe Dam water / new distribution network / no irrigation dams	440	513	73	1.2
Water from the Western Corridor Recycled Water Scheme (WCRWS)				
Option 24—WCRWS PRW / irrigation dams / new distribution network /pre-commissioning of WCRWS	1,051	608	−443	0.6
Option 31—WCRWS purified recycled water (PRW) / irrigation dams / new distribution network / post- recommissioning	919	608	−311	0.7
Option 32—WCRWS PRW / pipe to farm / post-recommissioning	919	580	−339	0.6

1.4.3 Recommended options

The preliminary economic analysis showed a benefit–cost ratio of above 1.0 for two of the water from Wivenhoe Dam options, which means that their benefits outweigh costs. All of the WCRWS options had a benefit–cost ratio of below 1.0. The much larger operating costs of the WCRWS options resulted in poorer performance in economic outcomes and cost-reflective prices. For this reason, the water from Wivenhoe Dam options are preferred, as shown below.

Table 1 2: Recommended options—summary of options analysis assessment

Option	Description	Benefits to be achieved	Stakeholders	Timeframe
Option 19—Wivenhoe Dam water / new trunk main / new distribution network/ existing irrigation dams	• Water from Wivenhoe/Somerset Dam • New small diameter trunk main supplying raw water to Atkinson Dam, Lake Clarendon and Lake Dyer • New distribution network to the farm gate	• Increased sustainable agricultural production, value and economic activity • Additional regional investment	• Seqwater • Queensland Urban Utilities • Governments • Irrigators	2–3 years
Option 23—Wivenhoe Dam water / new distribution network / no irrigation dams	• Water from Wivenhoe/Somerset Dam • No trunk main and no use of irrigation dams • The new distribution network (small pipes) takes water from the dam to farm	• Increased sustainable agricultural production, value and economic activity • Additional regional investment	• Seqwater • Queensland Urban Utilities • Governments • Irrigators	2–3 years

As part of finalising the strategic business case, several parties provided correspondence raising issues they sought to be considered in the detailed business case. Seqwater[3] provided the following statement:

1) Impact on initial recommissioning of WCRWS—the initial recommissioning of the WCRWS is a significant task and will require extensive community education and engagement. We would be concerned if arrangements for supply to the Lockyer Valley had the effect of bringing forward or increasing the likelihood of the initial recommissioning of the WCRWS, regardless of any cost compensation. That is, our preference would be for any supply to Lockyer Valley irrigators to occur only after the WCRWS had already been recommissioned for urban water supply purposes.
2) SEQ to be no worse off in terms of regulated bulk water charges and water security—that is, we would not expect our bulk water customers to pay for the additional costs or risks arising from Lockyer Valley supply to meet either existing and future urban water security needs. This may require irrigation customers to pay charges that offset the additional costs, for example both bring forward and incremental capital and operating costs, required to preserve water security or meet any future changes in standards. Irrigators will also be subject to supply restrictions and interruptions to ration water and prioritise urban supply. These restriction and interruption arrangements will need to be transparent, widely understood and accepted, and able to be implemented over long timeframes.
3) Consistency with water planning regime—any arrangements would need to be consistent with, and implementable through, water planning instruments in the Central Brisbane Water Supply Scheme. Those arrangements should not diminish or erode the performance of water access entitlements held by Seqwater and others in the scheme and may need to be provided for under a future Transmission License or similar instrument. The rights of various parties, including Lockyer Valley irrigators, to divert water from the scheme would need to be clearly specified. Moreover,

[3] Water for the Lockyer Strategic Business Case (2019), Appendix H.

the arrangements should not place new or additional limits upon Seqwater's annual diversions at Mt Crosby compared to the current situation.

4) No constraint to supply to existing recycled water (non-urban) customers—Seqwater is currently able to supply recycled water under contracts direct to certain customers, including Tarong Power Station and Swanbank Power Station. These demands can vary from year to year. Supply to these customers would need to take first priority from any available capacity in the WCRWS.

5) No change in risk to SEQ bulk water—some options involve probabilistic assessments to determine impacts on SEQ bulk water, including costs and water security. Translating such assessments into commercial arrangements and prices will require an allocation of risk between the parties involved, given future events (particularly costs, inflows and storage levels) are uncertain. Moreover, levels of service and water security appetite may change over time, and arrangements with the Lockyer Valley should not prevent those changes occurring (for example, to increase security). Any further development of options should clearly consider the allocation of risks between Seqwater (and ultimately SEQ water consumers) and Lockyer Valley irrigators. For SEQ consumers to be no worse off (and bear no greater risk), all new or additional risks associated with options would need to be allocated to Lockyer Valley.

6) Asset ownership and funding—Seqwater has a strong preference to not invest in or own new assets to connect the Lockyer Valley.

7) Only recycled water of purified recycled water (PRW) quality standard will be used within the WCRWS assets—we are concerned the production and transport of lower quality water would compromise our ability to convert to PRW standard later, which could then risk stranding the significant investment in the WCRWS.

The Department of Natural Resources, Mines and Energy (DNRME)[4] raised matters and principles on behalf of project steering committee for consideration in the development of a detailed business case:

1) The detailed business case must be developed in accordance with the Building Queensland Business Case Development Framework.

2) Economic assessment must occur in accordance with the Building Queensland Cost Benefit Assessment guidelines with strict adherence to the appropriate inclusions in costs and benefits.

3) Pricing of water needs to occur in the first instance based on full cost recovery principles (including return on, and of, capital as well as all ongoing operational and maintenance costs).

4) Demand for water from the additional water supply and security options need to be assessed specifically in the context of the price at which water would be available.

5) Consideration of an appropriate level of customer commitment (i.e. commensurate with the level of detail of the assessment) should be incorporated into the detailed business case process.

6) SEQ Urban water security cannot be negatively impacted by any of the options for additional water supply or security.

7) SEQ urban water users must not be responsible for any increase in costs associated with any option considered.

[4] Water for the Lockyer Strategic Business Case (2019), Appendix I.

2. Governance and assurance

Lockyer Valley and Somerset Water Collaborative has led the development of the detailed business case. The Collaborative members are the Lockyer Valley Regional Council, Somerset Regional Council, Lockyer Water Users Forum, Queensland Urban Utilities, Lockyer Chamber of Commerce & Industry and Lockyer Valley Growers Inc. The Collaborative acted as the project steering committee.

The Collaborative also undertakes the function of the project steering committee, with the following roles and responsibilities:

- Providing leadership and direction to the development of the detailed business case.
- Ensuring that proper governance processes, financial accountability and transparency are maintained
- Ensuring that the detailed business case reflects the views of the community.
- Ensuring that consultation takes place with local and government stakeholders, including the council, other affected landholders, environmental groups and commercial agricultural and industrial stakeholders.

The Collaborative appointed appropriately qualified and skilled people as part of a project working group, outlined in Table 1.2, to manage the day to day activities of the project and to work closely with Jacobs.

Table 2.1 : Project working group

Members	Organisation
Stephen Robertson	Chair, Lockyer Valley and Somerset Water Collective
Jason Harm	Project Manager, Lockyer Valley Regional Council
Gordon Van Der Est, Greg Banff and Brock Sutton	Irrigator representatives

Jacobs was appointed as the advisor for development of the business case and reports directly to the working group. Jacobs also provides briefings to the Collaborative and key stakeholders.

This business case has been subject to a full quality assurance program. The assurance method consists of both an internal (Jacobs) review and a full external review. The approach to the internal review includes steps:

1) Each topic is researched by a discipline expert and the draft chapter is prepared. In many cases, several authors contribute to each chapter.
2) The full chapter is reviewed by the discipline lead.
3) Each chapter is technically reviewed by a technical director, who is external to the project team.
4) The full report is reviewed by a Building Queensland compliance specialist, who ensures full compliance with the Building Queensland guidelines.
5) The full report is edited and proof-read by specialists.
6) The full report is reviewed by the Project Manager.
7) The full report is reviewed by the Project Director and is authorised for release.

The external review is led by the Project Working Group, and is as follows:

1) The Project Working Group provides initial comments and circulates the business case to the Collaborative
2) External Government stakeholders are briefed on the draft findings.
3) Written comments are received and incorporated into a final report, repeating the process set out above.

A more detailed explanation of the governance and assurance arrangements in included as Appendix A.

3. Service need

3.1 Key points

- Despite water reliability challenges, the Lockyer Valley is one of the most productive farming areas in Queensland, with significant comparative advantages and the potential to expand greatly.
- The service need is represented by an opportunity to significantly grow the economy and sustainability of the Lockyer region by 2030, with broader flow-on effects for South East Queensland, by:
  - leveraging the region's natural and competitive advantages
  - improving water reliability, supply, use and sustainability.
- The Lockyer Valley supplies most of Australia’s vegetables during the winter months and typically accounts for 28 per cent of Queensland’s total horticultural production.
- Agriculture is the dominant industry in the Lockyer Valley and the broader greater Ipswich area—total agricultural production was valued at over $523 million in 2018-19, consisting almost mainly of vegetables and livestock production.
- The current sources of water in the Lockyer Valley are unreliable and fully allocated. Medium priority allocations typically target a reliability of around 80 per cent—the monthly reliability of medium priority allocations in the Central Lockyer Valley and the Lower Lockyer water supply schemes are between 50 and 65 per cent. Announced allocations in the Lower Lockyer water supply scheme over the last three seasons have been below 20 per cent.
- Significant demand for additional water supply has been demonstrated through a detailed, two-stage demand assessment.
- Without increasing water supply and reliability in the Lockyer Valley, a significant increase in agricultural output will be unlikely. If the reliability of existing supply were to decline, a fall in output and increased unemployment could result.

3.2 Approach

The service need is represented by an opportunity to significantly grow the economy and sustainability of the Lockyer region by 2030, with broader flow-on effects for South East Queensland, by:

- leveraging the region's natural and competitive advantages
- improving water reliability, supply, use and sustainability.

The Lockyer Valley has many natural endowments, but access to adequate and reliable water is not among them. Stakeholders considered that the potential social and economic upside was large if water supply and reliability could be addressed.

Without increasing water supply and reliability in the Lockyer Valley, a significant change in agricultural output is unlikely to occur, and therefore economic development opportunities and growth will be limited.

3.2.1 Service need statement

During the development of the strategic business case (options analysis), the project working group developed the service need through the investment logic mapping workshops. The Project Steering Committee endorsed the service need. These workshops were informed by the work undertaken for previous studies (for example, NuWater and Cardno) and by additional consultation.

Three problems and opportunities identified in the options analysis were reconsidered for the detailed business case, including any changes in conditions or assumptions. The three statements were reviewed and confirmed as follows:

1) Availability of sustainable and reliable water supply limits economic development opportunities and growth

The Lockyer Valley experiences lower and more variable rainfall than the rest of South East Queensland. Agriculture relies on irrigation from groundwater, which is in turn impacted by droughts and floods. The agricultural sector shifted away from dairy, towards horticultural and market gardening in the 1960s, aided by irrigation. Climate change is likely to reduce access to water.

The analysis of groundwater and surface water indicated that these sources are fully allocated and relatively unreliable.

The project working group considered this data as well as the water supply data (section 3.4.2) and concluded that the unavailability and unreliability of water limits economic development opportunities and growth.

2) Lack of cross-government (three-tier) policy coordination constrains investment

Consultation with stakeholders revealed that interactions with the government can be uncoordinated. Governments at all levels have an interest in increasing the productive capacity of the region, and it is important that this is done in a coordinated way.

Improved coordination could increase investment and certainty among businesses. That could result in additional regional investment, leading to additional local jobs being created. It would also support agri-business and local value-add production.

The creation of new markets, especially export markets, also requires a coordinated regional approach so that economies of scale can be leveraged and learnings applied across the region.

These issues were raised in the project working group workshops and it was agreed to include them in a problem statement.

3) Leveraging the region's natural and competitive advantages would support economic growth

Queensland Treasury Corporation found that the region has significant natural endowments that result in competitive advantages:

- The Lockyer Valley possesses fertile alluvial soils, which allow it to grow the most diverse commercial range of fruit and vegetables in Australia. The Lockyer Valley supplies the majority of Australia's vegetables during the winter months. Reportedly, there is potential to irrigate an additional 15,000 hectares of suitable land in the Lockyer Valley.
- Significant transport infrastructure traverses the region—for example, highway access to Brisbane and Toowoomba (the Toowoomba Second Range Crossing was completed in September 2019), and a railway line servicing Toowoomba and further west. The Western Corridor is bookended by Brisbane Airport and Toowoomba Wellcamp Airport. Inland Rail may provide connectivity to NSW and Victoria from the Rocklea markets.
- Local growers have significant industry experience and know-how. The University of Queensland and University of Southern Queensland offer research and training in agriculture. Numerous peak bodies and government agencies offer additional informational support.
- The Lockyer Valley is located in the western growth corridor. The South East Queensland population is forecast to increase by 1.9 million inhabitants by 2041, and the economies of Asia are growing rapidly—a significant opportunity for the Lockyer Valley. Free-trade agreements, most recently with Hong Kong and Indonesia, present opportunities to access international markets.[5].

[5] Trade and Investment Queensland, Market profile Lockyer Valley, 24 October 2017, https://www.tiq.qld.gov.au/download/business-interest/about-queensland/qld-regional-market-profiles/Market-Profile-Lockyer-Valley.pdf.

The SEQ City Deal could also be leveraged to support a seamless connection between agricultural production and access to markets.

The project working group considered these natural endowments and determined that the leverage of these natural and competitive advantages could support economic growth.

3.2.2 Timeframe and urgency

The low level of water availability in the region's irrigation dams is the main driver for an urgent solution.

If additional water, or more reliable water, is provided into the Lockyer Valley, the benefits would start to be realised quickly, because most of the agricultural production has a gap of 16 to 20 weeks between planting and harvest. Therefore, additional water could be applied immediately, and the benefits could start to accrue within months of additional water becoming available.

Local irrigators have expressed significant demand (section 3.4.4), wishing to take advantage of the latent opportunities. Such indications of strong demand further increase confidence that benefits will be realised in the immediate to short term.

3.3 Stakeholders and stakeholder engagement

A structured program was undertaken to consult with targeted groups and representatives through meetings in person, phone calls, workshops, presentations, and written communication.

The responses received have been vital to the development of the project, and particularly in establishing the service need and supporting the demand analysis.

3.3.1 Previous stakeholder engagement

During the development of the options analysis, initial community and stakeholder engagement related to the project was undertaken. Engagement was intentionally collaborative and was mostly done through workshops and discussions. The focus was on forming a shared understanding across all stakeholders. This approach was continued when the detailed business case was developed.

Most of the stakeholder engagement took place within the project working group and project steering committee, which together represent a broad cross-section of interested parties. There was also other direct engagement during the options analysis with:

- Lockyer Water Users Forum
- Lockyer Valley Growers
- Lockyer Chamber of Commerce & Industry
- Seqwater
- Queensland Urban Utilities
- Lockyer Valley Regional Council
- Somerset Regional Council
- Queensland Government agencies, including DNRME, DAF, DSDMIP, Queensland Treasury, QTC and Building Queensland.

Stakeholder engagement activities in the options analysis supported:

- a greater understanding of different stakeholders' perceptions of the service need, which is helpful in identifying appropriate initiatives

- an effective identification of stakeholders' expectations regarding the potential project and the benefits they seek
- better outcomes and greater accuracy in identifying possible strategic responses, business changes and potential initiatives
- establishment of 'social license'
- effective risk management
- improved project outcomes resulting from liaison between agencies when there are overlapping jurisdictions or when approvals are required from multiple departments or independent regulatory agencies (these improved project outcomes may relate to time, cost and user satisfaction).

3.3.2 Stakeholder engagement plan

The starting point for stakeholder engagement for the detailed business case was the identification of stakeholders and the development of a stakeholder engagement plan. The stakeholder engagement plan included:

- stakeholder name or description
- extent of stakeholder interest
- extent of stakeholder influence
- expectations of stakeholders
- proposed means and timing of engagement (i.e. inform, consult/interview or active participation in workshops)
- information to be shared with stakeholders
- risks of engaging with individual stakeholders
- risks of not engaging with certain stakeholders
- proposed strategies for mitigating and managing stakeholder risks.

Additional information on the details of the stakeholder management plan as an Appendix X.

Table 3.1 summarises the stakeholders that were identified and their interests in the project.

Table 3.1 : Stakeholders' interest in the project

Stakeholder category	Stakeholder	Interest/s
Internal stakeholders		
Project partners	Lockyer Valley and Somerset Water Collaborative	• Proponent for the detailed business case (DBC)
	Jacobs	• Primary contractor for the DBC
Australian Government		
Departmental Ministers	Minister for Agriculture and Water Resources Minister for the Environment Minister for Infrastructure, Transport and Regional Development	• Alignment with federal objectives and plans • Infrastructure that is properly planned and timed • Investment decision/approval • Environmental approvals/requirements
Elected representatives	Federal Member for Wright Federal Member for Blair	• Alignment with federal objectives and plans • Infrastructure that is properly planned and timed • Local economic, social and environmental impacts

Stakeholder category	Stakeholder	Interest/s
Opposition and crossbench members of Parliament	Relevant shadow ministers and other interested members	• Alignment with state objectives and plans • Infrastructure that is properly planned and timed • Local economic, social and environmental impacts
Australian Government departments and authorities	Department of Infrastructure, Transport, Regional Development and Communications	• Administration of the National Water Infrastructure Development Fund • Review of business cases • Alignment with federal objectives and plans • Environmental approvals/requirements
	Department of Agriculture, Water and the Environment	
	National Water Grid Authority	
	Infrastructure Australia	
	Regional Development 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 • Environmental approvals/requirements
	Queensland Treasurer	
	Minister for State Development, Manufacturing, Infrastructure and Planning	
	Minister for Natural Resources, Mines and Energy	
	Minister for Agricultural Industry Development and Fisheries	
	Minister for Environment and the Great Barrier Reef	
	Minister for Local Government	
Elected representatives	State Member for Lockyer State Member for Nanango	• Alignment with state objectives and plans • Infrastructure that is properly planned and timed • Local economic, social and environmental impacts
Opposition and crossbench members of parliament	Relevant Shadow Ministers and other interested members	• 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 of, input into and feedback on the DBC • Ongoing management and delivery activities • Environmental approvals/requirements
	Queensland Treasury Corporation	
	Department of Natural Resources, Mines and Energy	
	Department of State Development, Manufacturing, Infrastructure and Planning	
	Department of Agriculture and Fisheries	
	Department of Environment and Science	
	Department of Local Government, Racing and Multicultural Affairs	
	Building Queensland	
	Seqwater	
	Queensland Urban Utilities	
	Sunwater	

Stakeholder category	Stakeholder	Interest/s
Local government		
Councils	Lockyer Valley Regional Council Somerset Regional Council	• Job creation in the region • Impact on environment • Advancing the area's status as an attractive place to invest • Pipeline route • Urban water supply security • Increasing agricultural production
Community and business		
Landholders	Directly affected landholders	• Access to and from property • Delivery of land management activities during construction and operations • Property damage, loss, acquisition and compensation
Potential customers	Parties that could receive water from the project	• Up-front capital and ongoing annual cost estimates • Potential investment models • Terms and conditions of water delivery • Timing and other impacts of the project
Potential contractors	Parties that could tender for the project if it is approved and funded	• Information on tender process and contract strategy • Promoting innovation, capacity and capability for the construction of the project • Terms and conditions of water delivery • Timing and other impacts of the project
Environmental groups	Healthy Land and Water Lockyer Valley Landcare	• Minimising and/or mitigation of environmental impacts • Monitoring and reporting activities
Industry peak bodies	Queensland Farmers' Federation Agforce Growcom Others	• Improved conditions for local residents, industry and other sectors • Minimal disruption to the local community and businesses during construction • Advancing growth • Job creation in the region • Advancing the region's status as an attractive place to invest
Community groups (interest groups and community service organisations)	Lockyer Chamber of Commerce & Industry Lockyer Water Users Forum Lockyer Valley Growers	• Improved conditions and opportunities for local residents and industry • Minimal disruption to the local community and businesses during construction
Utility service providers	Energex Vodafone Telstra Optus	• Service supply requirements during construction • Service supply requirements for operations
Traditional owners / Aboriginal cultural heritage	Yuggera Ugarapul People	• Contributors to Aboriginal Cultural Heritage Management Plan (nominated representatives) • Effective implementation of the Aboriginal Cultural Heritage Management Plan • Any native title or cultural implications

3.4 Current state

The current state describes the conditions surrounding the service need. It informs the development of a base case (Chapter 6), which sets a critical baseline against which the social, economic, financial, and commercial assessment of the project is measured. The following data has been identified, collated, and analysed:

- social baseline (presented in Chapter 11: Social impact evaluation)
- economic data including current agricultural production
- existing water supply
- land capability data
- detailed demand assessment.

3.4.1 Current agricultural production

According to Trade and Investment Queensland:

> The Lockyer Valley is one the top 10 most fertile farming areas in the world and grows the most diverse commercial range of fruit and vegetables in Australia. [6]

The Lockyer Valley is also one of the most important food bowl areas in Australia, supplying most of Australia's vegetables during the winter months and typically accounting for 28 per cent of Queensland's total horticultural production. Significant industry opportunities continue to emerge in the region, including specialist food processing, food packaging, transport and storage, construction and new agritourism developments.

A diverse food processing sector is developing, which includes dairy manufacturers, small goods manufacturers and meat processors. The region has export capabilities in agricultural technologies, services and equipment manufacturing.

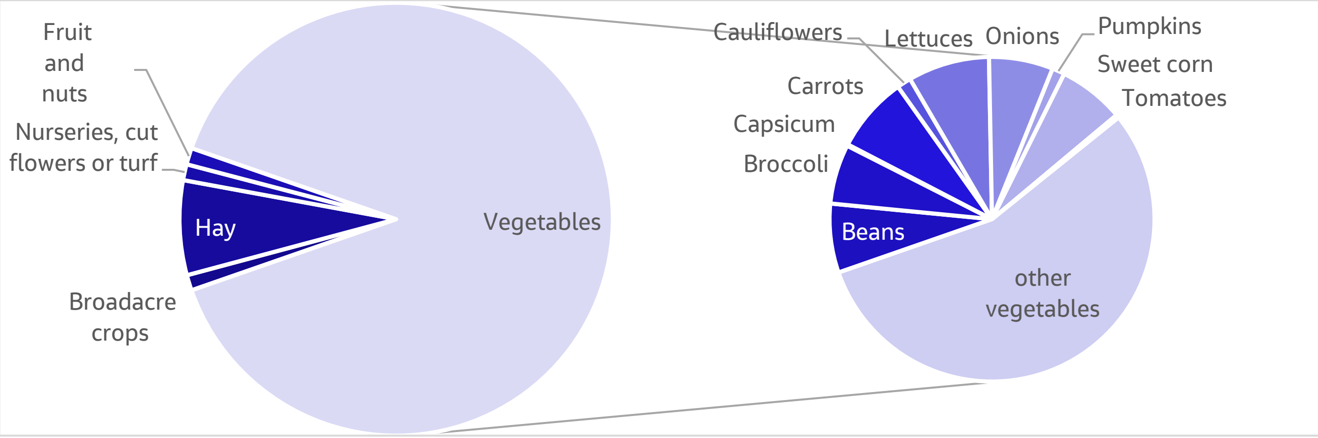
A unique combination of climatic attributes means pest populations in the area are naturally low. The area also has the important benefit of being only an hour from the key population centre of Brisbane. A key cluster of agribusinesses is associated with the School of Agriculture and Food Sciences at the University of Queensland's Gatton campus and with the Queensland Alliance for Agriculture and Food Innovation.

However, the region has some challenges, and it is important that water management is conducted appropriately to ensure the valley can continue to be a premier food-growing region into the future. The lack of sustainable and reliable water supply limits economic development opportunities and growth. Prioritising initiatives that support access to water and provide greater quantities of water for the agriculture sector will enable future growth.

Agriculture is the dominant industry in the greater Ipswich area, including the Lockyer Valley—the total value of crop production was valued at $351 million in 2018–19[7] (Figure 3.1).

[6] Trade and Investment Queensland, *Market profile Lockyer Valley*, 24 October 2017, https://www.tiq.qld.gov.au/download/business-interest/about-queensland/qld-regional-market-profiles/Market-Profile-Lockyer-Valley.pdf.
[7] ABS, Value of Agricultural Commodities Produced, Australia, 2018–19, cat. 7503.0, May 2020.

Figure 3.1: Gross value of agricultural commodities in the Ipswich region, 2018–19



Source: ABS, Value of Agricultural Commodities Produced, Australia, 2018–19, cat. 7503.0, May 2020.

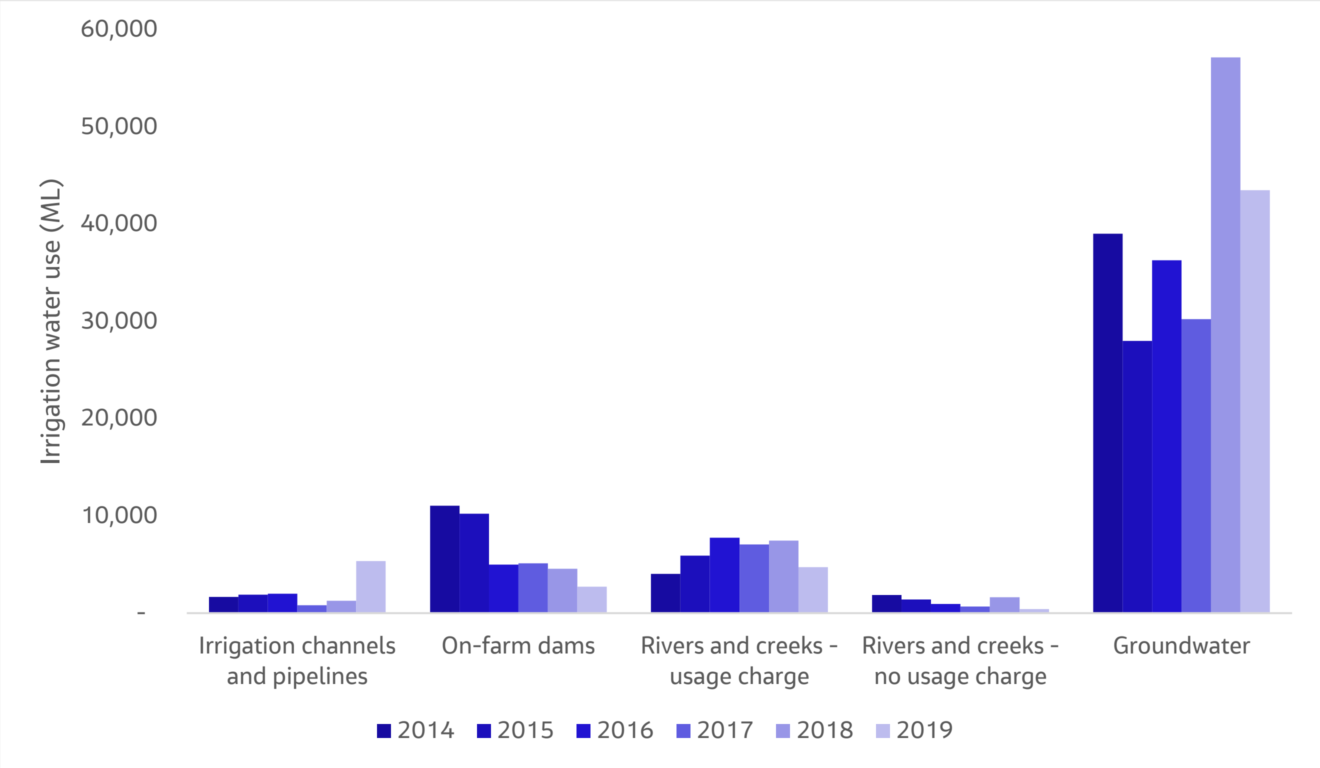
Vegetables contribute 60 per cent of gross value of agricultural production. Most of the irrigated agriculture relates to vegetable production, with beans, carrots, sweetcorn and tomatoes the largest four crops measured by value of production. The breakdown varies from year to year, depending on market and environmental conditions.

The crop mix are annual crops and can be planted and harvested each year. This approach allows for production to rise and fall in line with water availability and with rainfall.

3.4.2 Existing water use

For the five-year period between 2014 and 2019, the annual water use has averaged approximately 40,000 megalitres (ML) for the Lockyer Valley. Irrigators source their water from a variety of sources, including Seqwater irrigation schemes, on-farm storages, unsupplemented rivers and creeks, and groundwater. Rainfall is captured in privately owned on-farm dams. However, groundwater is the dominant source (Figure 3.2).

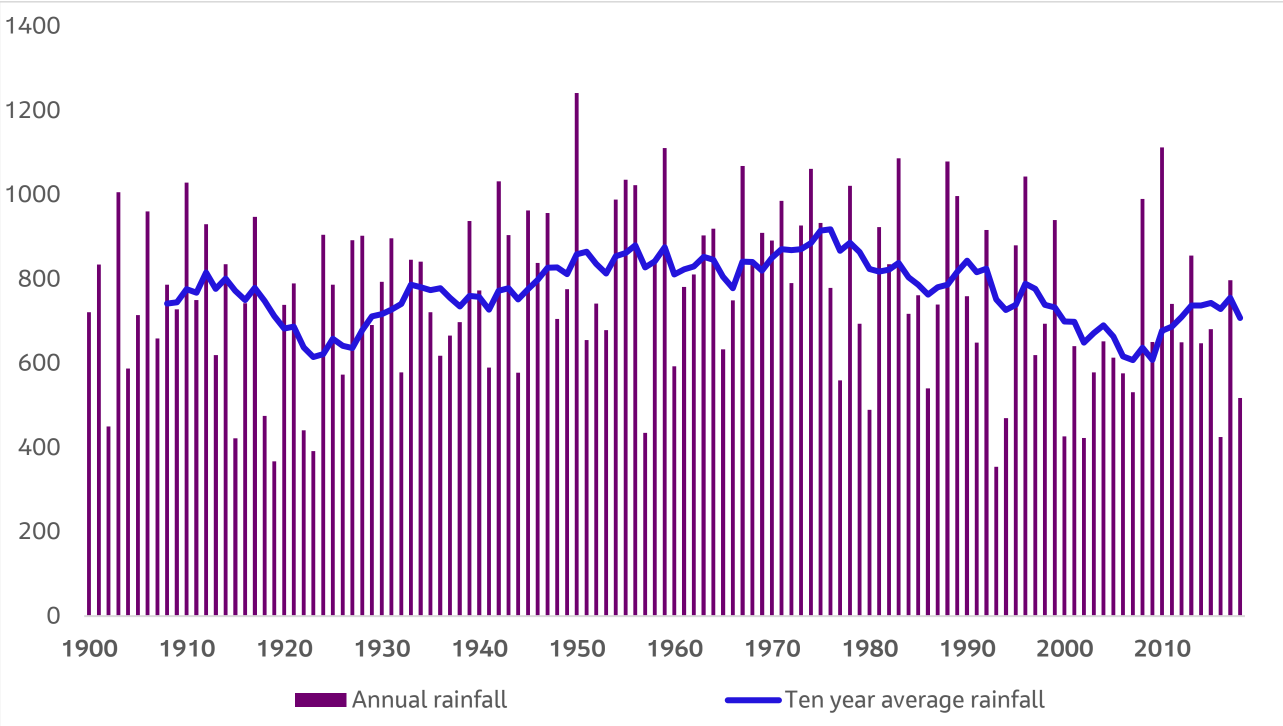
Figure 3.2 : Water sources in the Lockyer Valley , 2014–2019 (ML)



Source: ABS, Water Use on Australian Farms, cat. 4618.0. Data has been collected by Statistical Area 4 since 2012–13.

In addition, crops are irrigated naturally by rainfall. The average annual rainfall is shown in Figure 3.3. Rainfall is very variable over time.

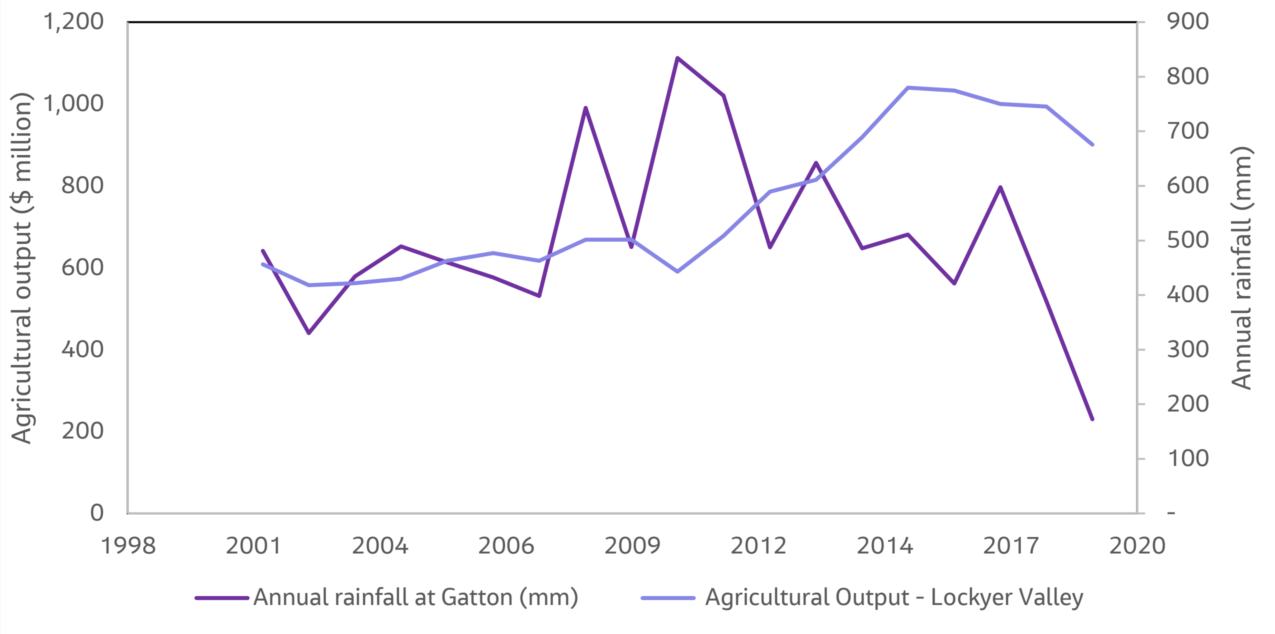
Figure 3.3 : Rainfall at the University of Queensland, Gatton, 1900 to 2019 (mm)



Source: BOM, station number 040082.

The value of agriculture produced depends on the amount of water applied, both from rainfall and from rainfall. Figure 3.4 shows that the value of agricultural production is much more stable than variations in rainfall.

Figure 3.4 : Relationship between rainfall and agricultural production

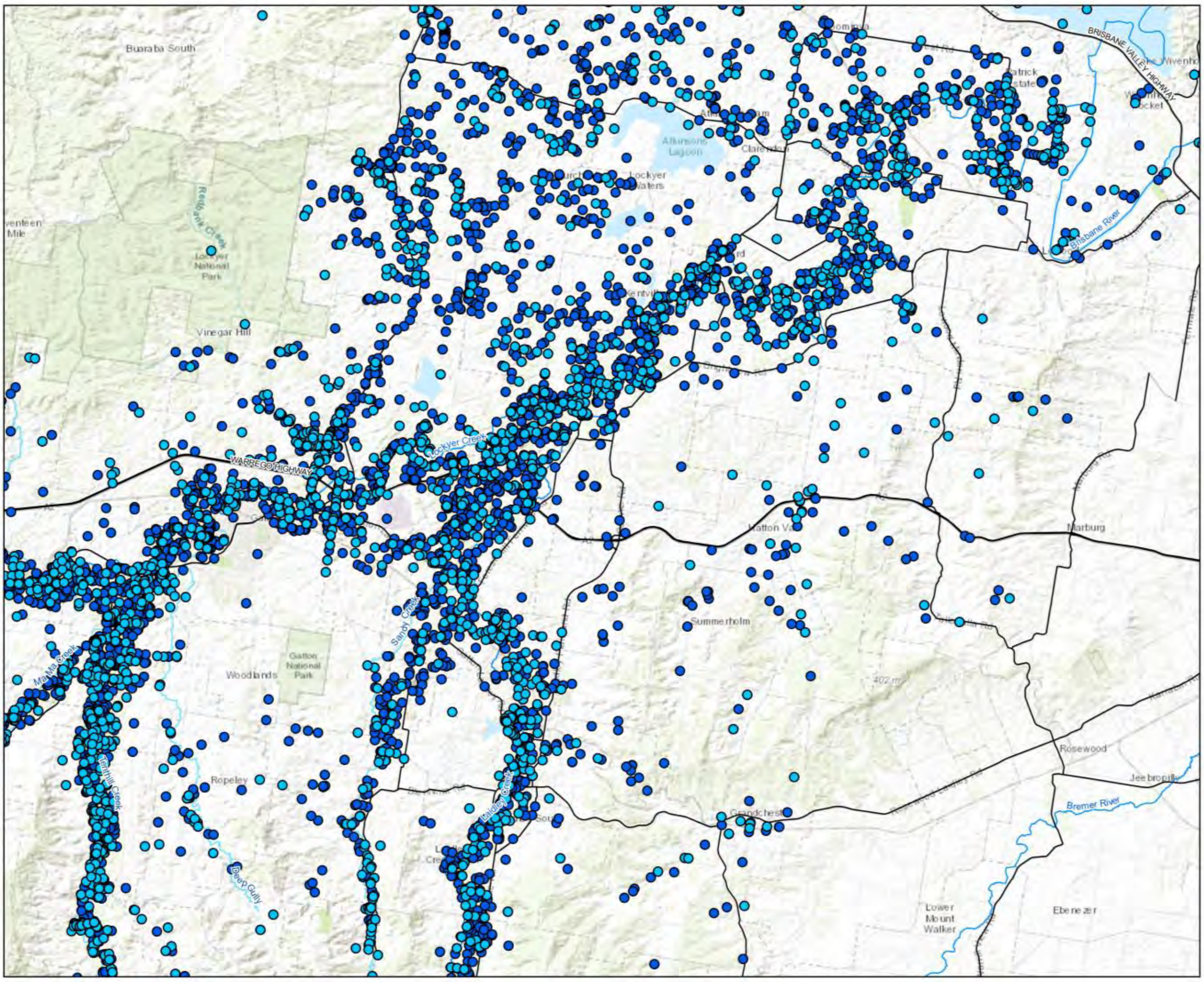


3.4.2.1 Groundwater

Groundwater resources provide a significant source of water for the Lockyer catchment, as evidenced by the high concentration of bores located within the alluvial plains where irrigated agriculture is undertaken. Streamflow within the waterways of the Lockyer catchment is interlinked with these groundwater resources. From the 1940s there was a rapid increase in the number of bores drilled in the catchment to access groundwater resources, resulting in a rapid increase in groundwater table drawdown in selected areas. In 2013, an estimated 5,000 or more bores were accessing groundwater resources within the Lockyer catchment.[8]

[8] WSP, *Lockyer catchment preliminary socio-economic study*, October 2017.

Figure 3.5: Location of registered bores



Intensive groundwater use can decrease water table levels, resulting in adverse water quality impacts, in terms of increased salinity—particularly during prolonged drier periods. Recent wet years, including the flood events in 2011 and 2013, resulted in a major recharge of the groundwater system, which demonstrated that the system is able to recover.[8.]

Bores that are closer to the creeks tend to recharge more quickly than bores that are further away. As shown below, after a large rainfall event (or a series of event), the bores near Lockyer Creek recharge two years before bores that are further away. Other factors, such as geological factors, impact on the time taken to recharge.

Figure 3.6: Groundwater recharge

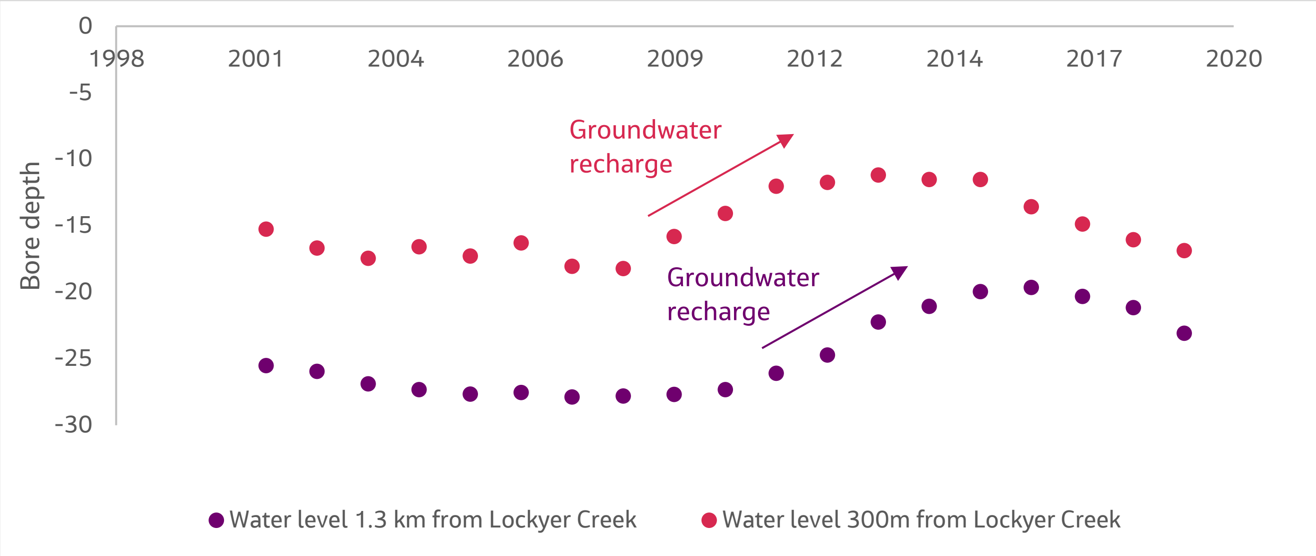
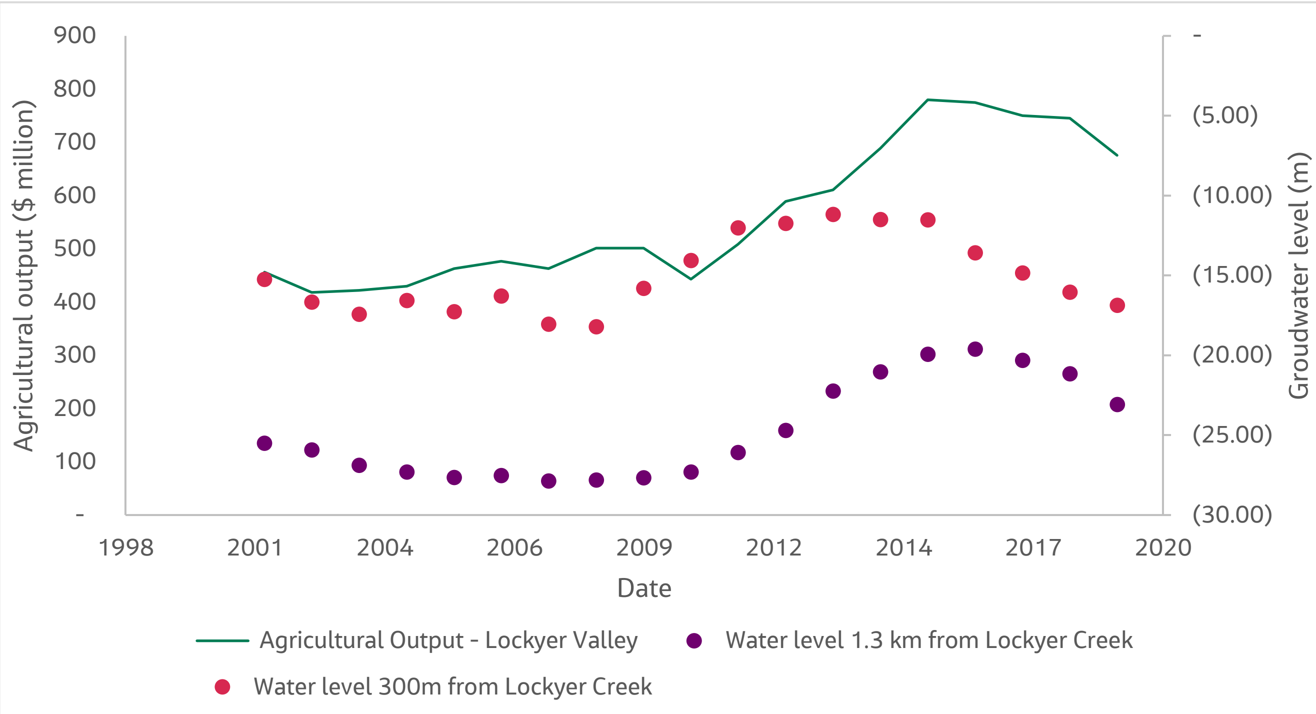


Figure 3.7 shows that as the groundwater near the creek is recharged (2009 to 2013), agricultural production increases. As the groundwater is recharged further from the creek (2010 to 2016), agricultural production continues to increase until the groundwater levels start to drop, which results in a drop in agricultural production.

Figure 3.7 : Relationship between groundwater and agricultural production



There is a strong relationship between the water available in bores, and the agricultural production of the area. When water is available, production increases. This relationship is much stronger than the relationship between production and rainfall. This is likely because groundwater can be applied as it is needed, and the availability of groundwater allows for planting to occur, while growers can be confident that the water needed to finish the crop is available. There is a strong benefit in water security.

3.4.2.2 Existing Seqwater irrigation assets

Seqwater operates Wivenhoe and Somerset dams within the study area. These storages are overwhelmingly used to supply urban water needs. A small volume of water allocations is available for irrigators.

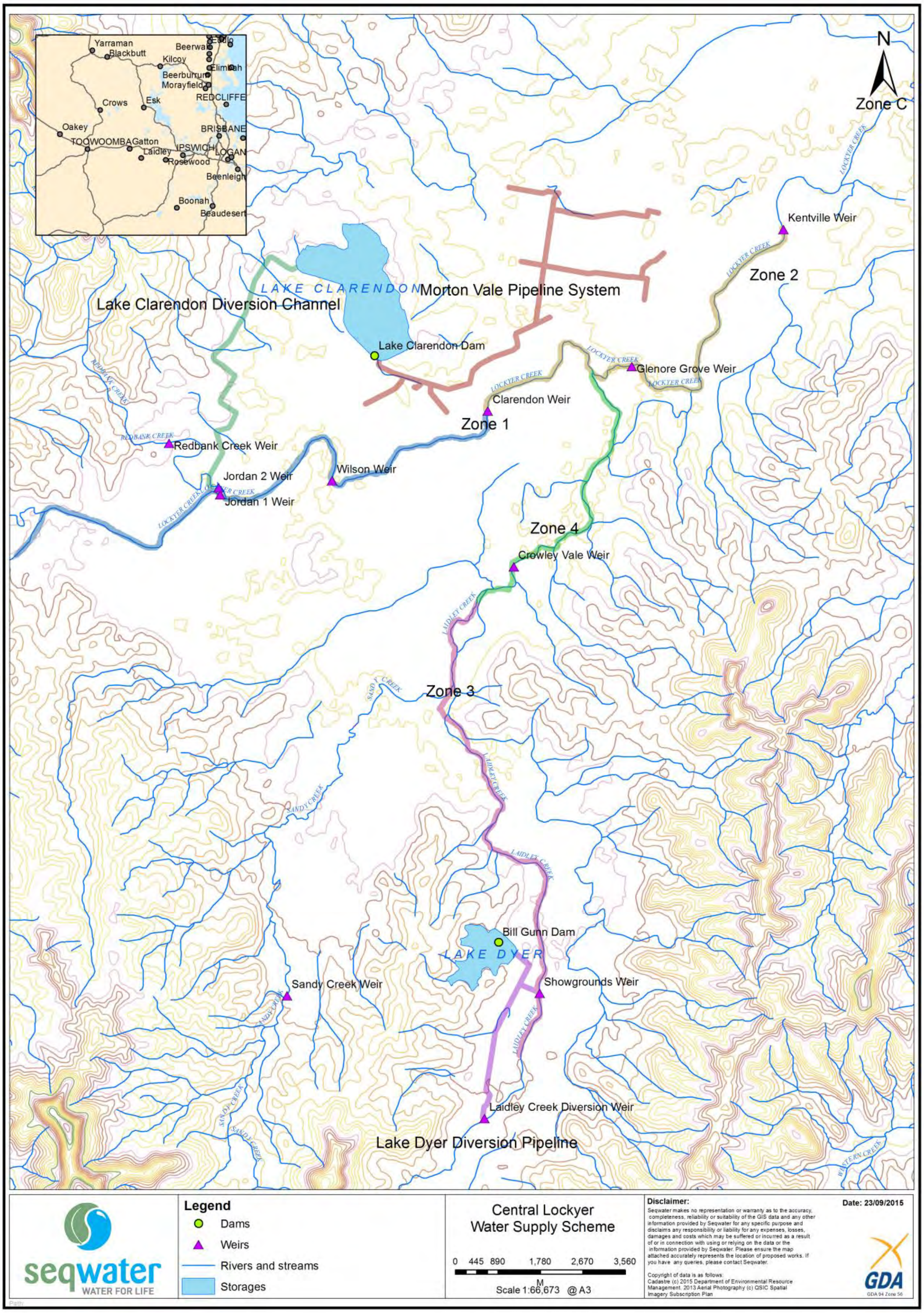
Seqwater operates two schemes in the Lockyer Valley—the Central Lockyer water supply scheme (including the Morton Vale pipeline) and the Lower Lockyer water supply scheme. The existing water storages and distribution assets for the schemes include the following:

- Bill Gunn Dam
- Clarendon Dam
- Atkinson Dam
- Kentville Weir
- Jordan 1 and 2 Weirs
- Wilson Weir
- Clarendon Weir
- Glenore Grove Weir
- Laidley Creek Diversion Weir
- Showgrounds Weir
- Crowley Vale Weir
- Morton Vale Pipeline.

The dams are off-stream storages that are filled by diverting water from nearby creeks during significant flow events. Water is then released at a later time to supply customers. Accordingly, the rate of inflow is constrained by the size of the pumps and diversions pipes/channels, and the dams are not able to capture all the available water during flow events.

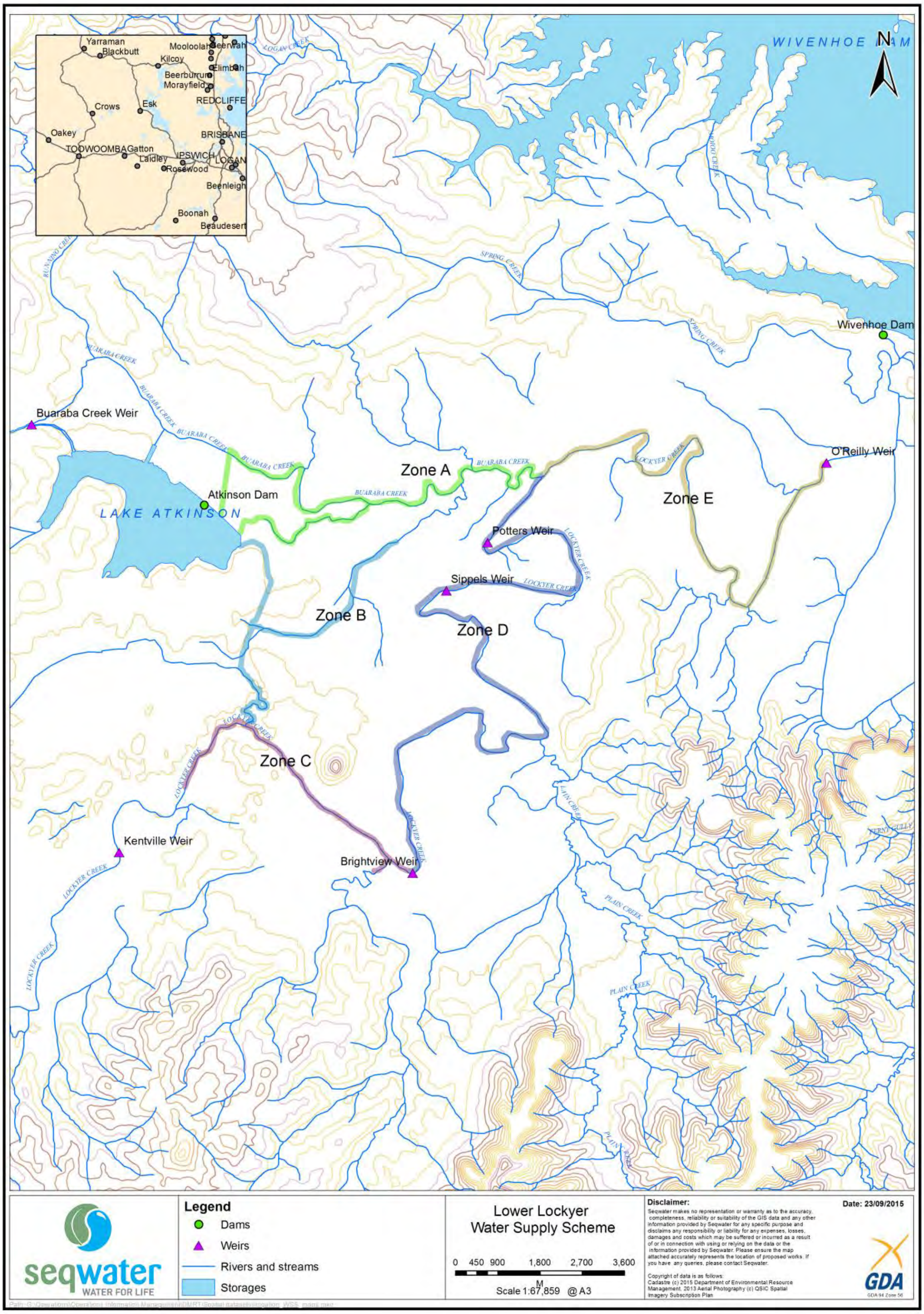
The Central Lockyer Valley scheme is supplied by Clarendon and Bill Gunn dams. The scheme supplies water using the Morton Vale Pipeline, recharges the groundwater areas adjacent to Lockyer Creek using the weirs, and supplies downstream area-based surface-water entitlements.

Figure 3.8: Map of the Central Lockyer Valley water supply scheme



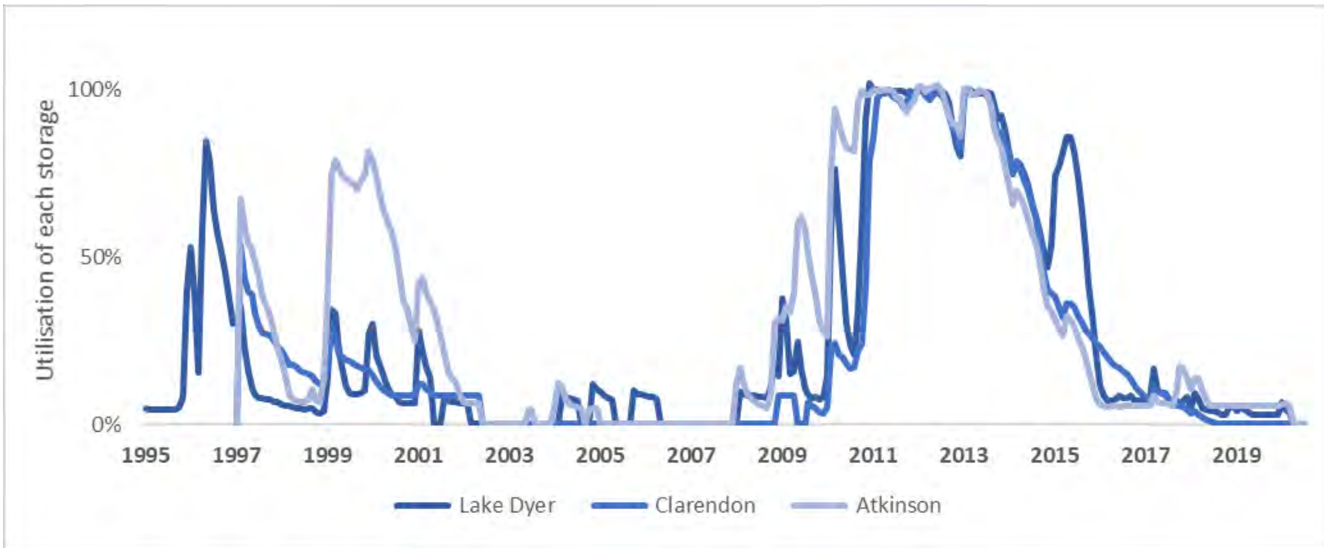
The Lower Lockyer water supply scheme was designed to supply surface water for irrigation. The scheme is managed under the Moreton Water Plan (Water Management Protocol and Lower Lockyer Valley Water Supply Scheme Operations Manual).

Figure 3.9: Map of the Lower Lockyer water supply scheme



Water reliability is low in the Seqwater schemes, relative to most other irrigation schemes in Queensland, where reliability is generally targeted to be about 80 per cent for medium priority water allocations. In the Central Lockyer Valley water supply scheme and the Lower Lockyer water supply scheme the monthly reliabilities are both between 50 and 65 per cent. There have been periods of very low water availability, such as in the early 2000s, when supply was low (Figure 3.10 and Figure 3.11).

Figure 3.10: Utilised storage capacity of Lockyer Valley irrigation dams



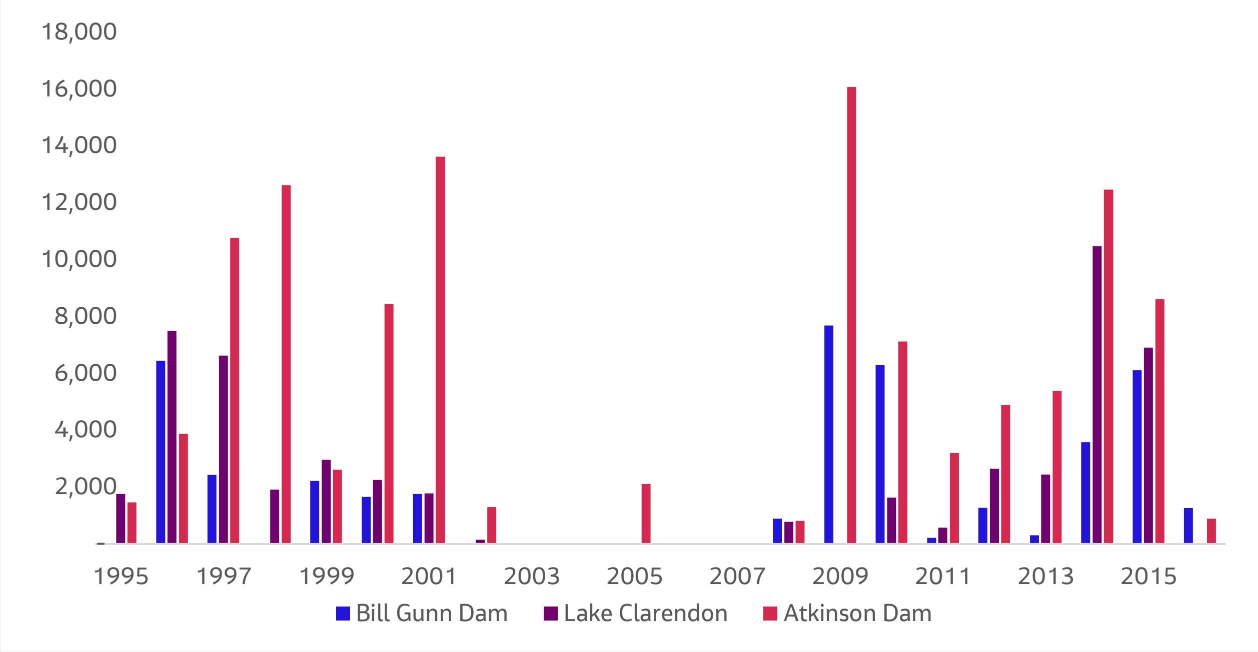
*These fluctuations result in variations in medium priority announced allocations. For example, in the Lower Lockyer water supply scheme, during the period from 2008 to 2020, five years started with a zero per cent announced allocation, while four years started with a 100 per cent allocation (**Table 3.2**).*

Table 3.2: Announced allocation—Lower Lockyer Valley water supply scheme

Year	Lower Lockyer Valley water supply scheme announced allocation (%)
2008	0–16
2009	13–63
2010	27–100
2011	100
2012	100
2013	100
2014	100
2015	81
2016	31
2017	0–10
2018	0–17
2019	0
2020	0

Note: Where a range is shown, the first number is the announced allocation at the beginning of the water year, and the last number is at the end.

Figure 3.11: Volume of water released from Lockyer Valley irrigation dams (ML)



Source: Irrigators' historical records.

It costs Seqwater approximately $2.5 million[9] annually to operate these schemes. The Queensland Government provides Seqwater with an annual community service obligation (a subsidy), of approximately $1.7 million. This payment reflects the difference between total costs incurred by Seqwater and revenue received from irrigators.

3.4.3 Land capability

The 2002 soil suitability study[10] found that:

> The alluvial plains of the Lockyer Valley are a unique natural resource for agriculture. The better soils, in combination with irrigation water supplied from underground aquifers and a mild subtropical climate provide excellent potential for the sustainable production of a wide variety of crops.
>
> 43,748 ha of the alluvial plain areas are suitable for general irrigated agriculture. However, the main limitation to the full utilisation of this area is the lack of reliable, good quality irrigation water. The recent development of water storages at Lake Clarendon and Lake Dyer has helped somewhat, but is only of modest benefit overall.

Class 1 land is suitable for all crops considered under existing management conditions, with negligible management problems. It has excellent drainage and good available water capacity allowing quick access after rain or irrigation.

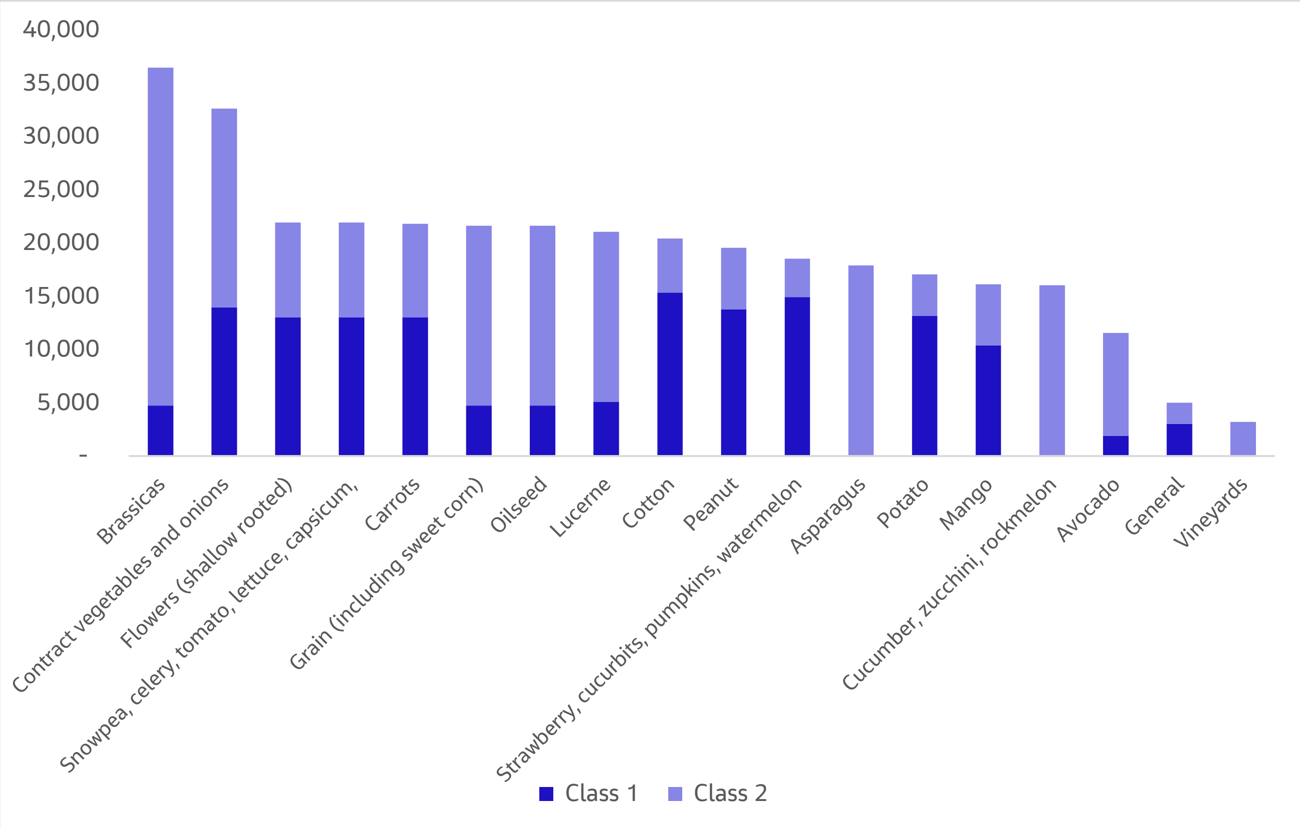
Class 2 land is suitable for growing most crops grown in the district but may have some problems with soil compaction and very occasional flooding in some parts.

There is enough class 1 and class 2 land in Lockyer Valley to support the cultivation and production of each of 24 identified crops. Further, there is enough class 1 suitable land for each crop, which means that cultivation and

[9] Seqwater, *Central Lockyer Valley Water Supply Scheme Annual Network Service Plan 2018–19* and *Lower Lockyer Valley Water Supply Scheme Annual Network Service Plan 2018–19*.
[10] Soil and Land Suitability of the Lockyer Valley Alluvial Plains South-East Queensland, Natural Resources and Mines, 2002

production should be able to proceed without requiring land suitability improvements. The below figure shows the amount of available land for each crop type – not the land currently under cultivation.

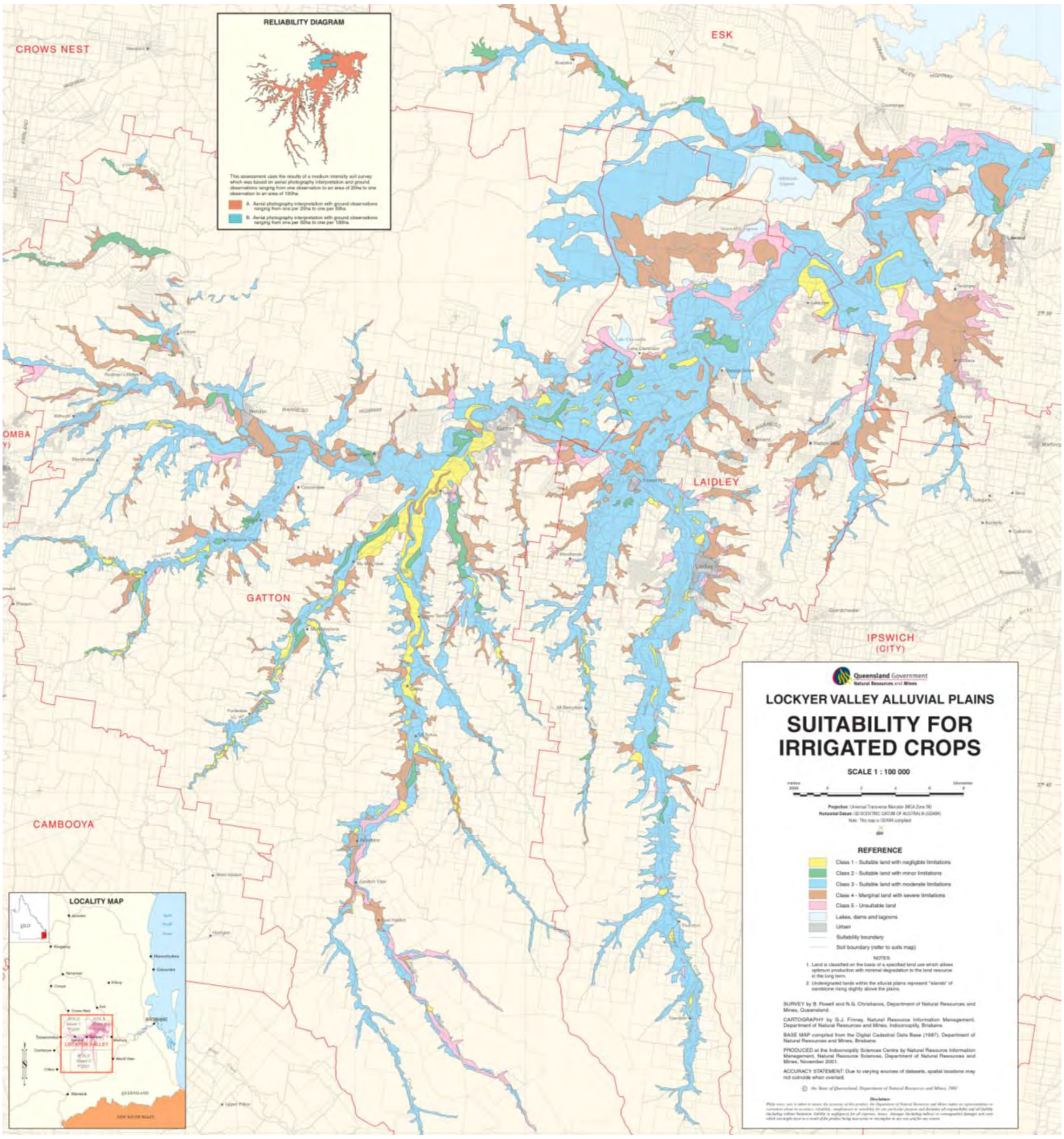
Figure 3.12: Class 1 and 2 land in Lockyer Valley by crop type



Accordingly, the availability of suitable land to cultivate each crop will not be a limiting factor on the viability and relative feasibility of each potential crop. As land suitability is not an effective differentiator between potential crop types, it is not an appropriate criterion for the multi-criteria analysis.

The suitable land is shown in Figure 3.13.

Figure 3.13: Soil suitability of agricultural land in the Lockyer Valley



3.4.4 Water efficiency

Growcom were engaged to review the water use efficiency in the Lockyer Valley. They found that:

> The analysis has found that there is some scope to improve water use efficiency across the irrigation systems used in the region. Gains of between 5 to 15 per cent are possible, through improved system management that achieves greater distribution uniformity. For most growers, however, efficiency gains would be incremental and hard won.
>
> In horticulture crops, solid set, drip and travelling boom systems have the greatest scope for efficiency gains and impact large areas of production. In fodder crops, the most significant opportunities are in hand shift, travelling gun and travelling boom systems. Achieving the optimal levels of efficiency in these systems, however, would require a significant effort which may be greater than the productivity or profitability gain attained. Realising more significant water use efficiency gains in the region would require a widespread transition to more efficient irrigation systems such as drip, centre pivot and lateral moves, or to advanced protected cropping systems.

The Base Case forecasts that water use efficiency will continue to improve over time as irrigation equipment is replaced with more efficient equipment. The full report is attached as Appendix O.

The large investments required to improve water use efficiency require irrigators to have access to reliable water. This project will assist the overall water reliability, and could contribute to improved water efficiency, over time.

3.4.5 Additional demand for agricultural product

In order for there to be additional demand for water, irrigators need to be able to profitably increase their production. This can be done by increasing supply either into the domestic or international markets.

The Lockyer Valley already supplies a large portion of vegetables into the South East Queensland market. As identified by QTC:

> As Australia's third-largest urban region, SEQ is home to one in seven Australians (3.4 million people) and is expected to attract an additional 1.9 million residents by 2041.[11]

The Lockyer Valley could increase supply to service this market. The region could also increase the share of production that is currently relatively low (turf, flowers, etc.). These products require reliable water supply.

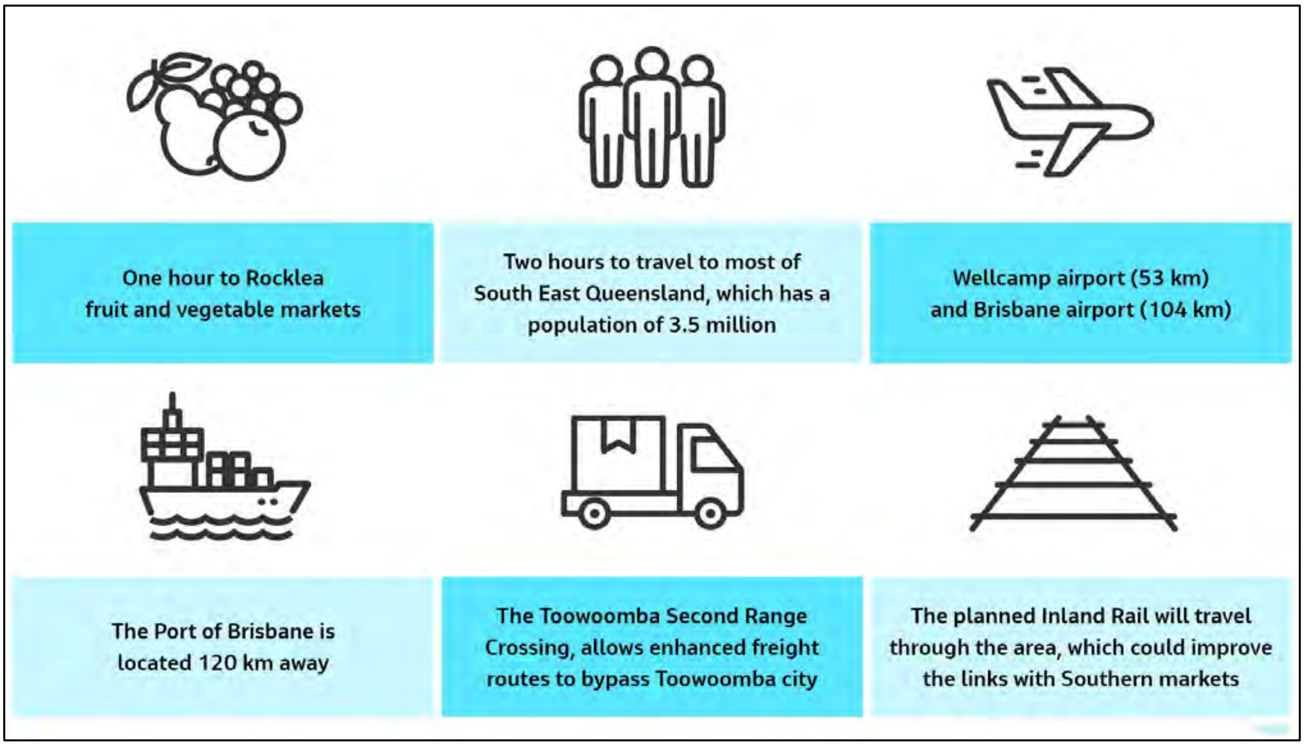
Another option is to increase supply into international markets. Presently, 6 per cent of output is exported.

3.4.6 Transport links and access to markets

The Lockyer Valley is strategically located in terms of transport. For example:

- The Lockyer Valley is linked by road to Brisbane and surrounds, including the Rocklea fruit and vegetable markets, which are the main markets serving South East Queensland. These markets are less than one hour away from Gatton.
- It takes only two hours to travel to most of South East Queensland, which has a population of 3.5 million.
- Commercial airports are not far away, for example Toowoomba's Wellcamp (53 km) and Brisbane (104 km).
- The Toowoomba Second Range Crossing

[11] Trade and Investment Queensland, Market profile Lockyer Valley, 24 October 2017, https://www.tiq.qld.gov.au/download/business-interest/about-queensland/qld-regional-market-profiles/Market-Profile-Lockyer-Valley.pdf.



These transport links (which are already good and are still improving) could support the increase of agricultural production. This was supported by QTC, who found that:

> Transport infrastructure is not a material barrier. The Lockyer Valley has strength in agricultural production and is served by good transport infrastructure in the form of highways, ports, and airports. These competitive strengths allow the Lockyer Valley to supply the majority of Australia's vegetable requirements during the winter months. Stakeholders supported the view that regional transport infrastructure is a key strength of the regional economy. Government continues to invest in these strengths e.g. Inland Rail and the Toowoomba Second Range Crossing. Lockyer Valley Regional Council has identified opportunities to build relationships with transport firms and growers, as well as a Gatton West Industrial Zone which could further leverage these competitive strengths. It should continue to implement this strategy.[12]

3.5 Targeted benefits

Seven key benefits of addressing the service need were identified through engaging with key stakeholders and reviewing previous assessments. These are:

- increased agricultural production, value and economic activity
- increased agribusiness and local value-add production, value and activity
- increased regional investment
- additional local jobs
- encouragement of commercially focused research and skill attainment
- development of new markets
- support for diversification, resilience, wellbeing and economic prosperity.

[12] Trade and Investment Queensland, Market profile Lockyer Valley, 24 October 2017, https://www.tiq.qld.gov.au/download/business-interest/about-queensland/qld-regional-market-profiles/Market-Profile-Lockyer-Valley.pdf

A record of the benefits is maintained in the Benefit Register (Appendix 1). There are no assumptions or dependencies that have an impact on the benefits sought.

3.5.1 Increased agricultural production, value and economic activity

If water volume and reliability are increased, agricultural production, value and economic activity will increase, which will result in broader economic activity.

The beneficiaries include the farm owners, workers, suppliers, processors, supply services, transport, supply chain networks consumers.

Achieving this benefit may require investment in other supporting public infrastructure. It also requires availability of skilled labour.

The key performance indicator (KPI) is the value of agricultural production (in dollars). This benefit should be measured using the value of agricultural commodities produced, published by the ABS.[13] Given the primary beneficiaries will be irrigated agriculture, only crops[14] (not livestock) will be measured.

3.5.2 Increased agribusiness and local value-add production, value and activity

If agricultural output increases, then additional business activity can be expected. This business activity could include agricultural inputs such as fertiliser, machinery or professional services. The potential for local value-add industries would also increase. Such industries may package, process, cool, dry, or extract the raw agriculture produce, and increase the value of the production before it leaves the area.

The beneficiaries include the existing and new business and their workers.

The KPI is the number of new businesses, measured by the Counts of Australian Businesses, published by the ABS[15], for the Lockyer and Somerset councils.

3.5.3 Increased regional investment

It is expected that as the economic activity in the region increases, additional investment in capital will be required. This additional capital will increase the productive capacity of the area and allow other benefits to be unlocked.

The beneficiaries include the business owners, workers, wholesale suppliers and local residents.

To undertake investment, businesses need to have access to credit, or sufficient equity.

The KPI is the change in regional investment.

3.5.4 Additional local jobs

An increase in business activity will increase employment opportunities.

The beneficiaries include the unemployed (or underemployed) Lockyer Valley residents, and the people who move into the area due to the availability of employment opportunities.

Potential new workers will need to have the required skills.

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[13] ABS, *Value of Agricultural Commodities Produced, Australia*, cat. 7503.0.
[14] ABS commodity code 9013959.
[15] ABS, *Counts of Australian Businesses, including Entries and Exits*, *June 2014 to June 2018*, cat. 8165.0

The KPI is the number of new jobs, measured by the data on small area labour markets, which is published by the Australian Government Department of Employment, Skills, Small and Family Business.[16]

3.5.5 Encouragement of commercially focused research and skill attainment

If production increases, then it may become more commercially viable to undertake research specific to the Lockyer Valley—for example, research into developing seed and crop types and varieties that are best suited to the soils and climate of the Lockyer Valley. For this to occur, there needs to be sufficient scale so that there can be a return on the research investment. Collaboration with research and teaching institutions (universities and TAFE) could also occur.

The stakeholders and beneficiaries are the farm owners able the access the improved technologies and the highly skilled workers undertaking the research. Close collaboration with the local universities is required to undertake applied research.

Further, as the agricultural sector becomes increasingly automated and specialised, there will be a greater need for highly trained employees and greater opportunities to become highly trained.

The KPI is a change in the number of people with post-school qualifications.[17]

3.5.6 Development of new markets

The Lockyer Valley supplies a significant portion of vegetables to the state and domestic markets. If water volume and reliability are increased, then the Lockyer Valley can increase its production to meet the growing domestic demand. A lack of water reliability may impact the capacity of domestic production to meet domestic demand.

However, new exports markets could also be developed with access to reliable water. This would uncap the potential of the Lockyer Valley and lead to a significant growth in export incomes.

The beneficiaries are the farm business, transport, logistics, and the processing and packaging businesses.

For exports to increase, there will need to be substantial investment in trading relationships, the supply chain and logistics. Further, access to markets can change quickly, depending on macro-political factors such as tariff changes and import protocols.

The KPI is an increase in the dollar value of international exports from the Lockyer Valley.

3.5.7 Support of diversification, resilience, wellbeing and economic prosperity

A benefit sought is that the economy will diversify, and that economic prosperity will increase for all residents of the Lockyer Valley—whether directly involved in agriculture or not (e.g. tourism).

It is expected that general wellbeing for residents and visitors (including tourists) will be enhanced.

The KPIs are:

- a change in the number of new tourists spending time and money in the area
- an improvement in the index of relative socio-economic disadvantage.

[16] Department of Employment, Skills, Small and Family Business, Small Areal Labour Markets publication, Australian Government, https://www.jobs.gov.au/small-area-labour-markets-publication.

[17] ABS census data.

3.5.8 Implications of not proceeding

Without increasing water supply and reliability in the Lockyer Valley, a significant increase in agricultural output will be unlikely.

If the project did not proceed, the identified problems will not be addressed, nor would the known opportunities be realised. The problems are specifically:

- the lack of sustainable and reliable water supply limiting economic development opportunities and growth
- the lack of cross-government (three-tier) policy coordination constraining investment
- failure to leverage the region's natural and competitive advantages to support economic growth

Furthermore, it could be expected that the following outcomes will continue:

- Unemployment will be higher than the Queensland average.
- Wages will be lower than the Queensland average.
- Socio-economic disadvantage will remain higher than in the rest of Queensland.
- Education attainment will remain lower than in the rest of Queensland.

4. Strategic considerations

4.1 Key points

- The reference project has been found to be broadly aligned with the following Queensland Government strategies and plans:
  - Shaping SEQ (South East Queensland Regional Plan)
  - Our Future State: Advancing Queensland's Priorities (2014)
  - Growing for Queensland
  - Queensland Bulk Water Opportunities Statement
  - State Infrastructure Plan
  - Queensland Agricultural Land Audit (May 2013).
- The reference project has been found to be broadly aligned with the following Australian Government strategies and plans:
  - National Water Initiative (NWI) (2004)
  - National Water Grid Authority
  - Australia Infrastructure Plan (2016).
- The reference project has been found to be broadly aligned with the following local government strategies and plans:
  - Lockyer Economic Development Plan (2018)
  - Somerset Economic Development Plan (2015).
- Seqwater considerations that the business case needs to be cognisant of are:
  - Initial impact of recommissioning of the Western Corridor Recycled Water Scheme (WCRWS)
  - SEQ to be no worse off of in terms of regulated bulk water charges and water security
  - Consistency with water planning regime
  - No constraints to supply to existing recycled water customers
  - Asset ownership and funding
  - Risk allocation
  - Potable recycled water quality only to be used in existing WCRWS assets.

4.2 Queensland Government strategies and plans

The following table outlines the state government strategies and plans that were identified as being relevant to the reference project, and the way the project aligns with them.

Table 4.1: Queensland Government strategies and plans

Government plan/strategy	Overview	Project alignment
Shaping SEQ	The South East Queensland Regional Plan (also known as Shaping SEQ) provides a regional framework for growth management. Under the theme of rural prosperity in the plan for the Western Sub Region the plan recognises that rural production lands (for horticulture, forestry and grazing) in the Lockyer Valley, Scenic Rim, Somerset and Ipswich	The project will provide a secure and sustainable water for agricultural production in rural production lands and meet the objectives of the South East Queensland Regional Plan.

Government plan/strategy	Overview	Project alignment
	areas support one of the nation's most important food bowls; they are extremely important for long-term food security and export opportunities. According to the plan this land resource and the supporting processing infrastructure will be protected, including preventing further land fragmentation and protecting rural industries and activities from encroachment by incompatible uses. Under the plan the Queensland Government will partner with Ipswich, Scenic Rim, Somerset, and Lockyer Valley councils, the private sector, and key stakeholders to identify opportunities to ensure a sustainable future for the sub-region's rural production land resources, including a secure and sustainable water supply.	
Our Future State: Advancing Queensland's Priorities (2014)	The relevant priorities include creating jobs, increasing private sector investment and engaging more young Queenslanders in education, training or work.	The project, through creating a more reliable water supply, will create additional jobs and encourage further private sector investment
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 is aimed at increasing the sustainability of production in the Lockyer Valley through providing a reliable water supply.
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 State Infrastructure Plan (SIP). The QBWOS recognises ongoing work to assess options for improving water supply and reliability. The Western Corridor Recycled Water Scheme is recognised as a bulk water source. If a state government contribution is necessary, the government should be presented with a business case that addresses the above points.	The project seeks to make investments in new infrastructure. This business case is compliant with Building Queensland guidelines.
State Infrastructure Plan (SIP)	The plan sets out the Queensland Government's strategic direction for the planning, investment and delivery of infrastructure in Queensland. The plan includes the following outcomes related to water: ▪ 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 project is aligned with the State Infrastructure Plan. It establishes a business case and water resources are available. Demand management options have been analysed and the water needs of local government have been included in the analysis. It seeks to make use of recycled water on an economically sound basis and will have no impact on dam safety.

Government plan/strategy	Overview	Project alignment
	▪ State dams are safe during extreme climate events. ▪ The water management and trading framework maximises the efficient use of water and water infrastructure. The SIP also outlines the hierarchy / preferred progression of options reflected in the QBWOS.	
Queensland Agricultural Land Audit (May 2013)	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.	The audit identifies key areas for horticulture. The reference project is aligned with increasing agricultural production in these areas.
Water Plan (Moreton) 2007	The water plan defines the availability of water in the plan area, identifies priorities and mechanisms for dealing with future water requirements, provides a framework for sustainably managing water and establishes water entitlements for surface water, groundwater and overland flow water. A new draft targeted amendment to the water plan was released for public consultation in August 2019 and was finalised in March 2020. The amendment establishes water allocation and management arrangements for existing surface and groundwater entitlement holders in the Central Lockyer Valley Water Supply Scheme.	The alignment of the project with the Moreton Water Resource Plan and the implications of the project on the plan is covered in this detailed business case.
Water for Life: South East Queensland's Water Security Program 2016– 2046 (2016)	The Water Security Program is Seqwater's plan for providing the region's drinking water over the next 30 years, including during times of drought and flood. The Water Security Program focuses on meeting level of service objectives for South East Queensland set by DNRME. The program covers urban use only and does not assess water security for irrigation customers.	The reference project will be managed in such a way that the objectives for urban water security will not be impacted.
Brisbane River Strategic Floodplain Management Plan (2019)	The plan, released in April 2019, outlines an integrated catchment management planning approach that positions water security and supply within the context of flood management, land use planning and landscape management. Wivenhoe Dam also provides flood mitigation for the downstream floodplain. The optimisation of water supply, flood mitigation and dam safety are a complex matter that is being addressed by Seqwater.	The reference project being investigated will not affect the flood mitigation or dam safety aspects of the dam.

4.3 Australian Government strategies and plans

The following table outlines the Australian Government strategies and plans that were identified as being relevant to the reference project, and the way the project aligns with them.

Table 4.2: Australian Government strategies and plans

Government plan/strategy	Overview	Project alignment
National Water Initiative (NWI) (2004)	The NWI is an intergovernmental agreement that provides the blueprint for national water reform. Federal government guidance notes for the NWI provide that water infrastructure projects should:	The project is aligned with the National Water Initiative. This detailed business case investigates the extent to which costs will be recovered through user costs and the economic viability of the project. The ecological sustainability of the reference

Government plan/strategy	Overview	Project alignment
	▪ be located in areas where NWI-compliant water planning and entitlement frameworks are in place or will be ▪ demonstrate that costs will be recovered through user fees ▪ be economically viable and ecologically sustainable ▪ demonstrate that unallocated water will be released for consumptive use through market-based mechanisms.	project is investigated in this detailed business case.
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 reference project is aligned with the objectives outlined by the National Water Grid Authority. It identifies a project that will support primary industries, increase water security and build resilience to climate change.
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. It also 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 reference project is aligned with the Australia Infrastructure Plan in that it seeks to improve use of existing infrastructure and increase the reliability of water for primary production.

4.4 Local government strategies and plans

The following table outlines the local government strategies and plans that were identified as being relevant to the reference project, and the way the project aligns with them.

Table 8.3: Reference project alignment with local government strategies and plans

Government plan/strategy	Overview	Project alignment
Lockyer Economic Development Plan (2018)	The plan identifies key opportunities for economic growth and some challenges to address. The plan seeks to invest in skills development across various sectors including health, retail, construction, education and agriculture.	The reference project is aligned
Somerset Economic Development Plan (2015)	The plan identifies opportunities as a lifestyle region, Somerset needs to retain its scenic environment, its quality towns and villages and maintain the 'country lifestyle' that is 'really close to Brisbane'. The plan focuses on job creation—strengthening the economy, creating local jobs in the region and retaining strong agriculture, manufacturing and construction sectors in the economy.	The reference project is aligned

4.5 Multi-jurisdictional strategies and plans

The following table outlines the multi-jurisdictional government strategies and plans that were identified as being relevant to the reference project, and the way the project aligns with them.

Table 4.3: Reference project alignment with multi-jurisdictional government strategies and plans

Government plan/strategy	Overview	Project alignment
South East Queensland City Deal	City Deals are a mechanism to develop collaborative plans for growth, renewal and reform. The concept was introduced in 2016 under the Australian Government's Smart Cities Plan. Each City Deal represents a long-term commitment that outlines the investments, planning governance and actions needed to implement them. The Smart Cities Plan wants to promote opportunities for not only metropolitan cities but also regional cities. In February 2019, the Queensland Government and the Council of Mayors (SEQ) jointly released Transforming SEQ, in which they outlined their proposition to the Commonwealth Government for a SEQ City Deal. The Australian Government has also confirmed its commitment to working with the Queensland and local government councils in SEQ to develop a City Deal for the region.	The statement of intent for the proposed City Deal outlines that the objectives of Shaping SEQ (South East Queensland Regional Plan) will be addressed. The project will provide a secure and sustainable water for agricultural production in rural production lands and meet the objectives of the South East Queensland Regional Plan.

4.6 Seqwater considerations in relation to reference project

During the development of the strategic business case, Seqwater expressed a number of considerations (Table 8.5) regarding proposed projects that are relevant to the reference project under consideration in this detailed business case.

Table 8.5: Seqwater considerations in relation to reference project

Issue	Description
Initial impact of recommissioning of Western Corridor Recycled Water Scheme (WCRWS)	Supply of water to the Lockyer only to occur after the WCRWS has been recommissioned for urban water supply
SEQ to be no worse off of in terms of regulated bulk water charges and water security	Existing customers should not be required to pay extra to cover additional costs associated with supply to the Lockyer Valley
Consistency with water planning regime	Any arrangements will need to be consistent with existing water planning and protect existing allocations and extractions
No constraints to supply to existing recycled water customers	Supply to existing customers to take preference
Asset ownership and funding	Seqwater not to invest in or own assets associated with the reference project
Risk allocation	Risk to bulk water supply arising from the project to be allocated to Lockyer Valley
Potable recycled water quality only to be used in existing WCRWS assets	Lower quality water (less than PRW) not be used in the existing WCRWS pipelines

5. Risk

5.1 Introduction

This chapter outlines the risk management methodology and approach utilised in this study and the outcome of the risk assessment conducted throughout the preparation of the detailed business case.

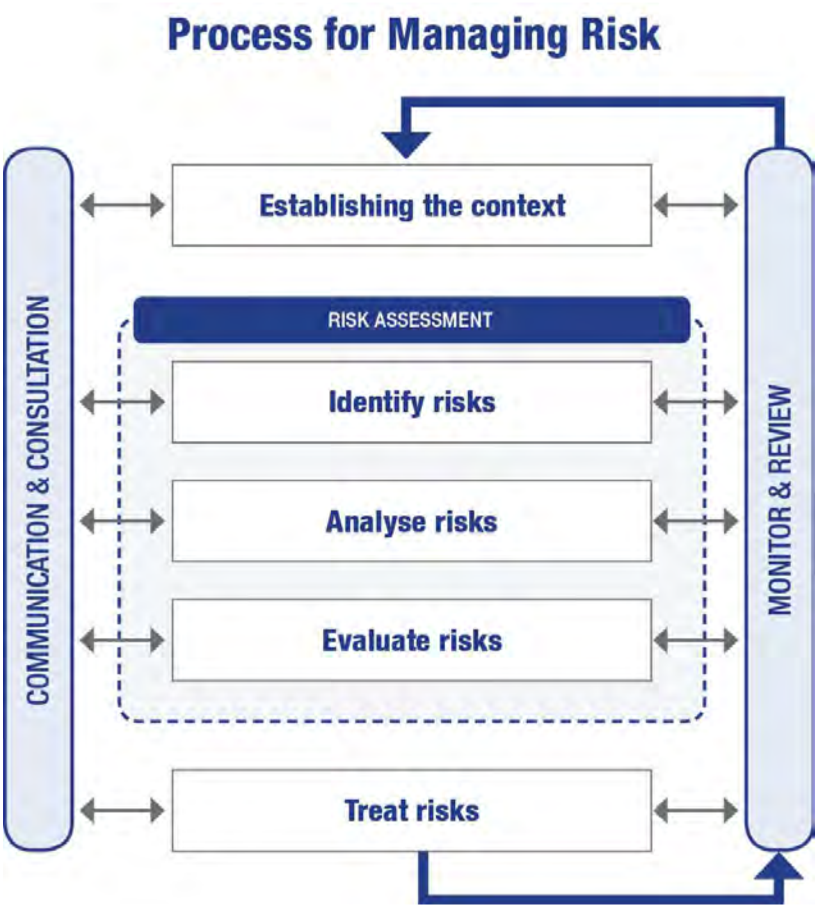
There are inherent risks in the detailed business case process and in the planning, implementation and development of the Reference Project. The risk management process is focused on the identification, assessment and management of risks related to the preparation of the detailed business case and the achievement of the objectives and outcomes associated with the Reference Project.

The Risk Register at Appendix A sets out the risk assessment and mitigation strategy for each identified risk. The risks identified in the Risk Register were identified through comprehensive consultation with stakeholders and in partnership with the Project Working Group.

5.2 Risk approach

Figure D2 outlines the risk management process adopted for this detailed business case. This risk management approach in the Detailed Business Case is aligned with the DNRME risk matrix and methodology. 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 D.1 : DNRME risk management process adopted



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

5.3 Risk criteria

The criteria used in the risk assessment process has been adopted and adapted from the DNRME risk assessment methodology and tools. The risk criteria have been developed in consultation with stakeholders and the Project working Group, and aligns with the equivalent criteria used in the *Water for Lockyer Strategic Business Case*. The risk criteria is composed of three parts: Likelihood; Consequence; and Analysis/Scoring.

5.3.1 Risk likelihood

The risk criteria establish and assess the probability of a particular risk materialising. Table D1 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 D1: 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).

5.3.2 Risk consequences

The risk consequences measure the impact of the occurrence of the risk on the realisation of the benefits of the detailed business case and the Reference Project. The risk consequences have been adapted from the DNRME risk management process.

Table 5.1: 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).

5.3.3 Risk Analysis/Scoring

The Risk Analysis and Scoring Matrix has been developed in the context of the risk appetite of the Project Working Group and stakeholders, and the scope of the detailed business case and Reference Project. 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 5.2: <insert table name> 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)

5.4 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 martialize. The potential risks considered in this risk management process include:

- Business case risks – risks associated with the development of this detailed business case, including risks in the collection and analysis of information related to the Reference Project.
- Project risks – risks associated with the design, procurement, construction, and commissioning of an asset and/or the planning, implementation and approvals required to change legislation, regulations or administrative protocols in order to undertake necessary water reforms.
- Ongoing risks—all operating risks associated with the operation of an asset from commissioning to maintenance to end of life and/or the management of a new or altered water scheme.

The risks set out in the Risk Register at Appendix A were identified through comprehensive consultation with relevant stakeholders and in partnership with the Project Working Group.

5.5 Outcome of risk assessment

The Risk Register (refer appendix) 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 Reference Project relate to the potential for the capital and operational costs of the project to become too high and impact the viability of recovering those costs through fixed and volume water charges. The Risk Register identifies that the effective control strategy for managing the project costs, and resulting impact in demand, is to actively manage the project costs through negotiations and solutions that put downward pressure on capital and operational costs. The management of these risks will require effective collaboration between the Project Working Group, consultants and other stakeholders.

These risks have been icnorporated in the caluclation of the P90 costs.

5.6 Uncertainty of re-commission the Western Corridor Recycled Water Scheme

Seqwater have stated that they will not supply water to the Lockyer until the WCRWS has been re-commissioned for the purpose of urban water users. This is due to the large costs (circa $200 million) for the re-commissioning. The re-commission will occur as required, depending on water levels in the Grid 12. This is largely dependent on future rainfall, which is unpredictable. Therefore, it may be many years until re-commission, or it could be a much shorter period.

6. Base case

6.1 Key points

- The base case represents the situation that will exist if project does not proceed.
- The base case is the baseline that economic and financial assessments of the reference projects will be assessed against.
- As outlined in the service need chapter, the Lockyer Valley is one of the most productive farming areas in Queensland, with significant comparative advantages and the potential to expand greatly. This is despite the region's water reliability challenges.
- The service need is founded on an opportunity to increase agricultural production in the study area, rather than to solve a problem (such as to improve urban water supply to Gatton).
- Without increasing water supply and reliability in the Lockyer Valley, a significant increase in agricultural output will be unlikely. If the reliability of existing supply were to decline, a fall in output and increased unemployment could result.
- The impacts of climate change in the Lockyer Valley are forecast to lead to temperatures gradually increase and overall rainfall to slightly decrease over time. Both changes are expected to be more prominent in spring.

6.2 Approach

The base case outlines what will happen without the construction of the project.

For the project to be economically preferable to doing nothing, its net benefits need to exceed the net benefits of the base case (these net benefits are compared in Chapter 18).

The base case covers a period of 30 years. It rests on the following assumptions:

- There is no material difference between urban and industrial water supply and demand under the 'with project' and 'without project' scenarios.
- The base case is not a 'zero spend' or static option—it is dynamic and assumes that parties will continue to pursue projects that add value (excluding this project).
- No large water storage and associated water distribution infrastructure are built within the study area.
- There are no material changes to the water planning framework or changes in the volume or reliability of water.
- There are no 'shocks' to agricultural commodity prices.
- There are no other shocks that would disrupt the social and economic fabric of the study area.

6.3 Base case

As outlined in the service need chapter, the lack of sustainable and reliable water, rather than land availability, is regarded as the primary limiting factor in production within the Lockyer Valley. Groundwater and surface water sources are fully allocated. Existing water sources are unreliable. A significant expansion in production in the region will not be possible without the introduction of additional reliable water.

The service need is founded on an opportunity to increase agricultural production in the study area, rather than to solve a problem (such as to improve urban water supply to Gatton).

Irrigators access water from a variety of sources. For the five-year period between 2013 and 2017, the annual water use has averaged approximately 40,000 megalitres (ML) for the Lockyer Valley.

Irrigators source their water from:

- Seqwater irrigation schemes,
- on-farm storages,
- unsupplemented rivers and creeks, and
- groundwater.

Most of the irrigated agriculture relates to vegetable production, with beans, carrots, sweetcorn and tomatoes the largest four crops measured by value of production. The breakdown varies from year to year, depending on market and environmental conditions.

The crop mix are annual crops and can be planted and harvested each year. This approach allows for production to rise and fall in line with water availability and with rainfall. This approach, along with consideration of market demand and prices, is expected to continue over time.

The majority of irrigators in the Lockyer Valley have adopted on-farm efficiency measures (i.e. drip and sprinkler irrigation systems) to maintain or improve crop yield per ML of water applied, and will continue to do so where it creates efficiencies for their business operations. Improvements in water efficiency may free up water allocations to support additional production.

In March 2020, the Moreton Water Plan was amended and has provided for an improved framework for water trading within the region. The amended plan has given a framework for determining volumetric limits on groundwater allocations which will allow the conversion of water entitlements to tradeable allocations which promotes efficient and effective water use. Over time, the region will move towards an efficient market for water, with temporary and permanent trading of water supporting 'highest and best' use. Permanent and temporary trades of water entitlements that are currently not used could facilitate industry growth and can activate sleepers (i.e. water allocation holders who use none of their allocation) and dozers (i.e. water allocation holders who use little of their allocation).

However, implementing further water use efficiency measures and increased water trading is unlikely to deliver a step change in the region's agricultural production.

The base case is considered as a continuation of the regional economic agricultural profile and current patterns of production. If the reliability of existing supply were to decline, a fall in output and increased unemployment could result. No future policy or infrastructure intervention is considered to have a materially different impact under either a 'with project' or 'without project' scenario.

6.4 Climate change

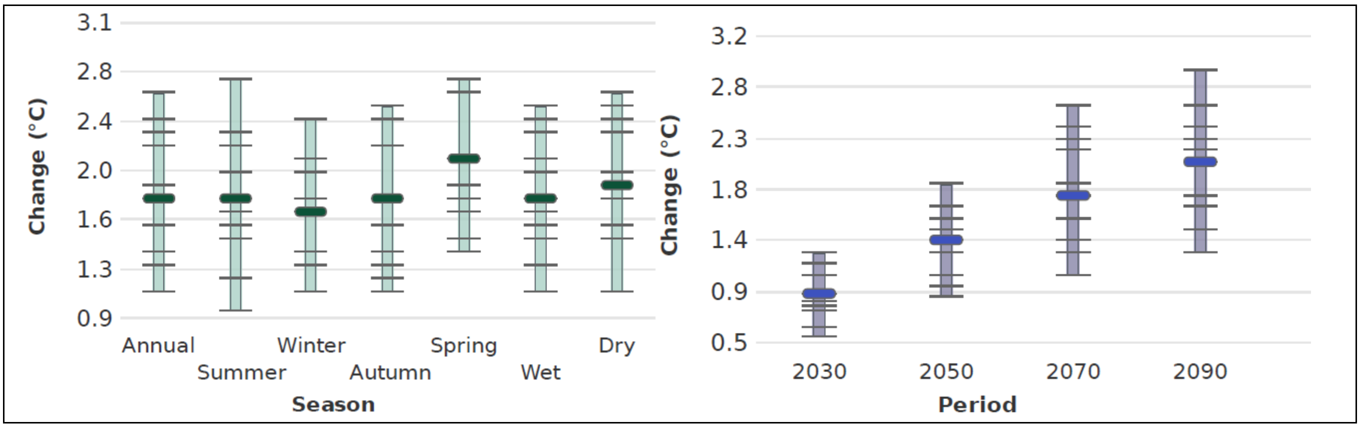
The Queensland Department of Environment and Sciences (DES) developed a comprehensive set of high-resolution climate change projections for Queensland to underpin the Queensland Climate Adaptation Strategy The effect on the South East Queensland region of climate change will include[18]:

- temperatures to continue to increase year round
- hotter and more frequent hot days
- harsher fire weather
- fewer frosts
- reduced rainfall
- more intense downpours.

[18] https://www.qld.gov.au/__data/assets/pdf_file/0023/67631/seq-climate-change-impact-summary.pdf

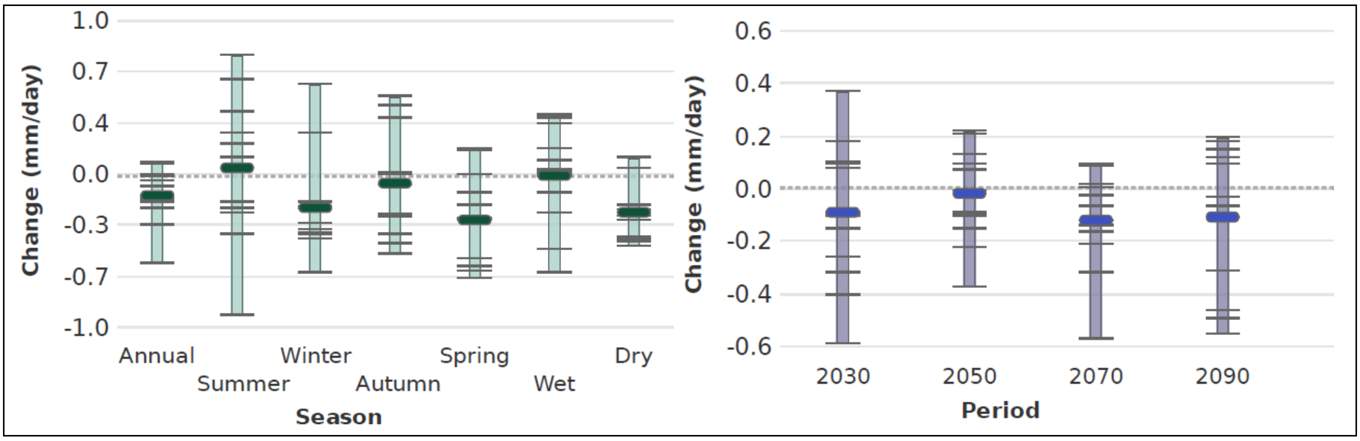
For the Lockyer Valley, temperatures are forecast to gradually increase over time, in particular during spring (**Figure 6.1**). Overall rainfall is expected to slightly decrease, in particular during spring (**Figure 6.2**).

Figure 6.1: Lockyer Valley—Mean temperature changes across seasons (2060-2079) and over time[1]



[1] *Based on long-term changes relative to reference period (1986-2005) and Representative Concentration Pathway 4.5 (CO2 concentrations increase steady until after mid-century, with CO2 concentrations stabilizing around 2060 and reaching 540 ppm by 2100) (Queensland Future Climate Dashboard, https://longpaddock.qld.gov.au/qld-future-climate/dashboard/)*

Figure 6.2: Lockyer Valley—Precipitation changes across seasons (2060-2079) and over time[1]



[1] *Based on long-term changes relative to reference period (1986-2005) and Representative Concentration Pathway 4.5 (CO2 concentrations increase steady until after mid-century, with CO2 concentrations stabilizing around 2060 and reaching 540 ppm by 2100) (Queensland Future Climate Dashboard, https://longpaddock.qld.gov.au/qld-future-climate/dashboard/)*

DES outlined the following potential impacts of climate change for the South East Queensland region:

- increased temperatures leading to heat damage to horticultural crops, difficulties in accessing sufficient water to meet demand, and stress on livestock
- changes in plant diseases, weeds and pests.
- lower rainfall and increasing evaporation causing frequent depletion of soil moisture, reduced ground cover and lower livestock carrying capacity.
- increased risk of storm damage and erosion, leading to greater nutrient runoff and loss of soil.

The following are potential adaptation measures to mitigate the impacts of climate change for the region:

- manage climate variability and change by using forecasts of rainfall (and temperature) in decision making about crops and planting times.
- monitor the spread of pests, weeds and disease.
- provide more cooling mechanisms for livestock, such as shade and sprays.
- investigate new crops or production systems better suited to expected climate conditions.
- develop programs to restore and protect fish habitats, breeding grounds, nursery habitats and fish refugia.

7. Reference project

The Strategic Business Case identified two possible permutations for delivering water to the Lockyer Valley:

- Direct delivery to customers via a pipe network
- Connecting the three Lockyer storages (Lake Clarendon, Atkinson dam and Lake Dyer) to temporarily store any water that is taken from Wivenhoe but not immediately used by the project's customers. Any water stored in the airspace of the three Lockyer Valley storages will be accounted separately to, and not change (improve or diminish) hydrologic performance of, the water supplies of existing water entitlements in the Lower Lockyer and Central Lockyer Water supply schemes.

The Project work group considered the appropriate criteria to use to assess which option should form the Reference Project.

A summary of the findings are provided in the below table.

Criteria	Direct delivery	Use irrigation dams
Fairness and simplicity	No change to existing Seqwater customers	The scheme rules will ensure that existing customers are no worse off and that a separate accounting will occur to ensure the new and old water is treated differently, with existing customers to be provided priority storage rights.
Reliability	No change to delivery reliability	Additional reliability of between 2.4% to 3.2%
Additional capital costs	No additional capital costs	Additional capex to connect the irrigation dams is approximately $1 million.
On farm storage capital costs	If underutilised water is not stored in an irrigation dam, it needs to be stored on site. On-farm storages cost $,1000 to $5,000 per ML of storage. Assuming a mid-point of 3,000 ML, for 3,400 ML of storage (10 per cent) then the avoided cost is $10.2 million.	No new on farm storages required[19]
Wider economic benefits	No additional recreational benefits	The recreational benefits of the fuller dams is approximately $3M

As the increase in reliability is significant, and the increase in direct capital expenditure is smaller than the cost of on-farm solutions, it was concluded to include the existing irrigation dams in the design of the scheme.

7.1 Sourcing water from Seqwater

This detailed business case has undertaken modelling to confirm that taking water for irrigation from Wivenhoe Dam will not have an impact on South East Queensland's urban water security. This is done by increasing the triggers for when the manufactured water products are utilised to supplement South-East Queensland's urban water supply. The additional costs of the manufactured water will be paid for by irrigators.

Jacobs worked with Seqwater to understand hydrologic modelling (using WATHNET) that was commissioned by Seqwater and undertaken by WREMA to explore the average hydrologic performance of the project over time. This modelling also examined potential implications of the project's operations on the average hydrologic performance of South East Queensland's bulk water supply system over the long term.

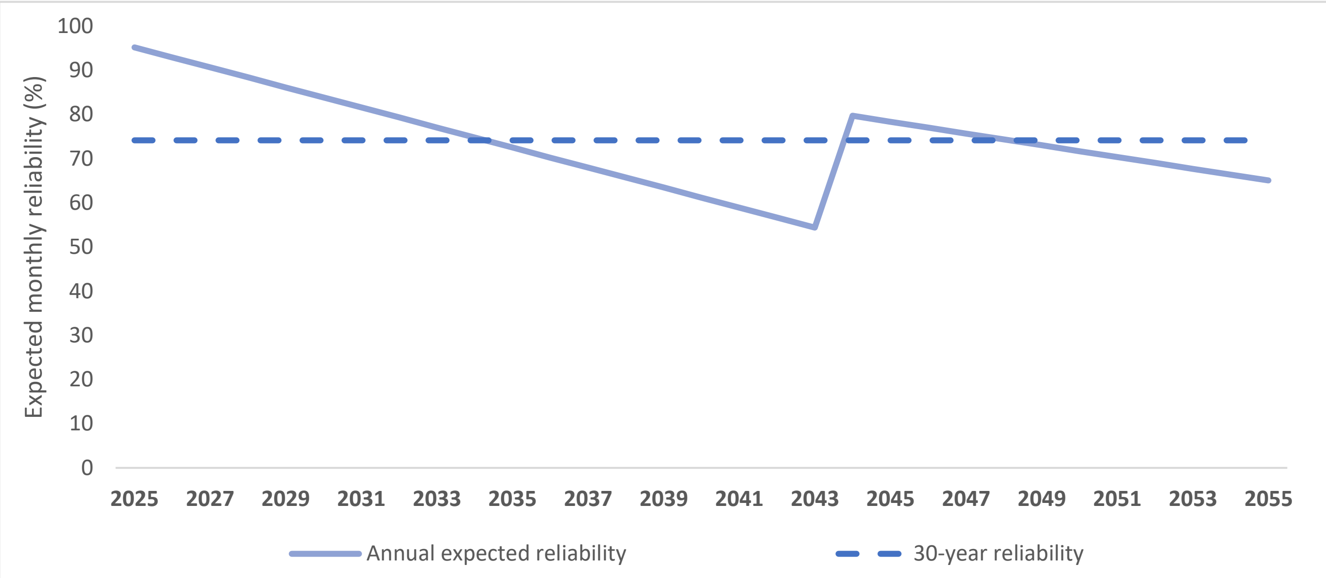
[19] Private investment in on farm storage may be required to optimise the use of water by individual customers under the scheme. The cost of these private on farm storages would not be included in the cost of the project.

For the proposed project, when the combined South East Queensland water storage volume (as represented by the water grid storage level) falls below a defined 'trigger level' then the manufactured water plants (i.e. the Tugun / Gold Coast desalination plant and the Western Corridor Recycled Water pipeline) are assumed to be turned on at which time irrigation transfers from Wivenhoe Dam to the Lockyer Valley will cease.

This means that water supply for the Lockyer will be interrupted to prioritise urban water security.

The new water will have a long-term average monthly reliability of 75 per cent. However, this is expected to vary over time as shown below.

Figure 7.1: Reliability of Reference project



The underlying average hydrologic performance of the scheme is not static but instead fluctuates over time. As the existing assets need to provide priority to urban users, without any degradation to reliability, the growth in urban demand (due to population growth), reduces the reliability for irrigation.

Seqwater are charged with meeting the urban water security objectives specified by the State Government. As population and urban water demand increases over time, Seqwater will need to increase the overall urban capacity in South-East Queensland. For the purpose of this modelling exercise, this is assumed to occur in 2043.

Consequently, the capacity to provide water to Lockyer irrigators will decrease slowly over time until the urban capacity is increased in 2043. Once this capacity is increased in 2044, reliability for irrigators will increase again. We have modelled a 30-year period, however, this pattern of irrigation reliability fluctuating between 55 per cent and 80 per cent will continue beyond this period.

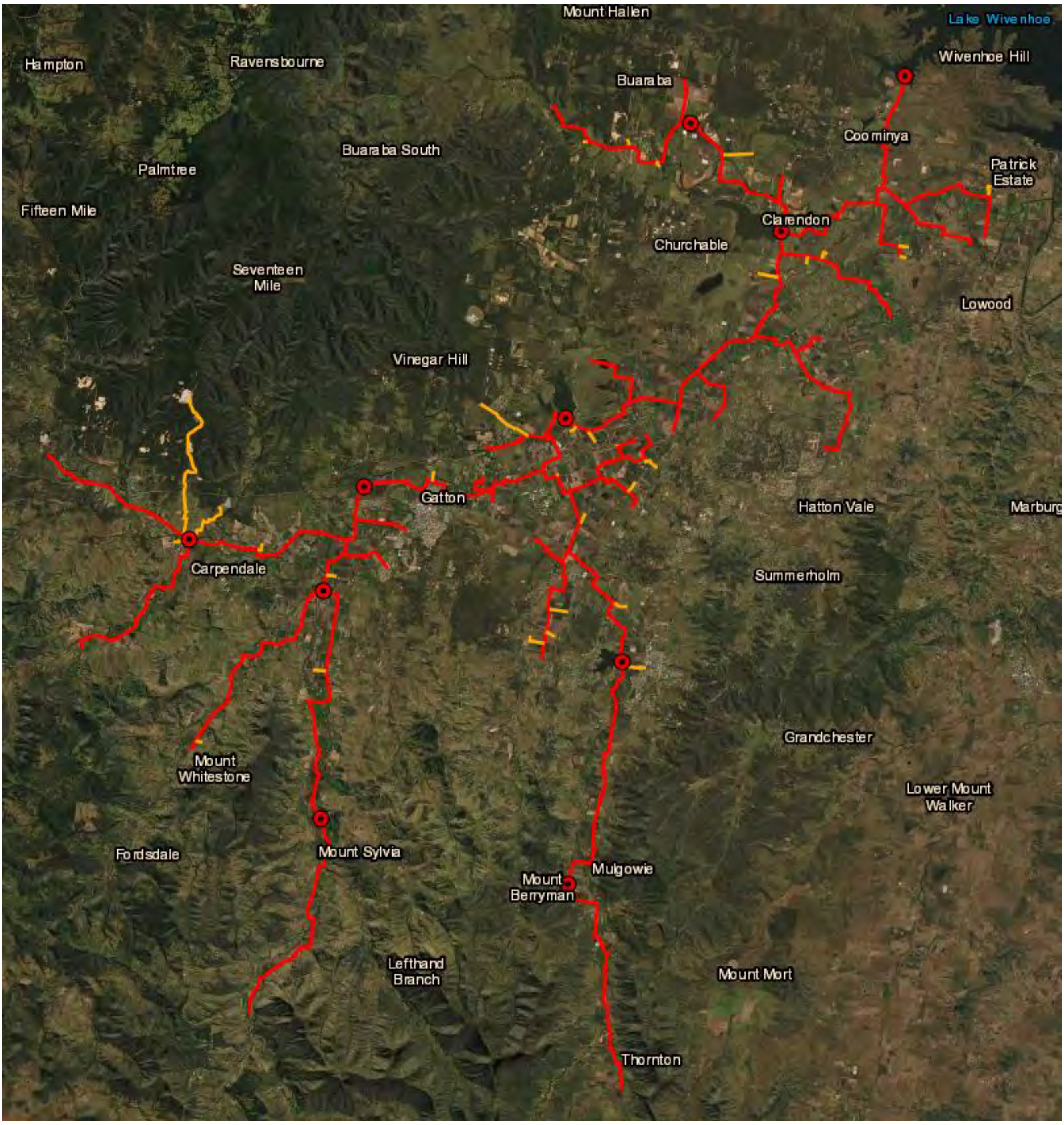
7.2 Pipeline network

In order to deliver this water to where it is needed, a pump and pipeline network is required. The full details are included in Appendix J. The key features include:

Lockyer Valley irrigation scheme snapshot	
Scheme volume	34,000 ML per annum
Delivery period	Scheme will operate 11 months of the year, with capacity to delivery all demand over 9 months
Number of customers	152

Lockyer Valley irrigation scheme snapshot	
Number of properties connected	251
Length of pipeline	297 km
Number of pump stations	10

The proposed route, and the pump stations are shown below.

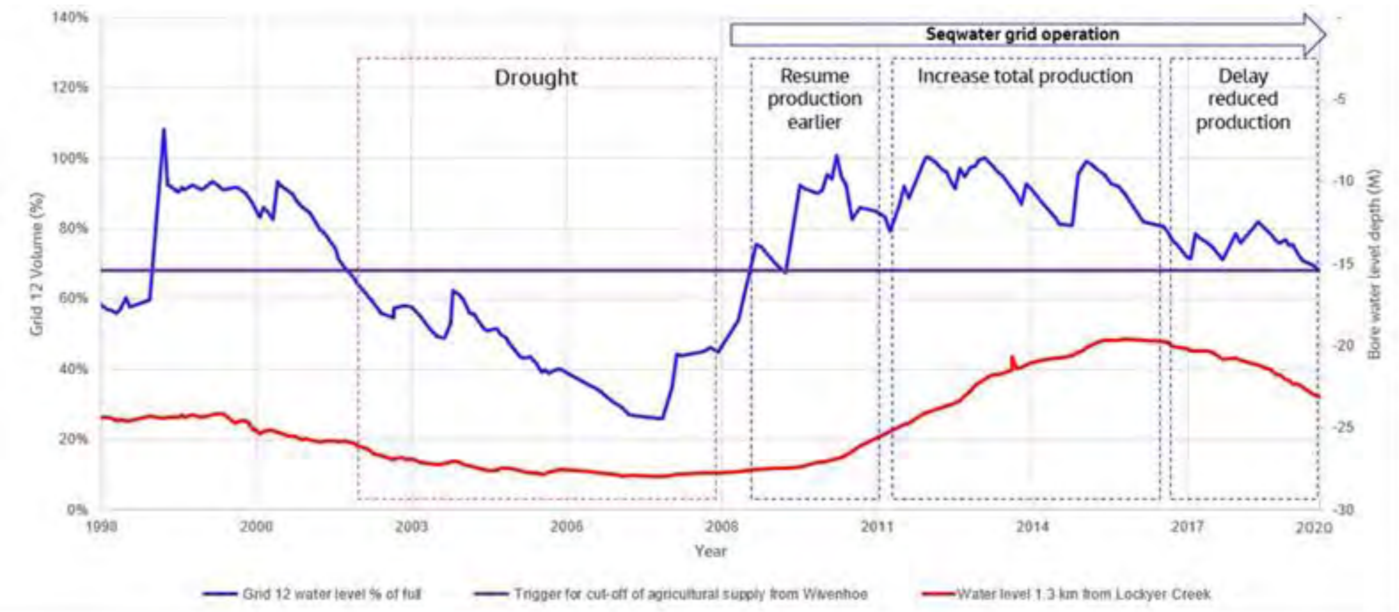


The key benefit of this scheme is to supplement the existing water sources and to add to the portfolio of water products. Water that is secure and reliable allows irrigators to plan and plant with confidence and provides the greatest returns.

As discussed, groundwater is the current dominant water source. Feedback from irrigators indicated that the water would be most valued if it were available when existing water sources were unavailable.

A review of the past 20 years shows when the new water would be available. There are four phases, shown in the figure below:

- Drought – during the 2002 to 2008 millennium drought, groundwater levels were low. At this time, the Grid 12 storages were also below 70 per cent. This means that water would not have been available for irrigators from the Seqwater storages.
- Resume production earlier - when the drought breaks in 2009, the Seqwater dams fill much more quickly than the groundwater recharges. The new water will become available more quickly than the groundwater after the drought break and production can resume more rapidly after a drought.
- Increase total production - during a wet period, total production may opportunistically increase as the additional water can be used in addition with existing sources.
- Delays reduced production – when a new dry period starts, and groundwater levels decrease and salinity increases, water will still be available from Seqwater storages. This will allow additional groundwater use as the new water can be used to dilute the groundwater as salinity increases. This will allow irrigators to delay the impacts of a new drought and shorten its length.



8. Legal and Regulatory considerations

8.1 Key points

- As water is being sourced directly from Seqwater for the project under a contract, rather than the proponent (or the individual holders of the scheme), a bulk water agreement will need to be developed with Seqwater which facilitates price setting and establishes rights to restrict supply.
- A significant portion of the funding for the project is to be raised via equity contributions from future customers for the scheme. The process of raising funds will require compliance with the fundraising provisions of the Corporations Act including the development of a disclosure document (e.g. a prospectus). The disclosure document will need to set out the risks associated with the investment by customers. In addition, prior to a commitment being made by customers, the contract with Seqwater, the customer contract for supply and the rights attaching to the water to be supplied will need to have been finalised. These matters will need to be set out as part of the disclosure.
- The project will require a significant number of local and State approvals. In order, to ascertain the full list of approvals a detailed analysis of the project footprint and an environmental assessment of the affected land will be required.
- As a major project over a significant project area with potential environmental impacts, an application for a declaration of the project as a 'coordinated project' should be made under the *State Development and Public Works Organisation Act 1971 (Qld)* (SDPWO Act). Whether the project will require an Environmental Impact Statement (EIS) or the less onerous process of an Impact Assessment Report (IAR) will depend on the environmental assessment of the project.
- Consideration should be given to applying for an infrastructure designation under the Planning Act (reference to this intent should be made in the application for a coordinated project declaration). If an infrastructure designation is not made individual planning approvals along the length of the pipeline will be required. A list of the possible approvals is set out at Schedule 1 and should be read in conjunction with Chapter 12, Environmental Assessment for this business case.
- As a 297 km pipeline system, access to land for the infrastructure will need to be acquired. Where the pipeline crosses freehold land, easements will need to be negotiated with landowners. If the pipeline falls within road corridors, appropriate agreements (approvals) will need to be negotiated with the State or the relevant Council. Given the length of the pipeline and the location across relatively high-density agricultural areas, land access is likely to be a major issue for the project and will require significant time, negotiation and coordination.
- The project area is subject to a native title claim by the Yuggera Ugarapul People. For land where native title may not have been extinguished, a section 24KA process under the Native Title Act should be considered as it validates a future act for infrastructure for the public, provided the act does not extinguish native title. The native title claimants and holders must be notified and consulted.
- An agreement should be made with the relevant Aboriginal parties, to address Aboriginal cultural heritage in the project area. If an EIS is required, then the agreement will need to be in the form of an approved cultural heritage management plan (CHMP).
- The contracting strategy for the construction of the project will need to be developed with a view to appropriately managing risks, including delays and costs. This will be a key risk needing to be disclosed in the disclosure document to investors.

8.2 Introductory matters

8.2.1 Scope

This Chapter considers the legal and regulatory issues associated with the project and can be divided as follows:

- water regulatory issues associated with making water available under the water framework for SEQ

- legal issues associated with securing appropriate access to land associated with the project footprint including any native title process that may be required
- regulatory approvals required to construct and operate the project including State and Commonwealth environmental approvals
- the contractual relationship between the LME and the customers
- regulatory approvals required by the LME to operate and maintain the project.

This Chapter is not intended to be definitive or final legal advice, nor does it address accounting, financial and tax matters. As the project progresses specialist legal and other advice should be sought on each component of the project. Limited searches have been carried out in relation to the land the subject of the project footprint and reliance is had on the searches carried out for the purpose of Environmental Assessment Chapter. In addition, due to the timeframes involved in implementing a project of this type there may be legislative changes which will need to be considered as the project progresses.

8.2.2 Overview

Jacobs has been engaged by the Lockyer Valley Regional Council on behalf of the Lockyer Valley and Somerset Water Collaborative (project proponent) to prepare a detailed business case (business case) for the development of a water pipeline from the Wivenhoe Dam to deliver water to producers in the Lockyer Valley (project).

There are two options under consideration in the business case:

- water is pumped from Wivenhoe Dam via a new trunk main and delivered through a new distribution network directly to customers (option 1), or
- water is pumped from Wivenhoe Dam through one or more of the three existing irrigation dams in the Lockyer Valley (Atkinson Dam, Lake Clarendon and Lake Dyer/Bill Gunn) via a new trunk main and new distribution network to customers (option 2).

The three existing irrigation dams currently support the Central Lockyer Valley and the Lower Lockyer Valley irrigation schemes. These irrigation schemes, Wivenhoe Dam and the existing irrigation dams are owned by Seqwater.

Under both options, the proponent envisages the ultimate owner and operator of the new infrastructure will be an entity owned by the customers, that is a locally managed entity (LME). The funding for the new infrastructure is expected to be primarily from the producers themselves with a substantial contribution from the Australian and Queensland Government.

On this basis, those producers who invest in the project will become both:

- owners, for example as shareholders in the LME, and
- customers, who are supplied water by the scheme.

Water for the project would be supplied by Seqwater to the LME under existing water allocations held by Seqwater. It is Seqwater's view that for the project to be feasible, the main customers for water from the Wivenhoe Dam, the South East Queensland (SEQ) urban users, must not be worse off in terms of both:

- the reliability and security of supply, and
- the cost of supply.

Key to the reliability issues and the viability of the project is the use of the Western Corridor Recycled Water Scheme (which is currently not operational) to supplement water to Wivenhoe Dam and the cost sharing issues associated with turning that Scheme 'on'.

8.3 SEQ water framework

8.3.1 SEQ water framework overview

Water resource management in Queensland is regulated under the Water Act 2000 (Qld) (Water Act) and the Water Regulation 2016 (Qld) (Water Regulation) (referred to collectively as 'the Water Legislation').

The Water Act establishes a system for sustainable planning, allocation and use of water and a framework for water supply and demand management specifically in the SEQ region. The SEQ region includes the Lockyer Valley Regional Council and Somerset Regional Council areas.

Under the Water Legislation a process for creating water planning instruments has been established. The key instrument relevant to the project area is the Water Plan (Moreton) 2007 (Moreton Plan). Within the Moreton Plan area there are currently three water supply schemes. The Moreton Plan was subject to amendments finalised in December 2019 to provide a framework for managing and allocating surface and underground water in the Central Lockyer Valley water supply scheme.

The water allocations for each are managed under resource operations licence (ROL) held by Seqwater. The existing water supply schemes are Central Lockyer Valley water supply scheme, Lower Lockyer Valley water supply scheme, and Warrill Valley water supply scheme.

The water supplied for this project will be supplied directly from Seqwater under a bulk water agreement with the LME. The water will therefore be separate from the water available in the existing water supply schemes.

8.3.2 Contracting framework for bulk water agreement

The water for the project will come from Wivenhoe Dam and be supplied via a 'bulk water supply agreement' with Seqwater. Neither the individual customers nor the LME will hold a water allocation under the Water Act rather there will be a contractual right for water under the bulk water supply arrangements. We anticipate that the contractual arrangements required to support the project will involve:

- a bulk water supply agreement between Seqwater and the LME (the number of customers, as well as the legal framework that applies to water supplied from Wivenhoe, means that establishing contracts directly between Seqwater and individual customers is not feasible), and
- a water supply contract(s) between the LME and each customer (customer contract).

This project differs from other existing irrigation schemes in Queensland where irrigation customers are the legal owners of their water allocations. This is the most common structure and allows customers to include their water allocation as an asset which a bank can register a security against. The rights associated with a water entitlement under this arrangement will be a contractual right.

8.3.3 Bulk water supply in SEQ

Water supply, security and management in the SEQ region is the responsibility of the Queensland Bulk Water Supply Authority (trading as Seqwater)[20]. Under Chapter 2A of the Water Act, Seqwater as the 'bulk water supply authority' has key obligations associated with water security planning and making contracts with bulk water customers.

Seqwater is also subject to the Bulk Water Supply Code 2013 (Bulk Water Code) which commenced on 1 January 2013[21]. The purpose of the Bulk Water Code is to regulate water pricing and regulate the interface between Seqwater and the bulk water customers responsible for supplying water to water users across SEQ.

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[20] The Authority is established under the *South East Queensland (Restructuring) Act* 2007 (Qld)
[21] The Bulk Water Code is made in accordance with section 360M of the Water Act

The content of any future bulk water supply agreement between Seqwater and the LME will need to have regard to the regulatory framework and constraints on Seqwater in that framework. Key issues of relevance are set out below.

8.3.4 Water security

Under the Water Act and the Water Regulation, Seqwater is required to have a water security program for SEQ to facilitate the achievement of the 'desired level of service objectives for water security' for the SEQ region[22]. The desired level of service objectives for water security are set out in the Water Regulation[23]. The objectives are primarily directed at security for urban demand, setting objectives for restrictions and an essential minimum supply volume per person for both residential and non-residential use. In the contracting arrangement with the LME, 'trigger levels' designed to ensure the supply of water to the project does not impact the Seqwater security objectives are likely to be included. Any right to restrict by Seqwater will need to be reflected in the contract between the LME and its customers. The bulk water supply agreement may also need to address the terms related to the activation (and deactivation) of the Western Corridor Recycled Water, including trigger points and well as pricing implications.

Both Seqwater and the proponent should seek protection from customer claims for failure to supply.

8.3.5 Bulk Water Customer

The Bulk Water Code applies to Seqwater and the 'bulk water customers'. The current bulk water customers are:

- 'SEQ service providers' who are the councils and council owned service providers responsible for urban water supply in SEQ, and
- entities declared as 'bulk water customers' under the Water Regulation. Those customers are CleanCo Queensland Limited, Seqwater (itself), Toowoomba Regional Council and Stanwell Corporation Limited.

Consideration will need to be given to whether the LME should be declared a 'bulk water customer'. If the proponent is declared a bulk water customer, the Bulk Water Code:

- requires that an operating protocol be agreed between Seqwater and LME. The operating protocol includes matters associated with the communication of operational capacity and constraints, asset maintenance and quality and requirements for demand forecasts,
- includes provisions regarding metering, testing and auditing, and
- includes pricing principles which must be considered if there is a pricing decision by the Minister for the Department of Natural Resources Mines and Energy (Water Minister) under section 360W of the Water Act.

In addition, certain provisions in the Water Act will apply to the bulk water agreement including:

- giving the Minister power to make or amend the agreement or make directions about the agreement[24], and
- limiting the liability of the proponent to Seqwater with respect of consequential loss[25].

8.3.6 Pricing under the bulk water agreement

Seqwater is a monopoly business and pricing under the bulk water contract may need to be subject to regulation. Price oversight of the bulk water price provided by Seqwater may occur either via a referral to the Queensland Competition Authority under sections 23 of the Queensland Competition Act 1997 (Qld) (QCA Act) or via section 999 of the Water Act.

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[22] Section 350 of the Water Act
[23] See Part 6, Subdivision 1 of the Water Regulation
[24] Sections 360G, 360H and 360I of the Water Act
[25] Section 360L of the Water Act

If the proponent is a bulk water customer the pricing decision is made by the Water Minster under section 360W of the Water Act following a report from the Queensland Competition Authority and the pricing principles for 'other user pricing' in the Bulk Water Code should be considered.

8.4 Local management

8.4.1 Project vehicle owned by producers

The project proponent intends to raise funds through financial contributions from producers seeking to access water in the project. This will require the incorporation of a corporate vehicle (likely a public company limited by shares) and the key components of this vehicle (referred to as the LME) likely to provide:

- customers, through the LME will own the scheme infrastructure,
- the LME will be not-for-profit with all revenue used for the operation and maintenance of the Scheme,
- the ownership rights held by individual producers in the LME will be (broadly) proportionate to their level of capital investment and reflective of the volume of water made available to the them,
- the ownership rights can be sold for value, and
- the governance arrangements reflect best practice and support long term stability, financial viability and transparency in the operation of an irrigation scheme.

8.4.2 Fundraising - requirement for disclosure document

In order to raise funds from producers for the project, it is expected that future customers will agree to commit funds to the project in return for equity (shares) in the LME and a right to receive water from the project. The LME will use these funds to finance the project.

Under the Corporations Act, there are specific disclosure requirements which must be followed by a Company when it issues securities (shares) [26]. Unless a specific exemption applies a prospectus or information statement (disclosure document) must be prepared and lodged with ASIC. Where the disclosure document provisions apply there will be prescribed content required by the regulatory regime. The intent of these provisions is to ensure that investors can make informed decisions about whether to accept the offer to invest. The investment by producers will carry significant risk which will need to be articulated in the disclosure document. Risk includes, for example, risk associated with approvals and construction, delay and cost overruns or force majeure events could result in delays to the start of the project or worst case a failure to start. Other risks include curtailment of water supply due to water restrictions or climatic conditions will need to be articulated.

The process of issuing a disclosure document is significant and will require specialised legal and financial advice. At least 12 months should be factored into this process[27].

The disclosure process exposes directors of the company to civil liability under the Corporations Act including for example misleading and deceptive conduct. To limit these risks, when developing a disclosure document, a careful due diligence process should be established to ensure that all statements of fact, opinion or belief can be justified and verified. Careful and through articulation of risk associated with the investment, including the possibility multiply factors will affect water supply and the investment does not guarantee a supply of water and that fixed charges would be payable through any curtailment. The due diligence process generally would include the establishment of a due diligence committee made up of key legal and accounting advisors and board representatives. All statements of fact, opinion and assumption will need to be carefully checked and verified through this process.

[26] Section 708 of the Corporations Act
[27] If an information statement rather than a full prospectus is issued financial reports for the prior 12 months are generally required by ASIC

8.4.3 Exception to disclosure requirements in the Corporation Act

Under the Corporations Act 2001 (Cth) there are exceptions to the disclosure document requirements. Given the expected number of shareholders and the amounts being raised it seems unlikely that an exemption from the disclosure requirements in the Corporations Act could be achieved.

8.5 Water and delivery rights –customer contracts

On investment in the LME, producers will be required to enter into contractual arrangements, conditional on the completion of the project, with the proponent LME which facilitate:

- the right of each customer to a share of the water available to the project under the terms of the bulk water supply agreement (water right), and
- the right of each customer to a share of the delivery capacity of the water supply infrastructure (delivery right).

The contract should be standardised for the scheme so that all customers are on the same terms and conditions. This does not prevent different prices applying if there are different water products. Significantly, the contract will need to provide for and allow (without liability to the LME) curtailment of supply when that occurs under the Bulk Water Supply agreement with Seqwater, for operation reasons or for reasons outside the LME's control.

The contract should cover the following:

- the link to the relevant shareholding so that there is no ability to terminate the contract, unless a termination or 'exit' fee is paid. The termination fee is necessary to secure the revenue stream to the LME given the significant infrastructure investment (in setting these, reference is required to the law associated with penalties and unfair contract terms[28] and would need to be reasonable).
- the contract should allow for rights under the contract (some or all of the water right and/or delivery right) to be transferred. However, in such a case the new owner of the right would be bound by the standard contract,
- a mechanism for price setting with respect to the delivery rights, including the basis on which the LME can set prices,
- a mechanism to change contract terms should circumstances require,
- mechanisms to require security from customers should that be deemed necessary by the LME, and
- an ability to seasonally assign part or all of a water right or delivery right within a water year (this may enable producers to use these rights to bring in water from other schemes).

Charges under the contract associated with the water rights should be linked to the bulk water supply agreement.

8.5.1 Pricing under the customer contract

In line with other local management irrigation schemes, it is expected that the pricing for water supply under the customer contract would be set by the LME without QCA oversight. Nonetheless, once established there is potential for the Minister or Governor in Council to declare the LME a monopoly business activity under the Queensland Competition Authority Act 1997 (Qld).

The customer contract will need to provide mechanisms for price setting and include pricing principles. Regard will need to be given to the unfair contract provisions in the Australian Consumer Protection Law under the Competition and Consumer Act 2010 (Cth) when developing the customer contract.

[28] The Commonwealth Water Charges (Termination Fees) Rules 2009 has been commonly used to assist in setting these charges. These Rules were repealed on 1 July 2020.

8.6 Legal matters arising between option 1 and option 2

Generally, the matters set out in this Report will be substantially the same for options 1 and 2 with the exception of:

- additional matters which will need to be dealt with in the contractual arrangements with Seqwater to manage and facilitate the project water mixing with the existing water supply schemes; and
- review of each resource operations licence (ROL) and resource operation manual for the three water supply schemes (being the Central Lockyer Valley, Lower Lockyer Valley and Warrill Valley) to interact with the distribution operations licence (DOL) held by the LME.

The Seqwater agreement will need to include details on:

- water accounting and sharing arrangements, including ensuring that the arrangements do not adversely impact on existing customers already supplied from the dams, and
- water pricing.

The terms and conditions of the contract between Seqwater and the LME related to the supply of water via the irrigation dams would need to be reflected in the water supply contract between the LME and individual customers.

8.7 Water Act and Water Supply Act – Operational approvals

8.7.1 Water Service Provider

Under the Water Supply (Safety and Reliability) Act 2008 (Qld) (Water Supply Act) the owner of water infrastructure is required to register as a service provider to operate a water service for which a charge is intended. The Act provides the registered service provider with certain powers, including for example protection for its infrastructure if it is located on land not owned by the service provider.

8.7.2 Distribution Operations Licence (DOL)

A distribution operations licence authorises its holder to take water or interfere with the flow of water to distribute water under water allocations. Given that the LME will not be distributing water under water allocations, there is a question as to whether a DOL would be required. However, in our view, the Regulator is likely to require the LME to hold a DOL under Option 2, where the water supplied will be mixing with the water held in the dams for the three water supply schemes.

8.8 Coordinated project

8.8.1 Coordinated project status

This is a significant project and will require local and state approvals and may also, depending on the environmental assessments, require federal approvals. The Environmental Assessment chapter details potential environmental impacts and secondary environmental approvals associated with this project. The scale and scope of the project indicate that there may be potential environmental impacts and therefore an application as a coordinated project under the State Development and Public Works Organisation Act 1971 (SDPWO Act) is recommended.

A project can be declared as a 'coordinated project' by the coordinator general under section 26(1) of the SDPWO Act.

The project may be declared a coordinated project for which:

- an environmental impact statement (EIS) is required, or

- an impact assessment report (IAR) may be required.

The IAR process is generally a simpler process to the EIS process and would only apply where the coordinator general is satisfied the environmental effects of the project do not, having regard to their scale and extent, require assessment through the EIS process[29].

Further consideration will be required as to the potential environmental impacts of this project to determine whether the project could be a coordinated project for which an EIS is required or a coordinated project for which an IAR is required. Noting the project footprint will be approximately 297 kms long, cross natural watercourses, roads, rail and private land and the potential environmental impacts set out in the Environmental Assessment Chapter it is likely that this is a project for which an EIS will be required.

In considering whether to declare a project to be a coordinated project, the coordinator general must have regard to:

- detailed information about the project given by the proponent in an initial advice statement,
- relevant planning schemes or policy frameworks of a local government, the state or the Commonwealth,
- relevant state policies and government priorities,
- a pre-feasibility assessment of the project, including how it satisfies an identified need or demand,
- the capacity of the proponent to undertake and complete the EIS for the project,
- any other matter the coordinator general considers relevant[30].

8.8.2 Applicant for the coordinated project

The applicant for the coordinated project approval must be the project vehicle (i.e. the LME). The application can occur before the capital funding process occurs.

The application must include an 'initial advice statement' and enough information about the project to allow the coordinator general to consider the matters mentioned in section 27(1) and (2).

8.8.3 Advantages to the coordinated project process

If the project is declared a coordinated project, the environmental assessment process carried out under the SDPWO Act is an 'authorisation process' accredited under section 46 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and would not require a separate approval under Part 9 of the EPBC Act[31]. In addition, if the project is a coordinated project:

- for which an EIS is required, the proponent can apply under the State Development Act for approval for the project as a private infrastructure facility, without having to satisfy the Coordinator General that adequate environmental assessment has been carried out[32]. Obtaining private infrastructure status enables the compulsory acquisition powers to be use in the SPDWO Act, and
- it is a 'relevant purpose' under the *Vegetation Management Act (Qld)* 1999 which allows a vegetation clearing application to be made under the Planning Legislation.

If an EIS is required, the proponent must have an approved Cultural Heritage Management Plan (CHMP).

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[29] Section 26(2) of the State Development Act
[30] Section 27 of the State Development Act
[31] Section 46 of the EPBC Act and the Bilateral Agreement between the Commonwealth and Queensland clause 3.1(c)
[32] Section 153AA(1)(a) and (b) of the State Development Act

8.8.4 8.4 Timeframe

8.4.1 The EIS process can take between 18 months to 2 years. An IAR process will generally be shorter particularly if no public notification process is required.

8.9 Planning Legislation

8.9.1 Overview

The *Planning Act 2016* (Qld) (Planning Act) and the *Planning Regulation 2017* (Qld) (Planning Regulation) (referred to collectively as 'the Planning Legislation') regulate certain types of development (including certain vegetation clearing). Before development of the project can proceed, a development permit may be required.

Under the Planning Act, there are 3 types of development:

- prohibited development, which is prohibited
- assessable development, which will require a development permit before the development can proceed
- accepted development, which can proceed without a development permit being obtained.

For a project of this type it may be possible to obtain an infrastructure designation under section 35 of the Planning Act. If a designation of the infrastructure is made, then 'development in relation to the infrastructure' will be 'accepted development' for the purpose of the Planning Act and no development application will be required[33]. A requirement to obtain a development permit for any components of the project that involve 'building work' under the Building Act will still be required.

The alternative would be to ascertain the components of the project which are assessable development against the Planning Legislation and the relevant Council Planning Schemes and make the appropriate application to the relevant assessment manager.

8.9.2 Infrastructure designation

A decision can be made under section 35 of the Planning Act by a local government or the Planning Minister that identifies a location for certain infrastructure. Such a designation can be made for "water cycle management infrastructure" (schedule 5 of the Planning Regulation). As this project covers two Council areas (Somerset Regional Council and Lockyer Valley Regional Council) the application should be made to the Planning Minister.

Should the designation of the infrastructure be made, then 'development in relation to the infrastructure' will be 'accepted development' for the purpose of the Planning Act and no development application will be required[34].

To designate the infrastructure, the Planning Minister must be satisfied that:

- the infrastructure will satisfy statutory requirements, or budgetary commitments, for the supply of the infrastructure, or
- there is, or will be a need for, the efficient and timely supply of the infrastructure[35].

To make the designation, the Planning Minister must also be satisfied that adequate environmental assessment, including consultation, has been carried out in relation to the project the subject of the designation.[36]

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[33] Section 44(4) and (6)(b).

[34] Section 44(4) and (6)(b). Note the usual position is that the infrastructure designation does not excuse the requirement to obtain a development permit for any components of the project that involve 'building work' under the Building Act. However, building work by a 'public sector entity' is 'accepted development' under section 2 of Schedule 7 of the Planning Regulation.

[35] Section 36(2) of the Planning Act.

[36] Section 36(2) of the Planning Act.

The process for consultation and environmental assessment is set out in the Minister's Guidelines and Rules (Guidelines) made under the Planning Act.37 If the Guidelines are followed, the Minister can be taken to be satisfied that there has been that adequate environmental assessment38. The Planning Act provides for the Minister to be satisfied that the consultation and environmental assessment has been adequate if another process is followed.

The Guidelines provide that a site description and location of the premises for the proposed designation. This will require the whole project footprint to be mapped at the time of making the application. Although, with respect to linear developments the Guidelines provide for linear development the location and premises description "may include plans and descriptions of proposed use, location and impact at a high level, provide the infrastructure proposal in a format that is tailored to linear infrastructure and use mapping[39])." Most designations approved since the provisions commenced in 2016 involve site specific infrastructure.

8.9.3 Planning approvals

In the event a designation of land for the project is not obtained, separate planning approvals will be required across both the Lockyer Valley Regional Council and Somerset Regional Council including the following development permits for:

- reconfiguration of lot,
- a material change of use at pump station locations,
- operational works for vegetation clearing under the Vegetation Management Act 1999 (Qld),
- for taking or interfering with water,
- operational work that is constructing or raising waterway barrier works, and
- building work.

The full list of relevant approvals will need to be prepared following confirmation of the project footprint, the vegetation mapping, land tenure and watercourse crossings.

When considering whether a development permit will be required, reference should be made to:

- within the Lockyer Valley Regional Council areas:
  - the Gatton Shire Planning Scheme 2007 which regulates development in the former Gatton Shire Council Area (other than the Grantham Reconstruction Area Development Scheme),
  - the Laidley Shire Planning Scheme 2003-Amendment 2 which regulates the development across the former Laidley Shire Council Area, and
  - the Grantham Reconstruction Area Development Scheme,
- within the Somerset Regional Council, the Somerset Region Planning Scheme 2016.

8.9.4 Strategic cropping land

Land in the region includes areas shown on the strategic cropping land trigger map as strategic cropping land which will need to be checked once the footprint is established.

Under the Regional Planning Interests Act 2014 (Qld) a strategic cropping area is an area of regional interest. Under the Act a 'regional interests development approval' is required for activity in a strategic cropping area which is likely to have widespread and irreversible impact on the area of regional interest. It will be necessary to

[37]Chapter 7 describes the designation process for environmental assessment and consultation for making or amending a ministerial designation; Chapter 8 outlines the designation process for local government when making and amending a designation.
[38]Section 36(3) of the Planning Act.
[39] See the Guidelines, Chapter 7, 2.2 and specific requirements for linear development at section 2.4.

consider the impact of the works in any strategic cropping area and whether any regional interests development approval is required.

8.9.5 Barrier works in a waterway

Operational work that is constructing or raising waterway barrier works will require a development permit unless it is accepted development. One assumption is that barriers may need to be constructed during the trenching across waterways (although mitigation techniques including horizontal drilling may be available). The works may be accepted development if:

- it is development in relation to designated infrastructure; or
- if it is listed in the Planning Regulation (schedule 7, part 3, section 6) which refers back to the Fisheries General Regulation 2019 (Qld) and the exemptions published under that called "Accepted development requirements for operational work that is constructing or raising waterway barrier works"

The exemptions should be considered if an infrastructure designation is not obtained.

8.9.6 Vegetation clearing

The *Vegetation Management Act 1999 (Qld)* (VM Act) regulates the clearing of vegetation in Queensland. Clearing native vegetation in the first instance is prohibited development under the Planning Regulation[40] unless it is for:

- a 'relevant purpose' listed in the VM Act (which includes a 'coordinated project' or relevant infrastructure), and
- is not exempt clearing (which includes clearing for water infrastructure if the clearing is on a designated premises (i.e. subject to an infrastructure designation listed above)), and
- is not accepted development under schedule 7, part 3, section 12 of the Planning Regulation. Accepted development for this purpose is clearing vegetation to which an 'accepted development vegetation clearing code' applies.

For native vegetation clearing involving the construction and maintenance of infrastructure the relevant code is "Accepted development vegetation clearing code for clearing for infrastructure".

If the clearing is for a relevant purpose but not exempt or accepted, the clearing will be is assessable development for which a development permit will be required. On determination of the final clearing requirements for the project, if an infrastructure designation is obtained separate clearing development permits should not be required. Otherwise an analysis of the vegetation clearing, the category type and the tenure on which it is to occur against the code is required to determine whether any clearing which will require a development permit.

8.10 Approvals for works within the watercourse

8.10.1 Water Act requirements

The project will include works to cross a watercourse, including for example the Lockyer and Laidley Creeks. (see [1.4.6.3] of Chapter 11, Environmental Assessment identified creek crossing).

Under the Water Act,[41] it is an offence to, without an appropriate permit or exception to:

- destroy vegetation, excavate or place fill in a watercourse[42]

[40] Schedule 10, Part 3 of the Planning Regulation
[41] The Water Act, Chapter 2, part 4, section 218 and the offence provisions in section 814.
[42] See section 814 of the Water Act.

- take or interfere with water if the taking or interfering is not authorised.[43]

8.10.2 Riverine protection permit – vegetation, excavation or place fill in a watercourse

For the authorisation of the destruction of vegetation, excavation or placement of fill in a watercourse to occur:

- it must happen as a necessary and unavoidable part of the construction of works that are accepted development and involves the taking or interfering with water in a watercourse, lake or spring[44] that is under an infrastructure designation, or
- a riverine protection permit must be obtained.

A riverine protection permit will not be required provided an infrastructure designation addresses the taking or interfering of water in a watercourse destruction of vegetation, excavation or placement of fill in a watercourse.

In the event a separate riverine permit is required, the criteria set out in the Water Act must be considered when applying for the permit.[45]

8.10.3 Taking or interfering with water

Operational work that involves the taking of, or interfering with water in a watercourse is classified as assessable development under the Planning Regulation[46], unless it is accepted development. It can be accepted development if:

- it is development in relation to designated infrastructure, or
- it is listed in the Planning Regulation (schedule 7, part 3, section 5) – a provision which is unlikely to apply to the scope of the project works.

8.11 Environmental approvals

8.11.1 Consideration of environmental issues

The environmental impacts of the project will need to be considered once the project footprint is determined.

Environmental approvals may be required under:

- the EPBC Act,
- the Environmental Protection Act 1994 (Qld) (Environmental Protection Act),
- the Nature Conservation Act 1992 (Qld) (Nature Conservation Act).

8.11.2 Environmental impact statement (EIS)

Depending on the scale and scope of the project it may be determined as being a coordinated project for which an EIS would be required. Whether an EIS will be required will depend on:

- any declaration as a coordinated project under the SDPWO Act for which an EIS is required,
- whether an EIS is required by the Commonwealth Minister under the EPBC Act, or
- if the relevant impacts of the project are to be assessed under a bilateral agreement[47].

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[43] See section 808 of the Water Act.
[44] See section 814(2) of the Water Act.
[45] See section 220 of the Water Act.
[46] Schedule 10, part 19, section 19 of the Planning Regulation.
[47] Section 37 of the EP Act.

8.11.3 Environmental Protection Act and 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 construction will meet the extraction of material volume for ERA 16 extractive activities (5,000t or more of material, in a year)[48],
- waste management during the construction process.

If any ERAs will occur during the construction or operation of the Scheme the project proponent will be required to be a registered suitable operator under the Environmental Protection Act.

8.11.4 11.4EPBC Act

The EPBC Act provides for the protection of 'matters of national environmental significance' (MNES). Further assessment of the project area is required to determine whether any matters of NES will be affected.

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.

It is noted that the EPBC Act is undergoing a major review and if matters of MNES are impacted by the project the changes (if any) to this legislation will need to be considered.

8.11.5 Environmental Offsets and Resources Reserve

A pipeline is projected to run through a 'resource reserve' which is a 'protected area' under the *Nature Conservation Act* 1992 (Qld) (Nature Conservation Act). An authority to construct the pipeline within the area of the reserve will require the consent of the Chief Executive of the Department of Environment and Science[49]. The authority must be consistent with the management principles for resource reserves set out in the Nature Conservation Act which includes that the works protect the area's cultural and natural resources, provide for the controlled use of the area and that it is maintained in predominately a natural condition.

A protected area is a matter of State environmental significance under the *Environmental Offsets Regulation 2014* (Qld) and therefore is a 'prescribed environmental matter' under the *Environmental Offsets Act 2014* (Qld). This Act permits an offset condition to be applied to the authority required under the Nature Conservation Act where, following consideration of avoidance and mitigation measures, the prescribed activity is likely to result in a significant residual impact on a prescribed environmental matter(s). Further information on the potential impact of the offset requirements and other matters of State environmental significance which may trigger an offset requirement.

8.12 Land access for infrastructure

8.12.1 Overview

To access land for the project and secure the project infrastructure, the LME will need to negotiate access to construct and locate infrastructure on privately held land. The pipeline may be secured by easements. For major infrastructure, for example pump stations, it would be preferable, given the scope of the infrastructure involved that freehold tenure which provides the most security is secured for those locations.

[48] Schedule 2, part 4, 16 of the Planning Regulation
[49] Section 34 of the Nature Conservation Act

Given the length of the pipelines and the location across relatively high-density agricultural areas land access is likely to be a significant issue for the project and will require significant time, negotiation and coordination. An initial estimate of the land parcels involved estimates 1,751 properties will be involved in the project.

Land acquisition negotiations and contracting can become protracted. The purchase price (or compensation for an easement) payable in these circumstances may also be elevated due to the project need to acquire the land. Compulsory acquisition powers may be available.

Any contracts with landowners should be in the form of an option which can be exercised by the proponent (or their nominee) upon the final project approvals and financial close being achieved.

8.12.2 Compulsory acquisition powers

Should negotiations fail or become protracted, the project proponent could consider making an application under the SDPWO Act to the Coordinator-General for approval of the project as a 'private infrastructure facility and to take land' required for the project under part 6, division 7, subdivision 2.

To be eligible to apply the provisions in the SDPWO Act requires that the project has been declared a coordinated project for which an EIS and the area of land identified as required for the infrastructure facility is consistent with the land assessed in the EIS for the project.

In addition, for the Governor in Council to approve the application, the Governor in Council must be satisfied that the criteria[50] have been met, including (most relevantly) that:

- the project has economic or social significance;
- the proponent has the financial and technical capability to complete the project; and
- for the relevant land, the proponent has negotiated for at least 6 months with each registered owner of the land and has taken reasonable steps to purchase the land by agreement.

8.12.3 Roads

The project is likely to either cross or run adjacent to both local and state-controlled roads. Land within a local road is owned by the State, however the Land Act provides that the control of roads rests with the relevant local government, in this case the either the Lockyer Valley Regional Council or the Somerset Regional Council. State-controlled roads are governed by the *Transport Infrastructure Act 1994* (Qld).

8.12.3.1 Local roads

Where pipelines are proposed to be constructed in the area of a local road, the consent of the relevant Council will be required, and appropriate crossing agreements agreed.

8.12.3.2 State controlled road

To construct the pipeline within the area of a state-controlled road, an approval to construct and locate ancillary works and encroachments within the area of the road will need to be obtained from Department of Transport and Main Roads (DTMR)[51].

Appropriate traffic plans which comply with DTMR's requirements and the *Transport Infrastructure Act 1994* (Qld) will be required.

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[50] Section 153AC(2) of the State Development Act.
[51] Section 50 of the Transport Infrastructure Act and the Ancillary Works and Encroachments Notice (No 3) 2017

8.12.4 Electricity

Energex, a Queensland government owned corporation, has electricity powerlines through the project area. This infrastructure is protected under the Electricity Act 1994 (Qld) and may also be subject to easements over privately owned land. If any part of the construction will impact these assets, agreements with Energex /Powerlink will be required.

8.12.5 Railway

The project may need to cross or run adjacent to the West Moreton Rail line operated by Queensland Rail. Should any crossing of the rail line be required a crossing agreement with Queensland Rail will be needed.

Works conducted in a rail corridor must comply with the Rail Safety National Law.

8.13 Queensland Heritage

Within the project area a number of state-listed and locally listed historic cultural heritage places and have been identified. A list of which is set out in Chapter 11: Environmental Assessment. The protection of state-listed cultural heritage is regulated and protected under the *Queensland Heritage Act 1992 (Qld)* (QH Act). In addition, under the QH Act, notice must be given to the State of any discovery during the construction process of an archaeological artefact with important information regarding Queensland's history.

Primarily, in order for works to occur on a state-listed or local-listed heritage place either:

- an 'general exemption' which gives upfront approvals for minor works,
- a specific exemption certificate for the works that have no more than a minor impact on heritage values from will be required from the chief executive of the Department of Environment and Heritage Protection for a Queensland heritage place or the chief executive of the local government for a local heritage place, or
- a development permit for assessable development under the Planning Legislation which is used if the works have more than a minor detrimental impact on a heritage place.

In assessing the application, the development must not have a detrimental impact, or minimal detrimental impact on the cultural heritage significance of the place.

8.14 Native Title and Aboriginal Cultural Heritage

8.14.1 Overview

Before the project can proceed steps are required under:

- *the Native Title Act 1994* (Cth) (Native Title Act),
- the *Aboriginal Cultural Heritage Act 2003* (Qld) (Aboriginal Cultural Heritage Act).

8.14.2 Aboriginal parties for the project area

A large part of the project area is subject to a claim by the Yuggera Ugarapul People (QC2017/005). A small parcel of land close to Wivenhoe Dam and close to the potential project area is subject to a determination that native title exists (QCD 2012/2011 Jinibara People).

The registered aboriginal parties for the area are:

- Yuggera Ugarapul People (QC2017/005),
- Jinibara People (QCD 2012/2011) (subject to the final project foot print), and
- the Jagera People #2 (QC2003/015 PRC) in the area close to outflow at Wivenhoe Dam.

8.14.3 Aboriginal cultural heritage

In Queensland, cultural heritage is protected under the *Queensland Heritage Act 1992* (Qld) and the Aboriginal Cultural Heritage Act.

The Aboriginal Cultural Heritage Act includes a general duty of care to take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage, makes it unlawful to harm Aboriginal cultural heritage and includes a prohibition in relation to the excavation, relocation or taking away of Aboriginal cultural heritage (cultural heritage duty of care)[52].

The Act creates further offences to which penalties attach for failing to comply including:

- 13.3.3.1 making it unlawful for a person to harm Aboriginal cultural heritage,
- 13.3.3.2 prohibition on excavating, relocating or taking away Aboriginal cultural heritage, and
- 13.3.3.3 prohibition on possessing an object that is Aboriginal cultural heritage.

Relevantly, the cultural heritage duty of care is taken to be complied with if the person carrying out an activity is acting:

- under an approved Cultural Heritage Management Plan (CHMP)
- under a native title agreement or another agreement with an Aboriginal party, or
- in compliance with cultural heritage guidelines[53].

Under the Aboriginal Cultural Heritage Act, the Aboriginal party for the project will be the registered native title party for the area, that being the Yuggera Ugarapul People (assuming the project does not impact the property covered by the determination of native title to the Jinibara People) and the Jagera People #2 (QC2003/015 PRC) for the area close to the outflow at Wivenhoe Dam.

To comply with the cultural heritage duty of care and other obligations in the Aboriginal Cultural Heritage Act, the project proponent should engage with the relevant Aboriginal party for the project areas.

If an EIS is required for the project, additional provisions apply and an approved CHMP will be required before any excavation, construction or other activity can occur[54].

8.14.4 Timeframe - CHMP

If a CHMP is required 18 months should be allowed as a minimum for the consultation and negotiation process.

8.14.5 Native Title Act

The Native Title Act recognises and protects native title and provides that native title cannot be extinguished contrary to the Act.

The Act provides the framework for:

- acts which may affect native title
- the process for determining whether native title exists and compensation for acts which affect native title.

'Native title' is recognised in the Native Title Act and at common law in Australia as communal, group or individual right and interests of Aboriginal people or Torres Strait Islanders in relation to land or water that is

[52] Section 23, 24 and 25 of the Aboriginal Cultural Heritage Act.
[53] Section 23(3)(a)(ii), 24(3)(a)(ii) and 253(a)(iii) of the Aboriginal Cultural Heritage Act.
[54] Section 87 of the Aboriginal Cultural Heritage Act.

possessed under traditional law and customs where there is a connection by Aboriginal people or Torres Strait Islanders to that place.

The Native Title Act provides the framework for determining which land may have been subject to an act which had the effect of extinguishing native title on that land prior to the commencement of the Native Title Act (or shortly after). Where land exists within the project area that has been:

- subject to a native title determination where native title is found to exist, or
- was not the subject of a 'previous exclusive possession act',

then before an act which may have the effect of extinguishing native title can occur in the relevant area a process under the Native Title Act must be followed.

8.14.6 Native title has been determined in parts of the project area

Within the project area there may be land where native title may not have been extinguished. Native title can be considered extinguished, relevantly, if the land has been subject to a 'previous exclusive possession act' prior to 23 December 1996 (the date of the Wik decision). A 'previous exclusive possession act' includes the valid grant of freehold or certain leasehold with respect to the land[55]. A claim for native title cannot be made with respect to land that was the subject of a 'previous exclusive possession act'[56].

In order to determine whether land in the project area has been subject to a prior 'exclusive possession act' a historical tenure analysis is required in relation to all land within the project area.

If on finalising the project footprint, land exists that was not the subject of a previous exclusive possession act, native title may still exist and before the land can be used for the project, a process under the Native Title Act must be followed.

Given that this project generally involves the construction of water pipelines and pump stations the process in section 24KA of the Native Title Act may be appropriate.

8.14.7 Section 24KA

Under section 24KA of the Native Title Act certain future acts associated with infrastructure can be validated (i.e. are permitted) under the section.

The section applies with respect to the construction and operation of certain infrastructure including pipelines or other water supply or reticulation facilities. It can be used by any person if the infrastructure is operated for the general public, provided the infrastructure does not prevent native title holders from having reasonable access to the land (other than during construction or for health or safety reasons).

The section provides for certain procedural rights including:

- the rights that would be available to an owner of any land concerned or covering the land adjoining, or surrounding, any waters concerned;
- in the exercise of the procedural rights, any native title holders are entitled to have matters considered;
- notice should be given to the relevant native title holders and the Queensland South Native Title Services.

Further guidance as to the process can be found in the Queensland Government Native Title Work Procedures – Module K. These work procedures set out the requirements the State will follow before granting the relevant easement/lease.

[55] Section 23B of the Native Title Act.
[56] Section 61A of the Native Title Act.

8.14.8 Timeframes

13.8.1 The proponent should allow at least 12 months for the process associated with native title.

8.15 Electricity

The project will require electricity to operate. Connections to the Energex Distribution Network may be required at the pump stations. Consent from Energex to connect to their assets will be required and depending on the loads require connection agreements.

8.16 Risk

8.16.1 15.1 Construction - risk

During the construction phase, the LME will be exposed to a number of risks which can be grouped as follows:

- Project constructed to standard,
- Project completed on time and within cost allowance,
- Claims for loss or damage to property or injury or death to any person.

The contracting delivery model for the construction of the project will need careful consideration to minimise the risk of delay or cost overruns.

8.16.2 Insurance

The risks of liability during the construction will need to be identified and the LME should obtain appropriate insurance.

8.16.3 Operations

To manage customer claims, the LME will need to ensure the customer contract includes robust protections for failure to supply. Ongoing insurance will be required.

8.17 Work, health and safety

16.1.1 During the construction phase, risks associated with the construction works, the construction contract with the principal contractor should be responsible for the construction site and the works and comply with the requirements in the Work Health and Safety Act 2011 (Qld).

8.18 Summary of approvals

A consolidated summary of approvals is shown below.

Table 8.1: Summary of approvals

Approval	Legislation	Description/Action	Timing	Responsible authority
Commonwealth				
Referral - 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. If the project will, or is likely to have, a significant impact on a	The referral should be made as soon as possible. Following receipt, the Minister has 20	Department of the Environment (Commonwealth)

Approval	Legislation	Description/Action	Timing	Responsible authority
		matter of national environmental significance a referral will be required.	business days to determine whether the action is a controlled action.	
State approvals				
Declaration as a coordinated project	*State Development and Public Works Organisation Act 1971* (Qld)	A declaration as a coordinated project for which an EIS is required under 26 of the SPDWO Act.	As soon as possible after project go ahead.	The coordinator general under the SDPWO Act. Department of State Development, Manufacturing, Infrastructure and Planning
EIS and Evaluation Report by coordinator general	*State Development and Public Works Organisation Act 1971* (Qld)	EIS process and evaluation by coordinator general	Following declaration. Allow 2 years.	The coordinator general under the SDPWO Act. Department of State Development, Manufacturing, Infrastructure and Planning
Application for designation of the infrastructure	*Planning Act 2016* (Qld) S35	A designation of the project obtained under the Planning Act will allow the project to proceed without development permits required under the Planning Act. Footprint for the project will be required before making the application.	Following declaration as coordinated project. Timing to be further considered. Allow 2 – 3 months. Consultation period will be required.	Minister for the Department of State Development, Manufacturing, Infrastructure and Planning
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)	Should the designation not be achieved a development application will need to be made for at least the following: ▪ 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[57]	Prior to constructions Applicable if designation for the project is not obtained	State Assessment and Referral Agency Lockyer Valley Regional Council, Somerset Regional Council

[57] Schedule 8, Table 4 of the Planning Regulation

Approval	Legislation	Description/Action	Timing	Responsible authority
	Nature Conservation Act 1992 (Qld)			
Environmental Approval for Environmental Relevant Activities (ERAs)	*Environmental Protection Act 1994* (Qld)	The proponent will be required obtain environmental authorities for any environmental relevant activities (ERAs)	Prior to construction	Department of Environment and Heritage/State Assessment and Referral Agency
Registered suitable operator	*Environmental Protection Act 1994* (Qld)	The proponent must be registered as a suitable operator for carrying our ERAs	Prior to construction	Department of Environment and Heritage/State Assessment and Referral Agency
Authority for works in a protected area	*Nature Conservation Act 1992* (Qld)	The proponent must obtain authority to construct the works within the area of a resources reserve (protected area)	Prior to construction	Department of Environment and Heritage
Exemption Certificate (or Development Permit) – Heritage Places	*Queensland Heritage Act 1992 (Qld)*	Any works on a local or state heritage place will need to either fall within a general exemption or an exemption certificate or a development permit will be required. Consent of the owner of the property will be required for the application.	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)	Development application required for any assessable building works against the Building Act	Prior to construction	Lockyer Valley Regional Council, Somerset Regional Council
Ancillary works and encroachment approval	*Transport Infrastructure Act 1994* (Qld) (section 50)	Approval is required to construct infrastructure within the area of a state-controlled road	Prior to construction	Department of Main Roads and Transport
Application to close a local road	*Land Act 1994* (Qld)	Required if any road is to be closed permanently	Prior to construction	Department of Natural Resources, Mines and Energy
Approval to interfere with a local road	*Local Government Act 2009* (Qld)	Required for local roads affected by the construction works	Prior to construction	Lockyer Valley Regional Council, Somerset Regional Council
Water Permit	*Water Act 2000* (Qld) (section 137)	Required to take water during construction.	Prior to construction	Department of Natural Resources, Mines and Energy
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	Prior to construction May not be required if part of	Department of Natural Resources, Mines and Energy

Approval	Legislation	Description/Action	Timing	Responsible authority
		infrastructure designation proposal.	infrastructure designation obtained	
Fisheries permit	*Fisheries Act 1994* (Qld)	Permit 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)	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	
Operating approvals				
Distribution operations licence and operations manual	*Water Act 2000* (Qld)	Required to operate a water service	Prior to operations	Department of Natural Resources, Mines and Energy
Service provider registration	*Water Supply (Safety and Reliability) Act 2008* (Qld)	Required to operate as a supplier of a water service	Already registered	Department of Natural Resources, Mines and Energy

8.19 Legal definitions

A consolidated summary of legal definitions is shown below.

Table 8.2: Legal definitions

Definition	Meaning
Aboriginal Cultural Heritage Act	*Aboriginal Cultural Heritage Act 2003* (Qld)
Acquisition Act	*Acquisition of Land Act 1967* (Qld).
ASIC	Australian Securities and Investment Commission.
Bulk Water Code	*Bulk Water Supply Code 2013*.
CHMP	Cultural Heritage Management Plan.
Corporations Act	*Corporations Act 2001* (Cth).
Councils	Lockyer Valley Regional Council and the Somerset Regional Council.
cultural heritage duty of care	includes a general duty of care to take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage, makes it unlawful to harm Aboriginal cultural heritage and includes a prohibition in relation to the excavation, relocation or taking away of Aboriginal cultural heritage under the Aboriginal Cultural Heritage Act.

Definition	Meaning
DOL	Distribution Operations Licence.
EIS	environmental impact statement.
Environmental Protection Act	*Environmental Protection Act 1994* (Qld).
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth).
ERAs	environmental relevant activities.
IAR	impact assessment report.
ILUA	Indigenous Land Use Agreement.
LME	Local Management Entity.
Land Act	*Land Act 1994* (Qld).
Local Government Act	*Local Government Act 2009* (Qld).
Moreton Plan	Water Plan (Moreton) 2007.
Native Title Act	*Native Title Act 1994* (Cth).
Nature Conservation Act	*Nature Conservation Act 1992* (Qld).
NES	national environmental significance under the EPBC Act.
NWI	National Water Initiative.
Planning Act	*Planning Act 2016* (Qld).
Planning Legislation	Collectively, the Planning Act and the Planning Regulation.
Planning Regulation	*Planning Regulation 2017* (Qld).
ROL	Resource Operations Licence.
SEQ	South East Queensland.
SDPWO Act	*State Development and Public Works Organisation Act 1971*.
TI Act	*Transport Infrastructure Act 1994* (Qld).
VM Act	*Vegetation Management Act 1999* (Qld).
Water Act	*Water Act 2000* (Qld).
Water Legislation	Collectively, the Water Act and the Water Regulation.
Water Regulation	*Water Regulation 2016* (Qld).
Water Supply Act	*Water Supply (Safety and Reliability) Act 2008* (Qld).

9. Public interest considerations

9.1 Key points

- Significant community and stakeholder consultation about the reference project has occurred throughout the Strategic Assessment, Options Analysis and Detailed Business Case phases.
- This consultation has involved one on one meetings, workshops, public meetings, media campaigns and advertising and social media.
- In addition, a detailed demand assessment process has occurred which involved significant stakeholder consultation
- The Reference Project will have negative impacts on some stakeholders mainly during the construction phase of the project.
- Landholders along the pipeline route will be negatively impacted by construction activities and the need to develop easements and other infrastructure facilities.
- Infrastructure providers (roads, electricity, water) will be impacted by construction activities.
- Existing vegetation and waterways will be impacted by the construction of the pipeline.
- Surface and groundwater impacts are likely.
- The project has a strong social licence from irrigators and other beneficiaries of the scheme.
- Seqwater has expressed concerns that the reference project should not accelerate the recommissioning of the Western Corridor Recycled Water Scheme and that there should be no cost or risk impacts on urban consumers.
- No major issues related to public access and equity, consumer rights, safety and security and privacy were identified that the project will not provide safeguards against.

9.2 Methodology

According to the Building Queensland guidelines public interest considerations should identify whether the reference project will provide (perceived or real) equitable outcomes for stakeholders and the potential negative impacts of the project. The assessment of whether the Reference Project is in the public interest needs to consider:

- Community consultation and stakeholder engagement undertaken
- Impact on stakeholders
- Social licence status
- Public access and equity
- Consumer rights
- Safety and security
- Privacy

9.3 Community and stakeholder consultation

A structured program was 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. Other direct community and stakeholder engagement conducted during the Options Analysis included:

- Lockyer Water Users Forum
- Lockyer Valley Growers
- Lockyer Chamber of Commerce & Industry
- Seqwater
- Queensland Urban Utilities
- Lockyer Valley Regional Council
- Somerset Regional Council
- Council of Mayors
- City Deals
- Queensland Government agencies, including DNRME, DAF, DSDMIP, Queensland Treasury, QTC and Building Queensland.

In the period between the finalisation of the Options Analysis and the commencement of the Detailed Business Case community engagement was conducted as part of the demand assessment process. Six community meetings were held throughout the Lockyer Valley in late January / early February. These were attended by at least the 247 people who provided contact details at those meetings. Each person was provided with an EOI form. A further 58 participants contacted the project and subsequently provided a completed EOI.

The Stakeholder Engagement Plan for the Detailed Business Case identified the relevant stakeholders to be consulted.

Table 9.1 summarises the stakeholders that were identified in relation to the reference project being investigated in the Detailed Business Case. Not all stakeholders are directly consulted.

Table 9.1: : Potential Stakeholders

Stakeholder category	Stakeholder
Departmental Ministers	Minister for Agriculture and Water Resources
	Minister for the Environment
	Minister for Infrastructure, Transport and Regional Development
Elected representatives	Federal Member for Wright Federal Member for Blair
Opposition and crossbench members of parliament	Relevant Shadow Ministers and other interested members
Australian Government departments and authorities	Department of Infrastructure, Transport, Regional Development and Communications
	Department of the Agriculture, Water and the Environment
	National Water Grid Authority
	Infrastructure Australia
	Regional Development Australia
Premier and departmental ministers	Premier and Minister for Trade
	Queensland Treasurer
	Minister for State Development, Manufacturing, Infrastructure and Planning

Stakeholder category	Stakeholder
	Minister for Natural Resources, Mines and Energy
	Minister for Agricultural Industry Development and Fisheries
	Minister for Environment and the Great Barrier Reef
	Minister for Local Government
Elected representatives	State Member for Lockyer State Member for Nanango
Opposition and crossbench members of parliament	Relevant Shadow Ministers and other interested members
Queensland Government departments, authorities and corporations	Queensland Treasury
	Queensland Treasury Corporation
	Department of Natural Resources, Mines and Energy
	Department of State Development, Manufacturing, Infrastructure and Planning
	Department of Agriculture and Fisheries
	Department of Environment and Science
	Department of Local Government, Racing and Multicultural Affairs
	Building Queensland
	Seqwater
	Queensland Urban Utilities
	Sunwater
Councils	Lockyer Valley Regional Council Somerset Regional Council Council of Mayors
Landholders	Directly affected landholders
Potential customers	Parties that could receive water from the project
Potential contractors	Parties that could tender for the project if it is approved and funded
Environmental groups	Healthy Land & Water Regional NRM Group
Industry peak bodies	Queensland Farmers' Federation
	Growcom
	Others
Community groups (interest groups and community service organisations)	Lockyer Chamber of Commerce and Industry
	Lockyer Water Users Forum
	Lockyer Valley Growers
Utility service providers	Energex
	Vodafone
	Telstra
	Optus
Traditional owners / Aboriginal cultural heritage	Yuggera Ugarapul People

9.4 Social licence status

A 'social licence to operate' is commonly defined as a project having ongoing approval within the local community and other stakeholders, resulting in broad social acceptance.

The stakeholder consultation revealed that within the Lockyer Valley community there was significant support for the project. Local governments in the area are strongly supportive of the project.

Most landholders who would be able to purchase additional water from the scheme supported the project going ahead. There was strong support for the opportunity to support production in the study area and investment in purchasing water allocations.

Consultation with peak bodies and chambers of commerce in the area revealed support for the project

Supporters of the project recognised the opportunities for the project to enhance regional development. Direct beneficiaries, such as irrigators within the supply area and other enterprises, strongly supported the project on the basis that it would lead to growth in business, provide drought resilience and improve the viability and sustainability of existing enterprises.

Wider beneficiaries of the project, such as local businesses and accommodation providers, were also supportive. The additional jobs supported by the project are a key feature of the social licence to operate.

Consultation with Queensland Government departments and corporations revealed additional matters relating to the wider implications and distribution of benefits and costs arising from the Reference Project.

Seqwater specifically identified that:

- The project must not result in the Western Corridor Recycled Water Scheme being brought forward.
- Supply to irrigators should only occur after the Western Corridor Recycled Water Scheme has been recommissioned for urban water supply.
- The project is to have no cost impacts on Seqwater
- The project is to result in no loss of water security for urban customers
- The project is to result in no constraints of recycled water supply to existing customers of the scheme

9.5 Public access and equity

The impacts of the project on public access to areas will be minimal and mainly related to the impacts of construction activities.

Irrigators associated with the current scheme that may be supplemented by the project or along the pipeline route will be granted equitable rights to purchase water from the scheme.

9.6 Consumer rights

No consumer rights issues (including right to safety, right to be informed, right to choose, right to be heard) were identified that the project will not provide safeguards against.

9.7 Safety and security

All construction and operational activities associated with the pipeline construction project will comply with the security, health and safety requirements outlined in the relevant legislation.

Procurement will follow the proper process and checks and balances. The risk of corrupt activity potentially in the building and management of the dam would be managed by adhering to strict procurement guidelines and the laws of the State of Queensland.

10. Sustainability assessment

10.1 Key points

- The purpose of this chapter is to assess the sustainability aspects of a project to increase the supply of irrigation water from the Wivenhoe dam to the Lockyer Valley.
- The Reference Project is assessed against the sustainability criteria set out in the Building Queensland guidelines.
- The Building Queensland Guidelines requires assessment against governance, environmental, economic and social aspects.
- A pipeline to the Lockyer Valley from Wivenhoe Dam will provide additional water to support agricultural development and improve water security sector.
- Significant strategic planning has occurred in relation to the project.
- Procurement strategies will be adopted that enhance sustainability outcomes.
- The project will add to the resilience of agricultural production in the Lockyer Valley by adding a climate resilient water source for producers.
- Sourcing materials locally will reduce the carbon footprint of the project.
- Operation of the irrigation pipeline will add to greenhouse gas emissions
- 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.
- Key potential environmental impacts that have been identified as part of the project include:
  - Vegetation clearing
  - Flora and fauna impacts
  - Impacts on waterways from pipeline crossings
  - Impacts on riparian zones and stream stability
  - Groundwater impacts
  - Surface water impacts
  - Construction impacts – dust, noise, air quality
- Materials will be recycled where possible

10.2 Methodology

The reference project has been assessed against the four identified aspects of sustainability identified by Building Queensland: governance, environment, social and economic.

Governance sustainability under the BQ Guideline 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 reference project design and project development was at an early stage when this assessment was undertaken further workshops will need to occur to refine the sustainability aspects of the project.

The workshops identified that the most important drivers for change in the future and how the project would respond to these. Key future drivers identified were global demand for food irrigation development, climate change and population growth.

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 BQ DBC 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:

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.

10.3 Sustainability Assessment

10.3.1 Governance

SUSTAINABILITY ASSESSMENT - GOVERNANCE	Achievement
1. CONTEXT	
Despite water reliability challenges, the Lockyer Valley is one of the most productive farming areas in Queensland, with significant comparative advantages and the potential to expand greatly. There is an opportunity to significantly grow the economy and sustainability of the Lockyer region with broader flow-on effects for South East Queensland. The Lockyer Valley supplies most of Australia's vegetables during the winter months and accounts for approximately 28 per cent of Queensland's total horticultural production Agriculture is the dominant industry in the Lockyer Valley and the broader greater Ipswich area. Total agricultural production was valued at over $523 million in 2017-18, consisting almost mainly of vegetables and livestock production. Agriculture is the biggest employer in the study region, employing 11.2 per cent of workers. This is significantly higher than for the rest of Queensland (2.8 per cent) and Australia (2.5 per cent). The level of socio-economic disadvantage in the Lockyer Valley and Somerset region is high, compared with the rest of Queensland. The current sources of water in the Lockyer Valley are unreliable and are fully allocated. Medium priority allocations typically targeted a reliability of around 80 per cent—the monthly reliability of medium priority allocations in the Central Lockyer Valley and the Lower Lockyer water supply schemes are between 50–65 per cent. Announced allocations in the Lower Lockyer water supply scheme over the last three seasons have been below 20 per cent. The availability of sustainable and reliable water supplies limits the economic development opportunities and growth in the study region. A further 57,500 ML per annum could be used within the study region based on land suitability. Significant demand for additional water supply has been demonstrated through a detailed, two-stage demand assessment. Without increasing water supply and reliability in the Lockyer Valley, a significant increase in	Advanced

agricultural output will be unlikely. If the reliability of existing supply were to decline, a fall in output and increased unemployment could result. The project aims to meet the service need by providing additional water to the area. It is aligned with key Australian, State and Local Government strategies that aim to increase agricultural production. The project is predicated on the Western Corridor Recycled Water Scheme being operational and returning additional water to Wivenhoe Dam. It aims to leverage of existing recycled water and irrigation assets that are currently underutilised.	
2. STRATEGIC PLANNING	
There have been numerous studies and reports into the issue of additional water supply for the Lockyer Valley for irrigated agriculture over the past twenty years. Recently the Commonwealth Government, through the National Water Initiative, funded two pre-feasibility studies to investigate specific options for the region. Water for Agriculture Productivity and Sustainability completed by Cardno in 2018 for the Lockyer Valley Regional Council and the NuWater Project Feasibility completed by GHD for the Queensland Farmers Federation in 2018 were both major investigations into options for additional water supply The Strategic Assessment and Options Analysis that can be considered the forerunner to this detailed Business Case identified a range of options to meet the service need with the Reference project being the highest rated of the options assessed.	Advanced
3. LEADERSHIP AND MANAGEMENT	
National thought leaders in irrigation and pipeline design have been recruited for the development of the Detailed Business Case. The Steering Committee for the project is highly skilled in the development of irrigation infrastructure. The project builds on the experience of external consultants working on dam infrastructure projects across Australia. The Detailed Business Case considers governance, economic, environmental and risk assessments in line with the Building Queensland frameworks.	Advanced
4. 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 (Sustainable Procurement Guide, 2013). The core principle underpinning the guide is value for money, which has also been a key consideration for the development of the project. 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

5. RESILIENCE	
The project will add to the resilience of agricultural production in the Lockyer Valley by adding a climate resilient water source for producers. The major natural hazard in the project area is flooding with the proposed infrastructure being designed in accordance with this risk	Moderate
6. INNOVATION	
The project will contribute indirectly to the reuse of waste-water from a major capital city for agricultural production which is considered a highly innovative approach.	Moderate

10.3.2 Environment

SUSTAINABILITY ASSESSMENT - ENVIRONMENT	Achievement
7. ENERGY AND CARBON	
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 South East Queensland market will reduce the need for importing food from interstate with its associated carbon and energy. Pumping associated with the movement of water through the pipeline will add to the carbon and energy footprint of the project. The operation of the Western Corridor Recycled Water Scheme as part of the operation of the project will have a significant carbon and energy footprint. Procurement of construction and materials will 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. 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. .	Basic
8. GREEN INFRASTRUCTURE	
The project involves the construction of a pipeline and the use of existing irrigation infrastructure assets. Green infrastructure solutions have not been considered as appropriate or required within this context.	Not applicable
9. ENVIRONMENTAL IMPACTS	
Key environmental impacts that have been identified as part of the project include: ▪ Vegetation clearing ▪ Flora and fauna impacts ▪ Impacts on waterways from pipeline crossings ▪ Impacts on riparian zones and stream stability ▪ Groundwater impacts ▪ Surface water impacts ▪ Construction impacts – dust, noise, air quality ▪ Additional greenhouse gas Detail of the mitigation options identified are presented in the environmental chapter of this Business Case.	Moderate

10. RESOURCES	
All materials that can be recycled would be processed through local recycling facilities, although volumes are expected to be minimal. Waste that could be generated by construction activities during the construction phase include 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.	Moderate
11. WATER	
The construction activities associated with the project are expected to require little water usage. The additional water delivered to the Lockyer will be used highly effectively. The area is experienced in delivering high quality agricultural output with limited water supplies The project will indirectly make a major contribution to water reuse in that the additional water supplied from Wivenhoe dam will be supplemented by water from the Western Corridor Recycled Water Scheme.	Advanced

10.3.3 Social

SUSTAINABILITY ASSESSMENT - SOCIAL	Achievement
12. STAKEHOLDER ENGAGEMENT	
A structured program was 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. Other direct community and stakeholder engagement conducted during the Options Analysis included: ▪ Lockyer Water Users Forum ▪ Lockyer Valley Growers ▪ Lockyer Chamber of Commerce & Industry ▪ Seqwater ▪ Queensland Urban Utilities ▪ Lockyer Valley Regional Council ▪ Somerset Regional Council ▪ Queensland Government agencies, including DNRME, DAF, DSDMIP, Queensland Treasury, QTC and Building Queensland. In the period between the finalisation of the Options Analysis and the commencement of the Detailed Business Case community engagement was conducted as part of the demand assessment process. Six community meetings were held throughout the Lockyer Valley in late January / early February. These were attended by at least the 247 people who provided contact details at those meetings. Each person was provided with an EOI form. A further 58 participants contacted the project and subsequently provided a completed EOI. The Stakeholder Engagement Plan for the Detailed Business Case identified the relevant stakeholders to be consulted.	Advanced

10.3.4 Economic

SUSTAINABILITY ASSESSMENT - ECONOMIC	Achievement
13. BENEFIT REALISATION	
Seven key benefits of addressing the service need were identified through engagement of key stakeholders and review of previous assessments. These are: • increased agricultural production, value, and economic activity • increased agribusiness and local value-add production, value, and activity • increased tourism and recreational benefits • additional regional investment • creating local jobs • encouraging commercially focused research and skill attainment • development of new markets • supporting diversification, resilience, wellbeing, and economic prosperity. A record of the benefits is maintained in the Benefit Register	Advanced

11. Social impact evaluation

11.1 Key points

This chapter presents the social impacts associated with the construction of a pipeline to the Lockyer Valley from Wivenhoe Dam (Reference Project) to facilitate an increase in agricultural production.

The Social Impact Evaluation is conducted in alignment with the Building Queensland guidelines.

The baseline study for the Social Impact Evaluation showed that:

- The population of the study area is 67,950 people.
- The population of the area is growing faster than the rest of Queensland.
- The median age of residents is higher than the rest of Queensland with a higher proportion of people over 65.
- 3.8% of the regional population is identified as Indigenous, as compared to 4.0% for Queensland.
- The Index of Relative Social Disadvantage showed that 38.1% of residents were classified as in the most disadvantaged quintile as compared to Queensland (20%).
- The region has lower median weekly incomes than in Queensland as a whole.
- Unemployment in the Lockyer Valley region is 5.9%
- Unemployment in the Somerset region is 7.4%
- Agriculture is the major employer in the study region.
- 30% of all businesses in the area are involved in agricultural production

Key positive social impacts from the project are associated with increases in employment through the construction and operational phase.

Key negative social impacts associated with the project are:

- Disruption of lifestyles and business activities associated with the construction phase.
- Additional noise, dust and traffic associated with construction
- Property impacts associated with easements and permanent infrastructure
- Potential impacts on areas of cultural heritage
- Environmental impacts

11.2 Introduction

This chapter presents the social impacts associated the Reference Project. It includes an overview of the existing social conditions and values in the study area and an assessment of potential positive benefits and negative impacts of the project’s construction and operation. Mitigation measures to manage identified impacts are also outlined.

11.3 Methodology

As part of this Detailed Business Case a Social Impact Evaluation in line with the guidelines developed by Building Queensland is presented. The three-step process outlined in the Building Queensland Social Impact Evaluation Guideline is presented in the table below:

Table 11.1: Building Queensland three-step process for undertaking a Social Impact Evaluation

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

Building Queensland (2020) Social Impact Evaluation Guide Release 3

This chapter builds on previous work done as part of the Detailed Business Case. Inputs into this chapter include 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 chapter will be used to inform the subsequent economic, financial and environmental analysis.

Data to further inform this social impact evaluation is derived from Australian Bureau of Statistics data, other published reports and previous studies. This chapter documents the key findings from the three-step social impact evaluation process

11.4 Stakeholders and Identified Impacts

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

Table 11.2: Identified Stakeholders and Potential Impacts

Stakeholder	Potential impacts
Landholders	Construction impacts Temporary loss of access to areas of land Disruption of business activities Transport disruptions Land acquisition and easements Additional on-farm infrastructure
Irrigators	Additional water for production Contractual obligations for water purchase
Local Businesses	Greater level of economic activity and certainty of investment
Contractors	Opportunities to participate in pipeline construction

Stakeholder	Potential impacts
Local Councils	Impacts on Council infrastructure such as roads from construction of pipeline
Utilities	Impacts on Utility infrastructure such as electricity, communications and water assets from construction of pipeline
State Government Departments	Additional workloads in terms of approvals for works required for pipeline construction
Seqwater	Disruptions to existing irrigation infrastructure operation Additional workloads and licencing requirements
Seqwater Urban Customers	Greater future reliance on water from the Western Corridor Recycled Water Scheme
Traditional Owners	Impacts on areas of cultural significance
Environmental groups	Vegetation clearing Flora and fauna impacts Impacts on waterways from pipeline crossings Impacts on riparian zones and stream stability Groundwater impacts Surface water impacts Construction impacts

11.5 Baseline

11.5.1 Regional context

The project will occur in the Lockyer Valley in South East Queensland (SEQ). The Lockyer Valley is in South East Queensland (SEQ), about 90 kilometres west of the Brisbane CBD. The valley is recognised as one of the most productive irrigation areas in Australia.

The social impacts of the Reference project are expected to occur most heavily in the Lockyer and Somerset areas. The study region comprises of the local government areas of the Lockyer Valley Regional Council and the Somerset Regional Council.

The Lockyer Valley experiences lower and more variable rainfall than the rest of South East Queensland. Agriculture relies on irrigation from groundwater, which is in turn impacted by droughts and floods. The analysis of groundwater and surface water indicated that these sources are fully allocated and relatively unreliable.

11.5.2 Social and economic baseline

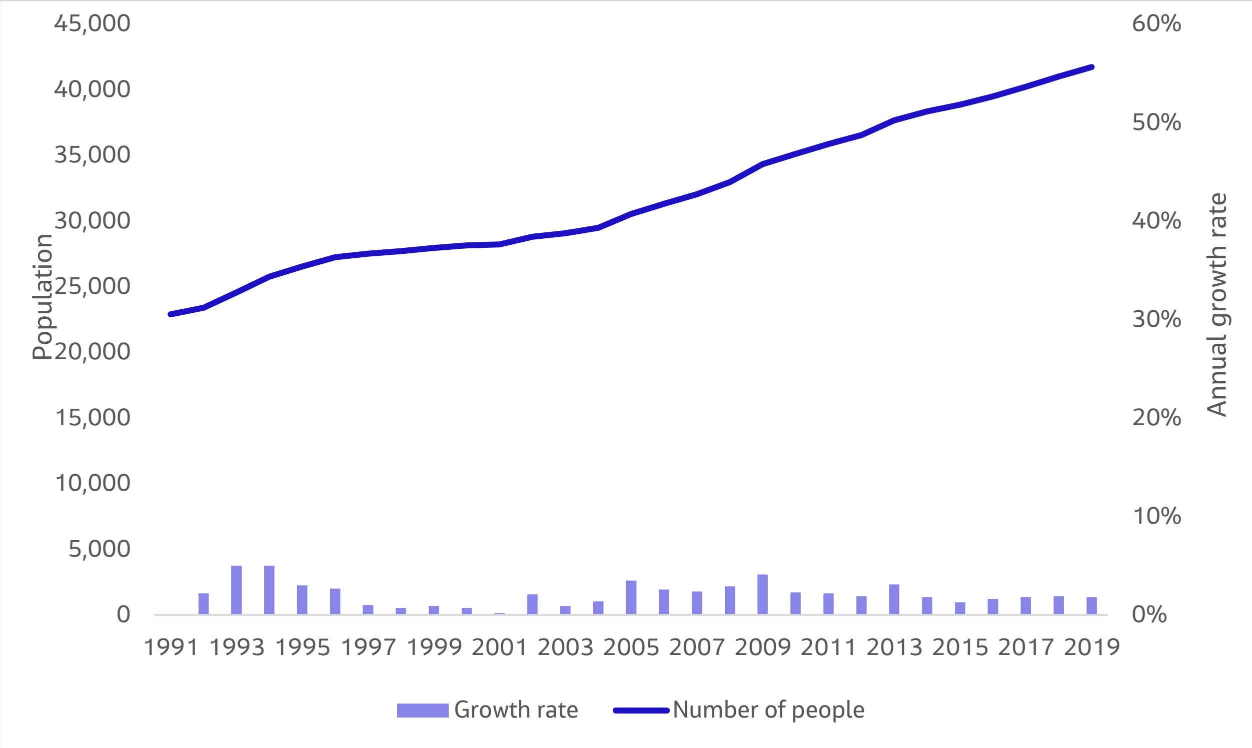
11.5.2.1 Population

The estimated residential population of Lockyer Valley and Somerset region was 67,950 persons in 2019, comprising 41,731 persons in the Lockyer Valley Regional Council area and 26,219 persons in Somerset Regional Council area. Since 1991, the region's population has steadily grown from 38,424 persons—an increase of over 77 per cent.

The growth in residential population in the study area has been linked to increased employment opportunities, improved transport links between the region and Brisbane, housing and land affordability and an appealing lifestyle in the region.

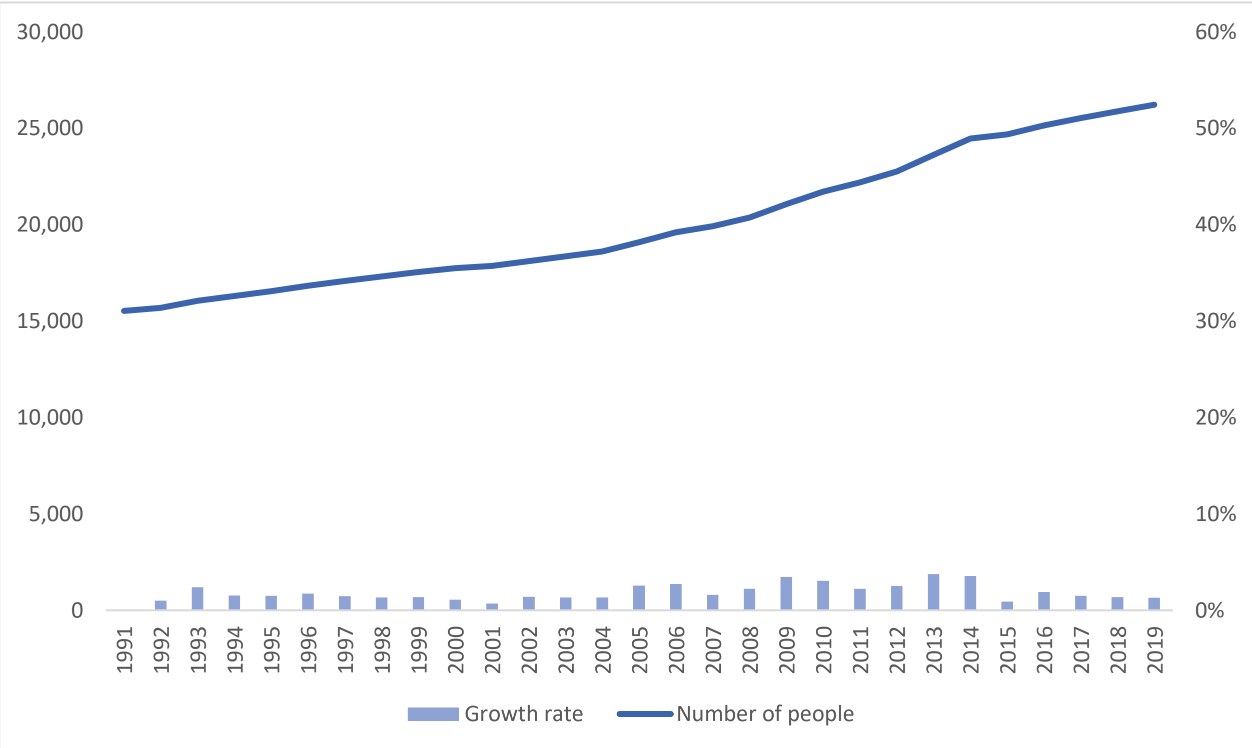
In the Lockyer Valley Regional Council area, the population has increased at an average rate of 2.2 per cent. The population has increased in every year since 1991.

Figure 11.1: Population in Lockyer Valley Regional Council Area, 1991 – 2019



Source: ABS, Regional Population Growth, Australia, cat. 3218.0, various editions.

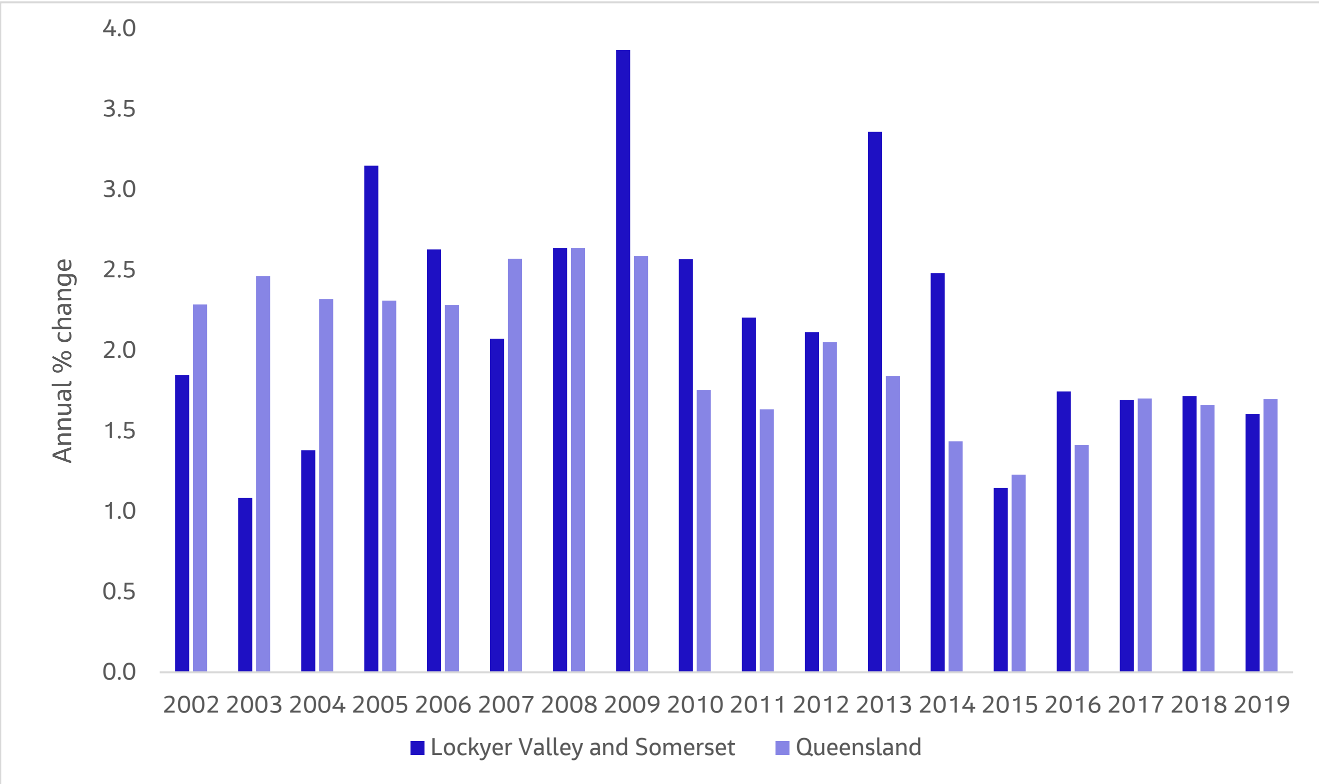
Figure 11.2: Population in Somerset Regional Council Area, 1991 – 2019



Source: ABS, Regional Population Growth, Australia, cat. 3218.0, various editions.

Between 2005 and 2016, annual population growth rate in the Lockyer Valley and Somerset region regularly exceeded the annual population growth rate for Queensland (Figure 11.3). Over the last 10 years, the study region has had an average annual growth rate of 2.1 per cent, compared to 1.6 per cent for Queensland. However, over the last five years, the annual population growth rates for the study region and Queensland have been similar, at 1.6 per cent and 1.5 per cent respectively.

Figure 11.3: Population growth for the Lockyer Valley and Somerset regional council areas and Queensland, 2002–2019



Source: ABS, Population by Age and Sex, Regions of Australia, cat. 3235.0.

11.5.2.2 Age

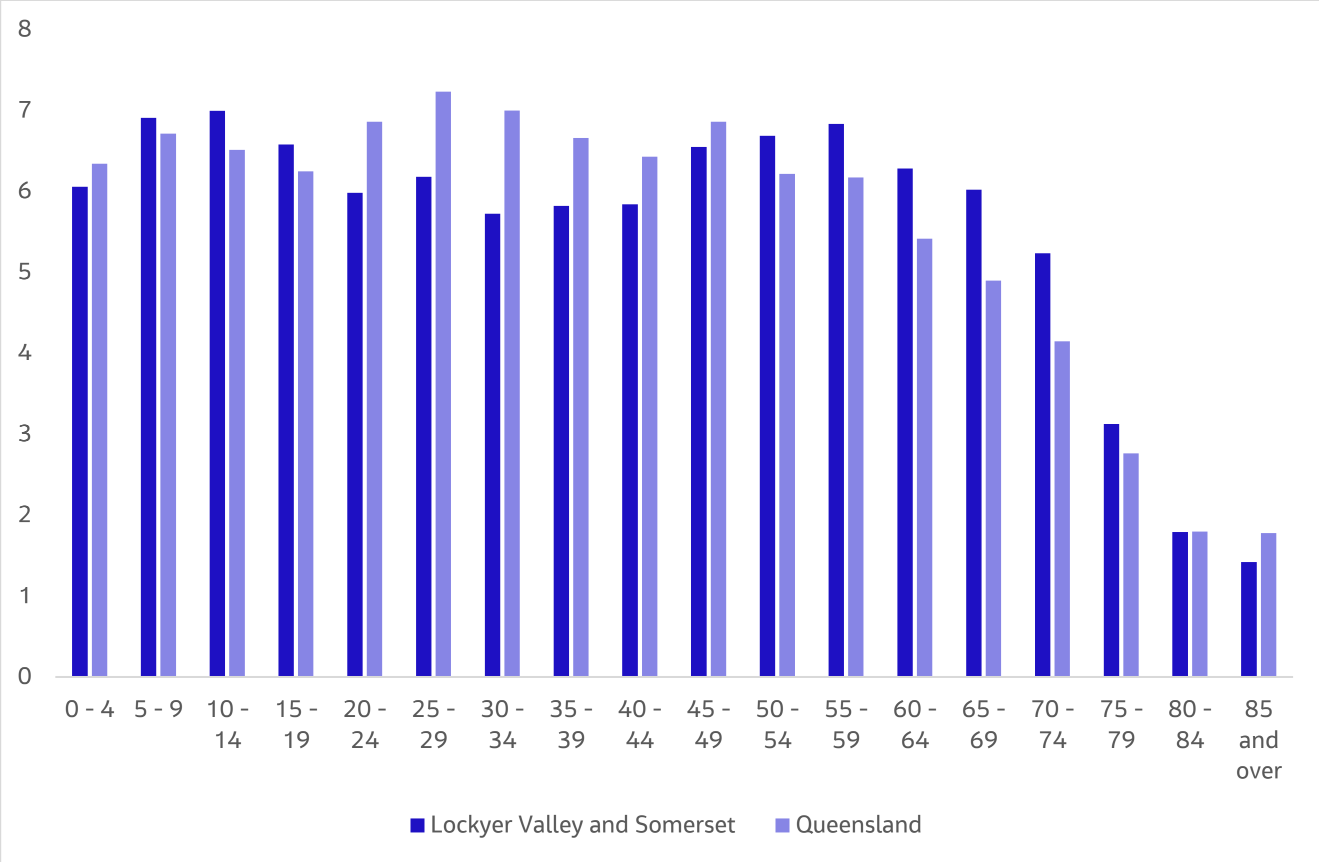
The median age in the Lockyer Valley and Somerset area of 40 years is slightly higher than the Queensland median age of 37. The percentage of people aged between 20 and 49 years is much lower than in the rest of Queensland. This is most likely due to people in this age range leaving the region to seek education, employment and lifestyle opportunities.

There are relatively more residents between 50 and 79 years of age, compared to the rest of Queensland. A strong contributing factor may be that agriculture, which typically has an older workforce, is the dominant employer in the region.

The proportion of the Queensland agriculture workforce aged 45 years is 54.6 per cent and over 60 is 24 per cent[58].

[58] The Australian Bureau of Statistics (ABS) 2016 Census

Figure 11.4: Age distribution of residential population, 2018 (percentage)



Source: ABS, Population by Age and Sex, Regions of Australia, cat. 3235.0.

11.5.2.3 Employment

The average unemployment rate in the Lockyer Valley and Somerset region, at 6.5 per cent, is higher than in the rest of Queensland, where it is 6.1 per cent (Table 5.1).

Table 11 3: Unemployment and labour force for the Lockyer Valley and Somerset regional council areas and Queensland, December 2019

Area	Unemployed (no. of people)	Labour force	Unemployment rate (%)
Lockyer Valley	1,084	18,425	5.9
Somerset	864	11,704	7.4
Study region total	**1,948**	**30,129**	**6.5**
Queensland	**165,629**	**2,693,713**	**6.1**

Source: Australian Government Department of Education, Skills and Employment, Small Area Labour Markets Australia, December 2019.

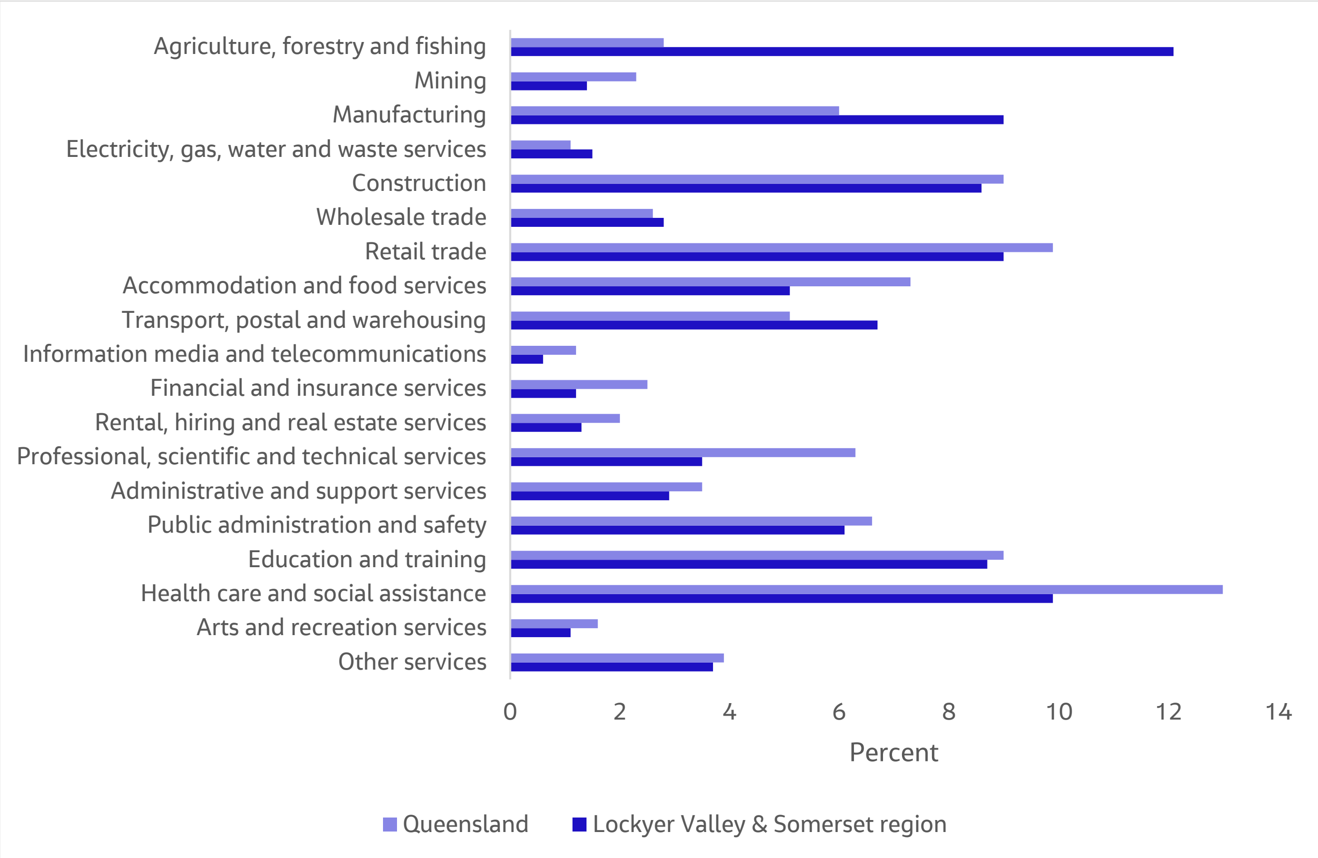
Agriculture, forestry and fishing is the biggest employer in the study region, employing 12.1 per cent of workers, of which 11.2 per cent relates to agriculture alone. This figure for agriculture is significantly higher than for the rest of Queensland (2.8 per cent) and Australia (2.5 per cent). It is larger than the health care and social assistance (9.9 per cent), retail trade (9 per cent), manufacturing (9 per cent) and education and training (8.7 per cent) (Table 11 4 and Figure 11.5). This data indicates that substantial growth in agriculture could improve the employment outcomes for residents.

Table 11 4:Top five industries of employment for the Lockyer Valley and Somerset regional council areas

Industry of employment	Lockyer Valley and Somerset (%)	Queensland (%)	Australia (%)
Agriculture, forestry and fishing	12.1	2.8	2.5
Health care and social assistance	9.9	13.0	12.6
Retail trade	9.0	9.9	9.9
Manufacturing	9.0	6.0	6.4
Education and training	8.7	9.0	8.7

Source: ABS, Census of Population and Housing, 2016, General Community Profile—G51; unpublished data.

Figure 11.5: Employment by industry for the Lockyer Valley and Somerset regional council areas and Queensland, 2016



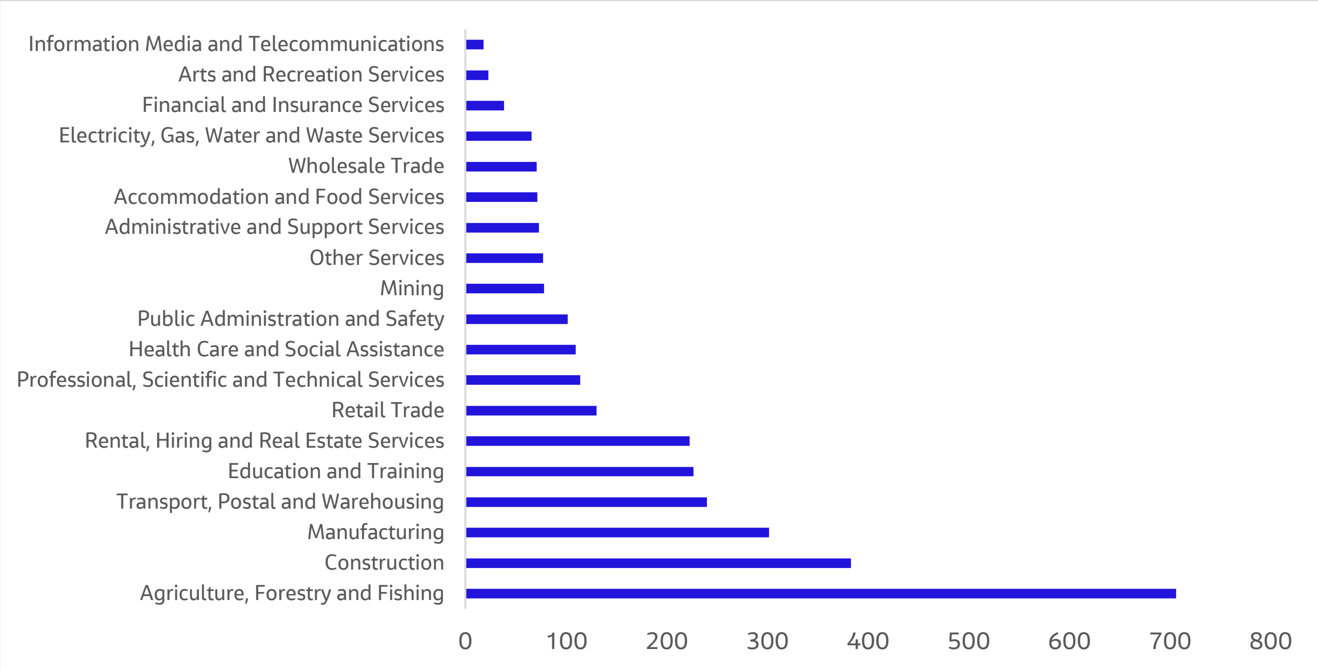
Source: ABS, Census of Population and Housing, 2016, General Community Profile—G51; unpublished data

11.5.2.4 Economic performance

The agriculture, forestry and fishing industries have the largest economic output by industry for the Lockyer Valley, generating $706.2 million in 2018/19. This represents 23.1 per cent of the region's $3.05 billion output. Other dominant contributors to the economic output of the Lockyer Valley region are the construction industry ($383 million, 12.5 per cent) and manufacturing industry ($301.6 million, 9.9 per cent) are (Figure 11.6).

Most of the output from agriculture, forestry and fishing was delivered by the agriculture subcategory with output of $675.8 million for 2018/19. However, this is a 5.4 per cent reduction from the 2013/14 figure of $711.6 million. A fall in commodity prices and reduced production levels could have contributed to this result.

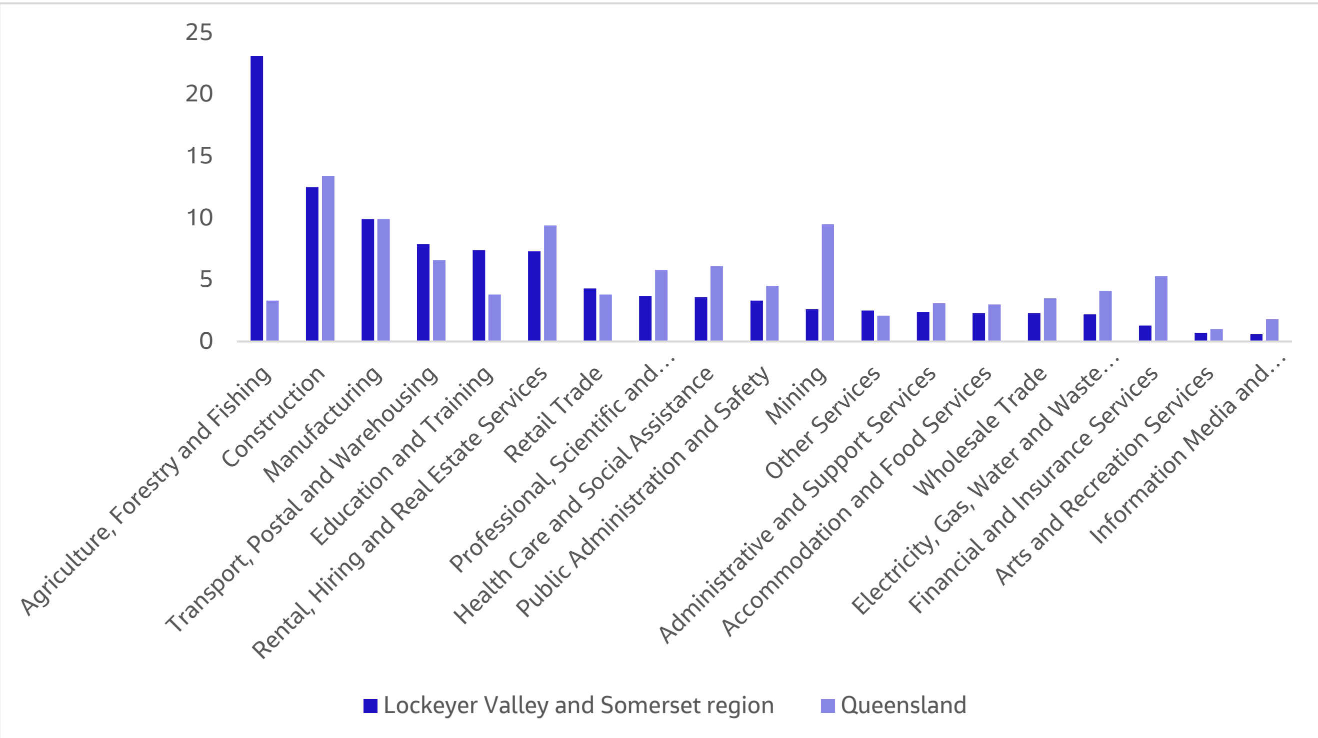
Figure 11.6: Output by industry sector in the Lockyer Valley, 2018/19 ($ million)



Source: National Institute of Economic and Industry Research, 2019.

The agriculture, forestry and fishing industries provide significantly more output relative to other industries, when compared to the rest of Queensland. These industries contribute 23.1 per cent of total output for the region, whereas they contribute 3.3 per cent for the rest of Queensland (Figure 11.7). This further highlights the importance of agriculture to the Lockyer Valley and Somerset regions.

Figure 11.7: Output by industry sector in the Lockyer Valley and Queensland, 2018/19 (percentage)



Source: National Institute of Economic and Industry Research, 2019.

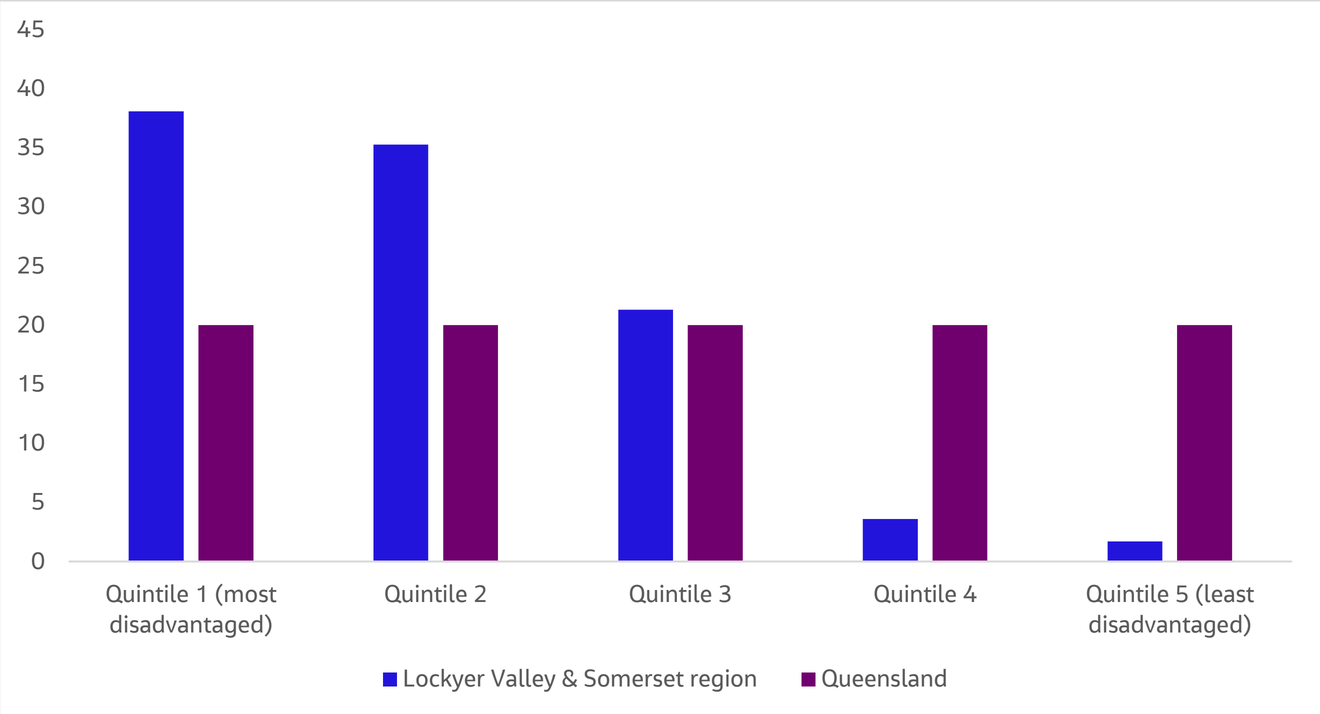
11.5.2.5 Socio-economic disadvantage

Socio-Economic Indexes for Areas (SEIFA) is a summary measure of the social and economic conditions of geographic areas across Australia. SEIFA, which comprises a number of indexes, is generated by the ABS from the Census of Population and Housing.

In 2016 an Index of Relative Socio-Economic Disadvantage was produced, ranking geographical areas in terms of their relative socio-economic disadvantage. The index focuses on low-income earners, relatively lower education attainment, high unemployment and dwellings without motor vehicles. Low index values represent areas of most disadvantage and high values represent areas of least disadvantage. This is based on persons by place of usual residence[59].

The level of socio-economic disadvantage in the Lockyer Valley and Somerset region is high, compared with the rest of Queensland—38.1 per cent of the study region's population are in the most disadvantage quintile and 35.3 per cent in the second most disadvantaged quintile. Only 1.7 per cent of the study region's population are in the least disadvantaged quintile (Figure 11.8).

Figure 11.8: Population by Index of Relative Socio-Economic Disadvantage quintiles for the Lockyer Valley and Somerset region and Queensland, 2016 (percentage)



Source: ABS, Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016, 2033.0.55.001 (Queensland Treasury derived).

11.6 Impact identification

11.6.1 Property impacts

Construction of the pipeline and 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 landholder within the construction footprint will potentially be disadvantaged. This will be

[59] Queensland Treasury (2020) Queensland Regional Profiles: Resident Profile for Lockyer and Somerset. Brisbane: Queensland Government Statisticians

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).

11.6.2 Housing and accommodation

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 construction site is in commuting distance to the major urban centres in Ipswich and Brisbane. Significant accommodation for construction workers is available.

During operation of the project, no significant increase in demand for housing and accommodation is expected.

11.6.3 Population and demography

The acquisition of property for the project 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. 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, and develop new agricultural and horticultural businesses. This will provide new employment opportunities in the study area and help create diversity in employment opportunities.

11.6.4 Employment and training

Where possible, 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. Consultation has been undertaken with local contractors and suppliers to identify potential construction-related opportunities and how these can maximise local employment benefits.

Following construction, it is expected the pipeline would be operated by only a small workforce.

11.6.5 Community services and facilities

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 impact on community services and facilities.

11.6.6 Transport and access

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

11.7 Impact assessment and mitigation

Table 11.5: Social impact risk assessment

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 post 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
Additional demands on existing transport networks and electricity infrastructure in irrigation area	Operation	Negative	Infrastructure providers	Medium	Yes	Inform relevant organisations of proposed works program and schedule and engage as part of the planning process	Minor
Potential loss of areas of cultural significance during construction of pipeline and associated infrastructure	Construction and Operation	Negative	Traditional Owners	Major	No	Consult with Native Title groups. Undertake cultural heritage survey and incorporate in planning program. Develop Cultural Heritage Management Plan.	Major
Competition for skilled labour	Construction	Negative	Labour market	Medium	Yes	Undertake workforce skills gap analysis	Low
Urban water security supply – greater reliance on Western Corridor Recycled Water Scheme	Operation	Negative	Urban consumers	Major	Yes	Undertake community engagement and education program	Major
Additional demands on existing services during construction and operational phases	Construction and Operation	Negative	Service providers	Medium	Yes	Inform relevant organisations of 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	Downstream industries	Major	No	Determine significance of impacts as part of 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 post mitigation
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 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 detailed consultation and communication strategy	Minor
Temporary influx of construction workers impacting on community cohesion	Construction	Negative	Regional community	Medium	No	Develop detailed consultation and communication strategy	Minor
Displacement of existing landholders and industry	Operation	Negative	Land holders	Minor	Yes	Develop detailed consultation and communication strategy	Minor
Health Impacts							
Additional noise and dust during construction	Construction	Negative	Landholders Local residents	Medium	No	Minimise noise and dust as part of construction plan	Minor
Lifestyle Impacts							
Disruption of lifestyles during construction of pipeline from additional traffic	Construction and Operation	Negative	Landholders Local residents	Medium	No	Develop 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 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	Medium	No	Mitigate as part of environmental approvals	Minor

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 post mitigation
Acquisition of land through purchase or easement	Construction	Negative	Land holder	Medium	Yes	Adequately compensate landholder	Minor
Impacts on current water licence holders	Construction and Operation	Negative	Water license holders	Medium	Yes	Adequately compensate landholders	Minor
Opportunities for additional recreation areas surrounding dam	Construction and Operation	Positive	Regional community	Medium	Yes	No mitigation required	Medium
Lifestyle impacts from construction, development of new irrigation area and supporting infrastructure.	Construction and Operation	Negative	Regional community	Medium	No	Develop detailed consultation and communication strategy	Minor
Temporary impacts during construction on liveability (noise, dust)	Construction	Negative	Regional community	Medium	No	Mitigate as part of approvals process	Minor
Restriction on land use within pipeline area	Construction and Operation	Negative	Land holder	Minor	Yes	Adequately compensate 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 and public access and recreational opportunities	Construction	Negative	Environmental groups Residents Recreationists	Major	No	Develop environmental management plan	Medium
Changes to surface and groundwater flows	Operation	Negative	Environmental groups Residents Recreationists	Medium	No	Develop environmental management plan	Minor

11.8 Conclusion

An assessment of potential social impacts associated with the construction and operation of a pipeline in the Lockyer Valley has been undertaken. Possible mitigation measures were also identified to minimise potential social impacts.

A number of social impacts are identified that would need to be managed through construction management and consultation with key stakeholders. With the implementation of mitigation measures, these impacts are expected to be low.

Impacts that may have a major level of ongoing impact through construction and operation generally relate to the impacts on sites of cultural heritage, the environment and urban water users.

Employment and training opportunities are also likely to have a medium level of impact, including opportunities provided through the construction phase and opportunities associated with future expansion of primary industries.

12. Environmental assessment

12.1 Key points

- This chapter assesses potential environmental impacts associated with the project.
- Given the size, scope and potential environmental impacts of the project, it is expected that the project would be assessed as a 'coordinated project' under the *State Development and Public Works Organisation Act 1971*, requiring completion of an environmental impact statement or impact assessment report.
- Further investigation is required to determine whether the project should be referred to the Commonwealth Environment Minister for a controlled action determination under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- The project generally aligns with state and local planning instruments that are relevant to the project area, including the South East Queensland Regional Plan 2017 and various planning schemes in effect for the Lockyer Valley Regional Council and Somerset Regional Council local government areas.
- As a result of the project, agricultural water security would improve, more land could be used for irrigation, and agricultural land could be used for a greater variety of purposes.
- Where project infrastructure is located on private land, an easement will be required to facilitate construction and operational aspects of the project. Native title and approval from the Queensland Government will be required for land dealings that generally relate to land not in freehold tenure.
- Flora and fauna of conservation significance could potentially be present within the project area, including both matters of national environmental significance and matters of state environmental significance. The project is likely to trigger offset requirements for impacts to matters of state environmental significance associated with the clearing of native vegetation that is necessary before construction works can go ahead.
- There is a risk of an impact on unidentified tangible and intangible Aboriginal cultural heritage values as part of the proposed project. Further consultation with Aboriginal parties/Traditional Owners, as the primary knowledge keepers of all matters relating to their cultural heritage, is required.
- Further consultation with the Department of Environment and Science is required to guide project design and manage potential impacts on the University of Queensland Gatton Campus, which is listed on the Queensland Heritage Register.
- The following environmental factors should be investigated further:
  - soils and contaminated land
  - groundwater
  - hydrology
  - flora and fauna
  - air quality
  - noise and vibration
  - cultural heritage
  - waste management.

12.2 Purpose

The purpose of this chapter is to identify the impacts on the environment and ways to mitigate those impacts.

The Building Queensland Business Case Development Framework requires environmental impacts of the reference project to be documented, ensuring that they are identified and accounted for in the decision-making process. This assessment reviews and updates the environmental assessment completed at previous stages of the project, including the Strategic Assessment and the Options Analysis, taking into account additional relevant information since the project has progressed through these stages, particularly the refinement of the project design.

Should the project proceed, further detailed environmental assessments will be needed. This is likely to include the preparation of an environmental impact statement (EIS) under Queensland and/or Commonwealth legislation, or the preparation of an impact assessment report (IAR). If approved, the project is also likely to be subject to environmental conditions and requirements set by the Queensland and/or Commonwealth governments.

12.3 Methodology

This environmental assessment follows Building Queensland's *Business Case Development Framework – Stage 3: Detailed Business Case Guide and Template (2020)* as it relates to the assessment of environmental factors.

The preparation of the environmental assessment involved:

- reviewing existing environmental assessments, studies and documentation undertaken for the project or relevant to environmental values within the study area
- identifying environmental issues and impacts relevant to the design, construction and operational phases of the project
- assessing, at a high level, the environmental issues and impacts and identifying recommended strategies to avoid, manage or mitigate identified impacts where appropriate
- identifying further technical investigations to be undertaken as part of a detailed environmental assessment for the project.

The environmental assessment is closely linked to legal and regulatory considerations, which outlines the key legal and regulatory considerations relevant to the project, including those relating to water, planning, tenure, native title, construction approval, corporate structure and the ongoing operation and maintenance of project infrastructure.

This assessment identifies some secondary planning and environmental approvals and permits that may be required in future stages of the project.

12.4 Legal context

12.4.1 Legislation and permit requirements

The project is likely to require the preparation of an EIS or IAR under Queensland and/or Commonwealth legislation (see Chapter 8: Legal and regulatory considerations).

Given the size, scope and potential environmental impacts of the project, it is expected that the project would be assessed as a 'coordinated project' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act), requiring completion of an EIS or IAR. Both processes seek to ensure that all relevant environmental, social and economic impacts of the project are identified and assessed and mitigation measures are identified to avoid or minimise adverse impacts. Generally, an EIS is likely to be required where a project is considered to have a high risk of environmental impact, whereas an IAR is required for projects that are likely to have a low or medium risk of environmental impact.

Further investigations are required to determine whether a referral to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) would be required for the project to determine whether the project is a 'controlled action' requiring formal assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EBPC Act). A project is considered to be a controlled action where the Commonwealth Minister for the Environment determines that the project may have a significant impact on a matter of national environmental significance (MNES), including:

- world heritage properties

- national heritage places
- wetlands of international importance
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine area
- the Great Barrier Reef Marine Park
- nuclear actions
- a water resource, in relation to coal seam gas development and large coal mining development.

If the project is determined to be a controlled action requiring an EIS, the assessment may be conducted under the Queensland environmental assessment bilateral agreement with the Commonwealth.

Additional secondary approvals may be required for some construction-related activities, such as actions causing impacts to heritage values, species management programs being undertaken and waste and soil disposal. Provisional estimates of approval timeframes and costs (in Table 12.1) should be reviewed in subsequent project stages once project impacts are more clearly defined. Further, some approvals may also trigger offset liabilities.

Table 12.1: Potential secondary approvals required for the project

Potential approval	Relevant legislation	Estimated approval timeframe	Estimated application fee*
Species management program	*Nature Conservation Act 1992*	No statutory timeframe	Not applicable
Approval for works within a protected area	*Nature Conservation Act 1992*	No statutory timeframe	No information available
Protected plant clearing permit	*Nature Conservation Act 1992*	No statutory timeframe	$3032
Disposal permit for contaminated soil	*Environmental Protection Act 1994*	10 business days	Not applicable
Waste levy for contaminated soil	*Environmental Protection Act 1994*	Not applicable	$80 per tonne
Waste levy for other waste	*Environmental Protection Act 1994*	Not applicable	Up to $160 per tonne
Constructing or raising waterway barrier works	*Planning Regulation 2017*	12 weeks	$3,313–$13,248 per application
Development on or adjoining a Queensland heritage place	*Queensland Heritage Act 1992*	12 weeks	$3,313.00 per application
Heritage Exemption Certificate	*Queensland Heritage Act 1992*	No statutory timeframe	No information available
Road corridor permit	*Transport Infrastructure Act 1994*	No statutory timeframe	No information available
Application to carry out work on a road reserve or council-owned land (Somerset Regional Council)	*Local Government Act 2009*	No statutory timeframe	Not applicable
Application to undertake works on a road	*Local Government Act 2009*	No statutory timeframe	Price determined on application

** Approval costs are based on FY20–21 fee schedules and do not factor in the cost of technical reporting that may be required.*

12.4.2 Planning, land use and tenure

The environmental assessment includes an overview of planning and land use, and in particular:

- the Queensland planning framework, including legislation and planning instruments relevant to the project
- a general overview of the planning intent for the project area, including a summary of the degree to which the project aligns with the intended settlement pattern
- the existing function of land uses within and adjoining the proposed pipeline route
- current land tenure within and adjacent to the proposed pipeline route
- impacts of the proposed development on land use and tenure within and adjacent to the proposed pipeline route
- potential impacts of the proposed development on land use within and adjacent to the project area.

A desktop assessment of planning and land use within the project area was undertaken through a review of the following planning instruments, geographic information systems and aerial imagery:

- legislation, including the *Planning Act 2016* (Planning Act), *Planning Regulation 2017* (Planning Regulation) and the *Land Act 1994* (Land Act)
- the Queensland Treasury Development Assessment Mapping System (DAMS)
- the Department of Natural Resources, Mines and Energy's Queensland Globe interactive mapping system
- South East Queensland Regional Plan 2017 (ShapingSEQ)
- Gatton Shire Planning Scheme 2007
- Laidley Shire Planning Scheme 2003
- Grantham Reconstruction Area Development Scheme
- Somerset Region Planning Scheme version 3
- a project-specific interactive mapping system prepared with the use of Esri mapping software and incorporating various datasets available on the Queensland Government Open Data Portal.

The assessment of tenure within the project area was undertaken by buffering the proposed pipeline alignment by 10 m and extracting cadastral data from the Queensland Government Digital Cadastral Database. This information was accessed from the Queensland Government Open Data Portal.

All information used to inform the desktop assessment of land use and tenure within the project area was accessed in August 2020.

12.4.2.1 Legislative context

The head of power for planning within Queensland is the Planning Act, which seeks to provide for 'an efficient, effective, transparent, integrated, coordinated and accountable system of land use planning and development assessment to facilitate the achievement of ecological sustainability'. The Planning Act is supported by the Planning Regulation and a range of state and local planning instruments in achieving this purpose, including:

- the State Planning Policy (SPP) – the pre-eminent state planning instrument that defines the state's interests in planning and development
- regional plans – state planning instruments that coordinate regional growth and development while protecting natural values and state interests as identified by the SPP
- planning schemes – local planning instruments prepared by local governments in consultation with their local community to guide long-term growth and development and identify key community and environmental values for protection.

The *Land Act 1994* (Land Act) establishes a framework for the management of land and tenure across Queensland. The Land Act establishes a range of key principles that guide the administration and management of land, application of land tenure and dealings with respect to Crown land.

The administration and management of land and land dealings within Queensland is generally the responsibility of the Queensland Government. Native title is administered by the Queensland Government through the Queensland *Native Title Act 1993* (NT Act). The purpose of the NT Act is to ensure that Queensland law is consistent with the Commonwealth Native Title Act with respect to the application and consideration of native title rights and interests.

In general terms, native title can be considered extinguished where land has been subject to a previous exclusive possession act. One such previous exclusive possession act is the valid grant of land in freehold or certain types of leasehold prior to 23 December 1996. A native title claimant cannot include land subject to a previous exclusive possession act in a native title application. However, where land has not been subject to this, native title may still exist, and before the land can be dealt with, the process established under the Commonwealth NT Act must be followed.

12.4.2.2 Alignment with relevant planning instruments

12.4.2.2.1 South East Queensland Regional Plan 2017

The relevant statutory regional plan for the project area is the South East Queensland Regional Plan 2017 (the Regional Plan). The Regional Plan provides a framework to manage growth, change, land use and development in South East Queensland to 2041.

The majority of customers of the proposed pipeline network live within the Regional Landscape and Rural Production Area (RLRPA) regional land use category (RLUC) of the Regional Plan (Figure 12.1 to Figure 12.4). Land in the RLRPA is designated as such to ensure its protection from inappropriate urban development and fragmentation and to support the region's population by preserving important agricultural land for agricultural purposes. Further, the Regional Plan identifies the importance of the project area as one of Australia's most significant food bowls, acknowledging the role that it plays in preserving long-term food security and providing economic benefits through export opportunities.

Figure 12.1: Regional land use categories 1 of 4

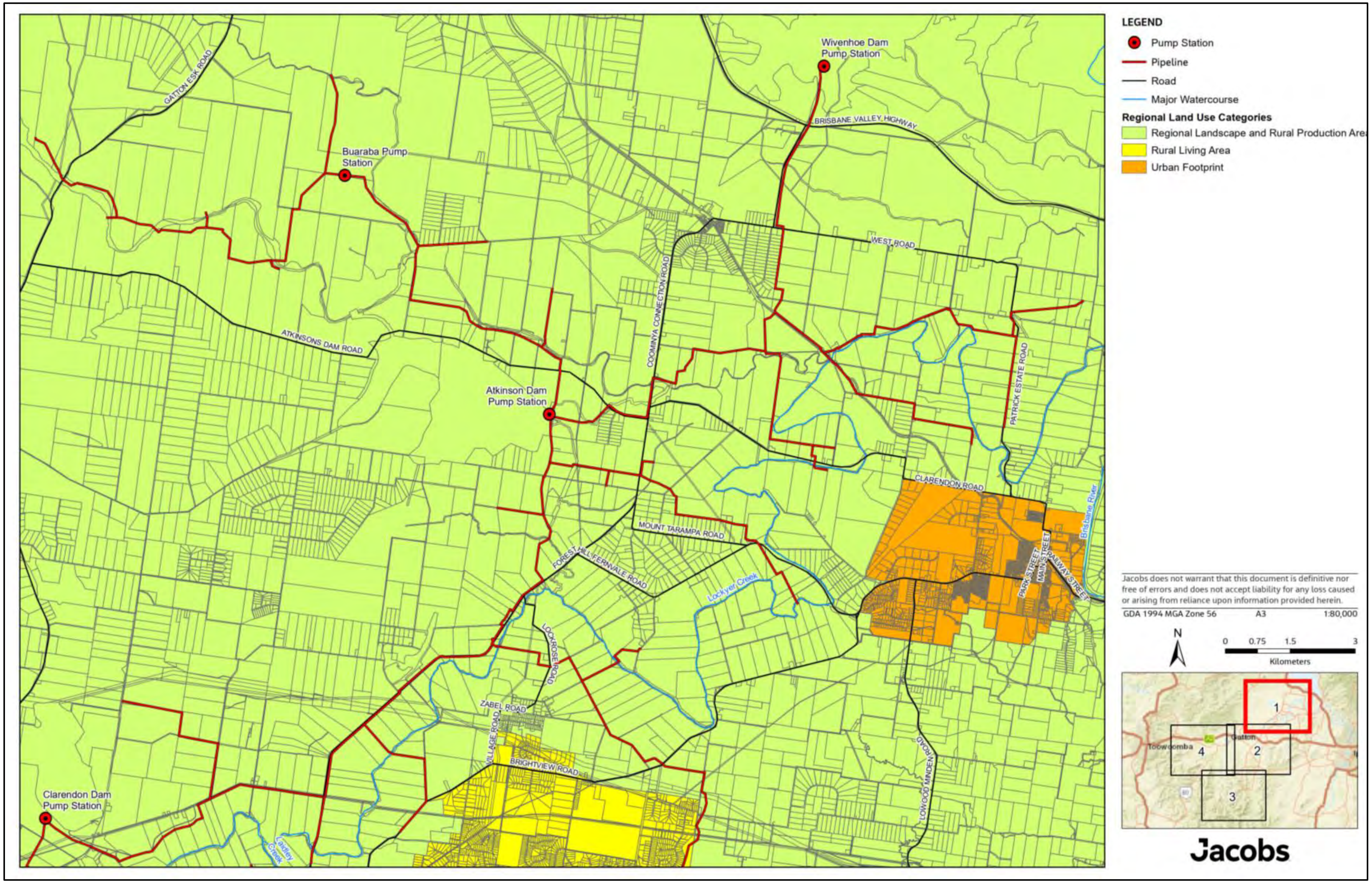


Figure 12.2: Regional land use categories 2 of 4

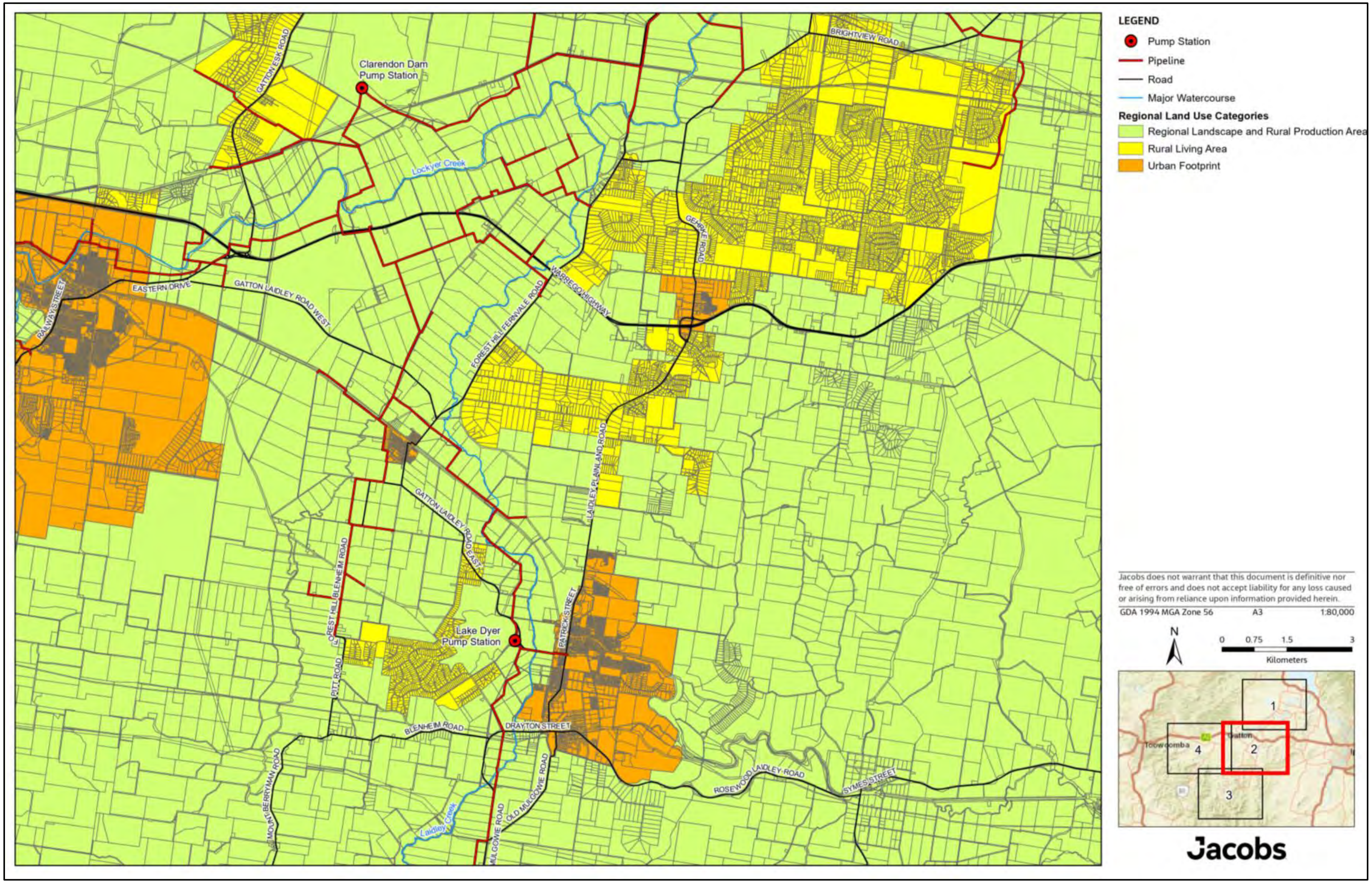


Figure 12.3: Regional land use categories 3 of 4

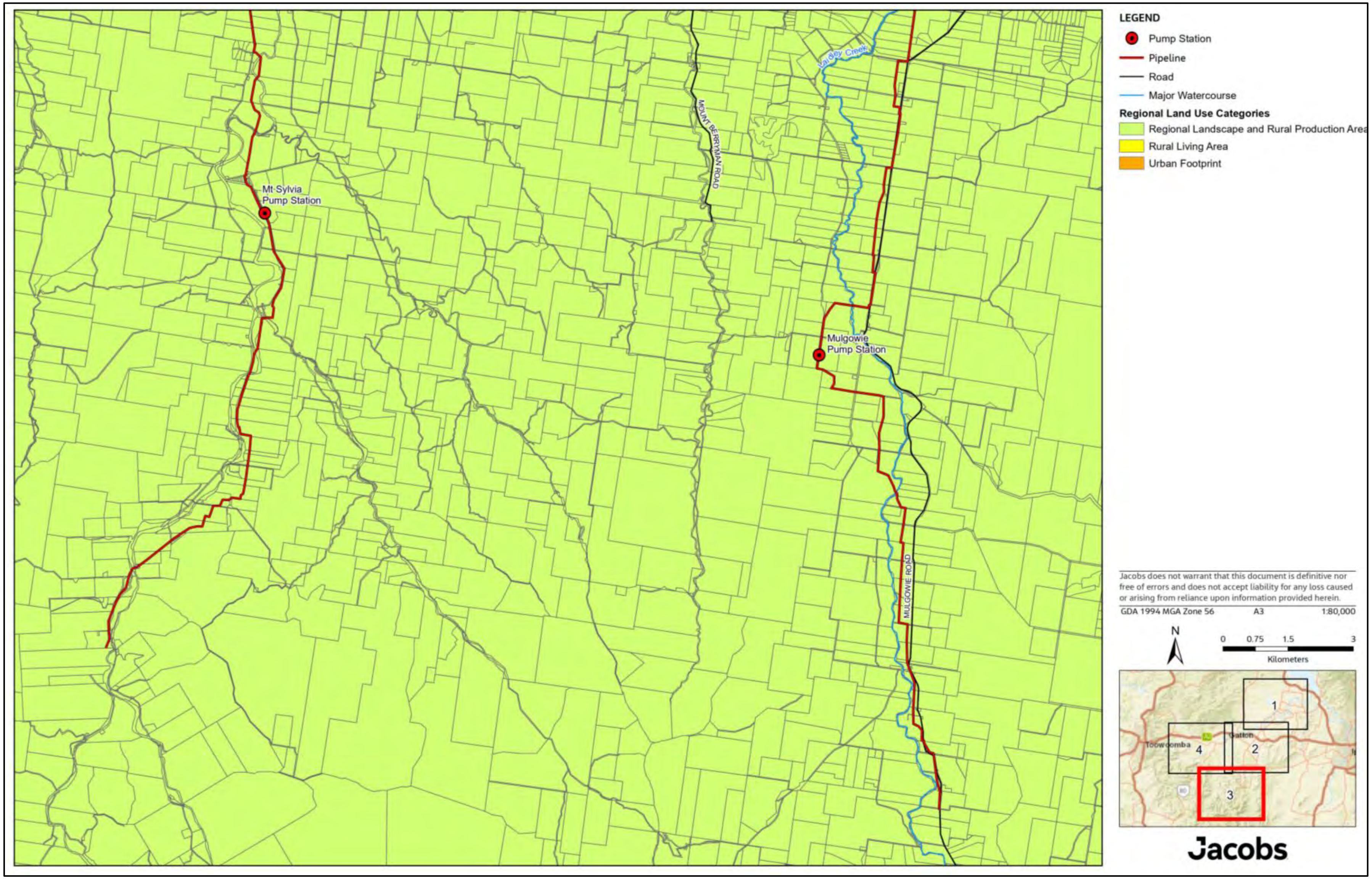
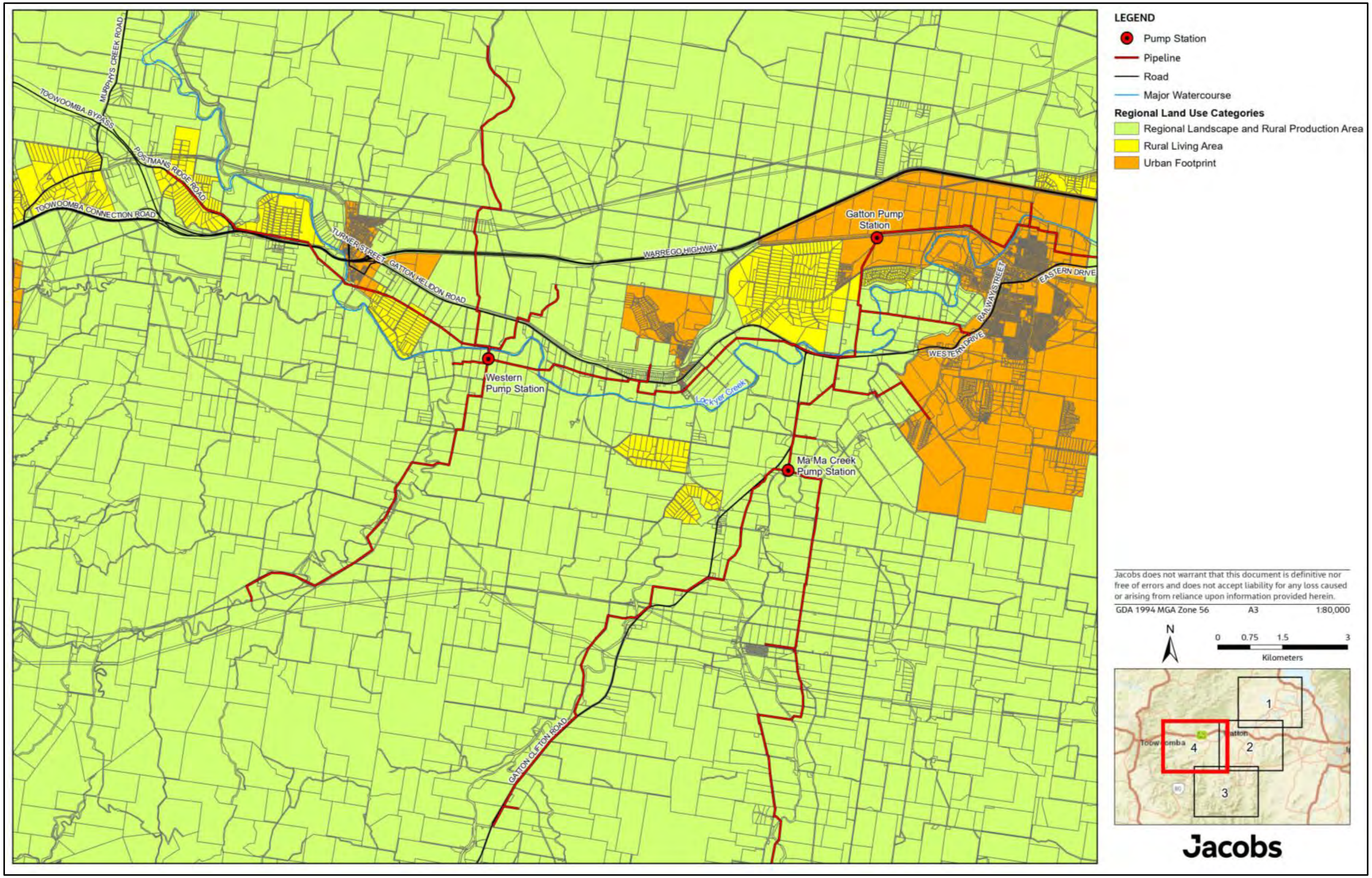


Figure 12.4: Regional land use categories 4 of 4



Other key strategies in the Regional Plan that are relevant to the project include:

- planning for opportunities to promote the viability of the rural economy
- supporting rural communities to adapt and build on their strategic advantages to continue the profitability and sustainability of existing rural industry and activities
- encouraging the intensification or diversification of agricultural activities and the introduction of new rural value-adding activities
- conserving agricultural areas, including those that provide communities with an affordable supply of fresh food, food security and export earning potential.

The project is considered to support the stated planning intent for the Lockyer Valley and Somerset areas by improving access to water supply for irrigators within the Lockyer Valley. Once delivered, the project will contribute to increased productivity and sustainability of agricultural land uses within a significant food bowl for South East Queensland and Australia. The project will also provide for economic growth and improve export opportunities for agricultural produce grown in the region.

12.4.2.2.2 Relevant planning schemes

The project is located within the Lockyer Valley Regional Council and Somerset Regional Council local government areas (Figure 12.5 to Figure 12.8). Four planning schemes are currently in effect within the project area.

Table 12.2: Planning schemes relevant to the project area

Planning scheme	Local government area
Somerset Regional Planning Scheme (version 3)	Somerset Regional Council
Gatton Shire Planning Scheme (version 2)	Lockyer Valley Regional Council (western extent)
Laidley Shire Planning Scheme (version 3)	Lockyer Valley Regional Council (eastern extent)
Development Scheme for the Grantham Reconstruction Area	Lockyer Valley Regional Council (township of Grantham)

Figure 12.5: Planning scheme 1 of 4

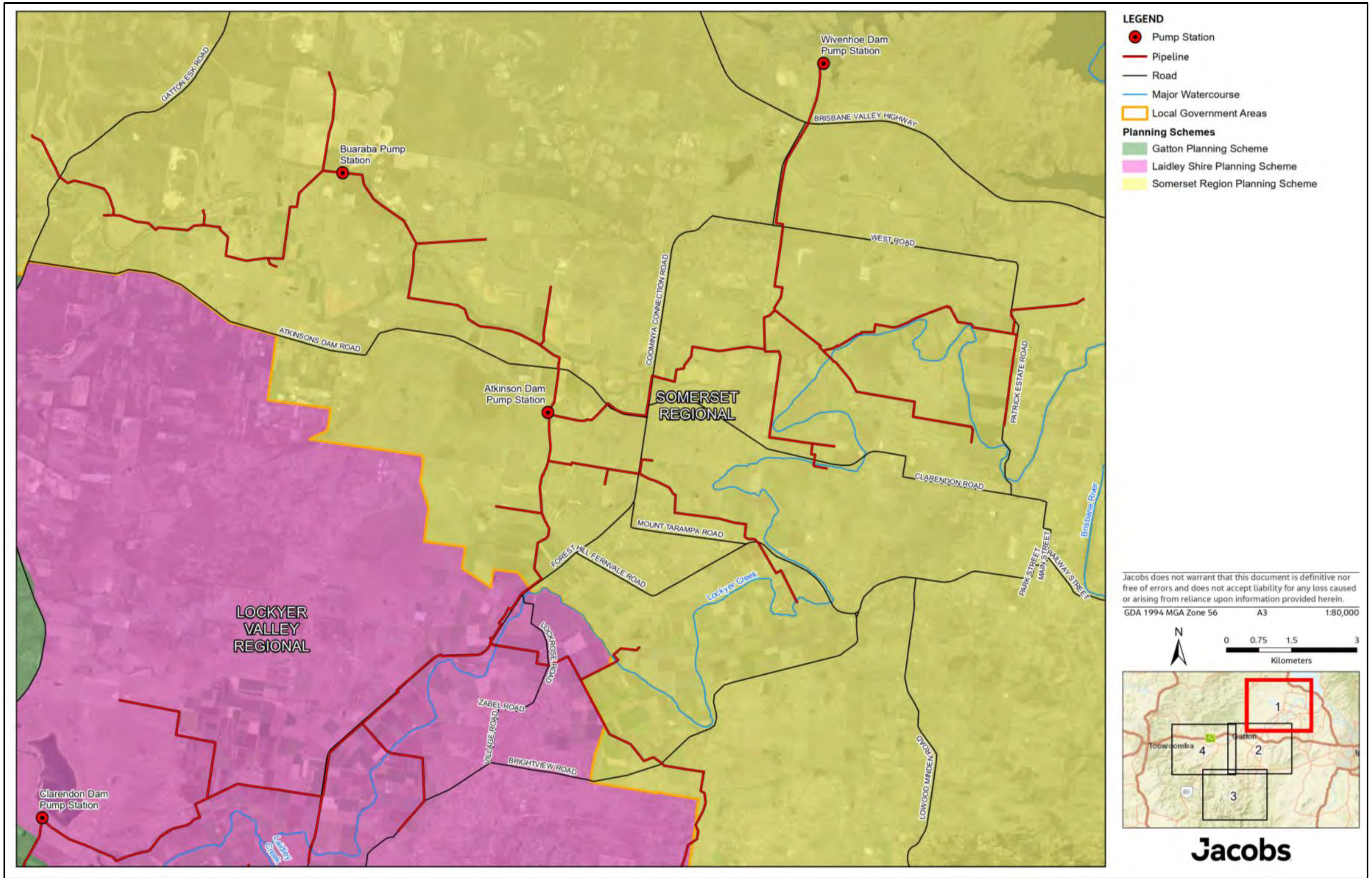


Figure 12.6: Planning scheme 2 of 4

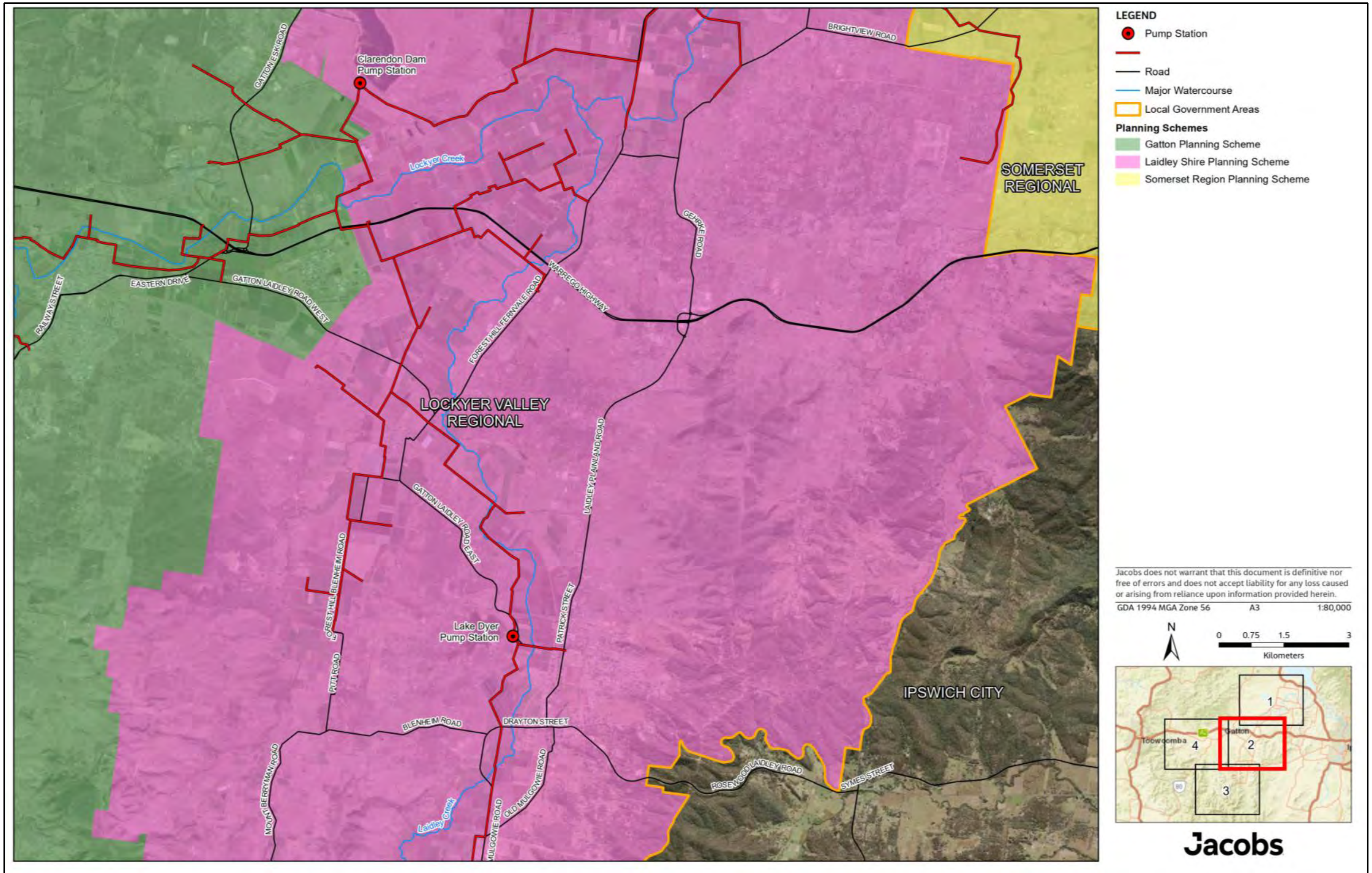


Figure 12.7: Planning scheme 3 of 4

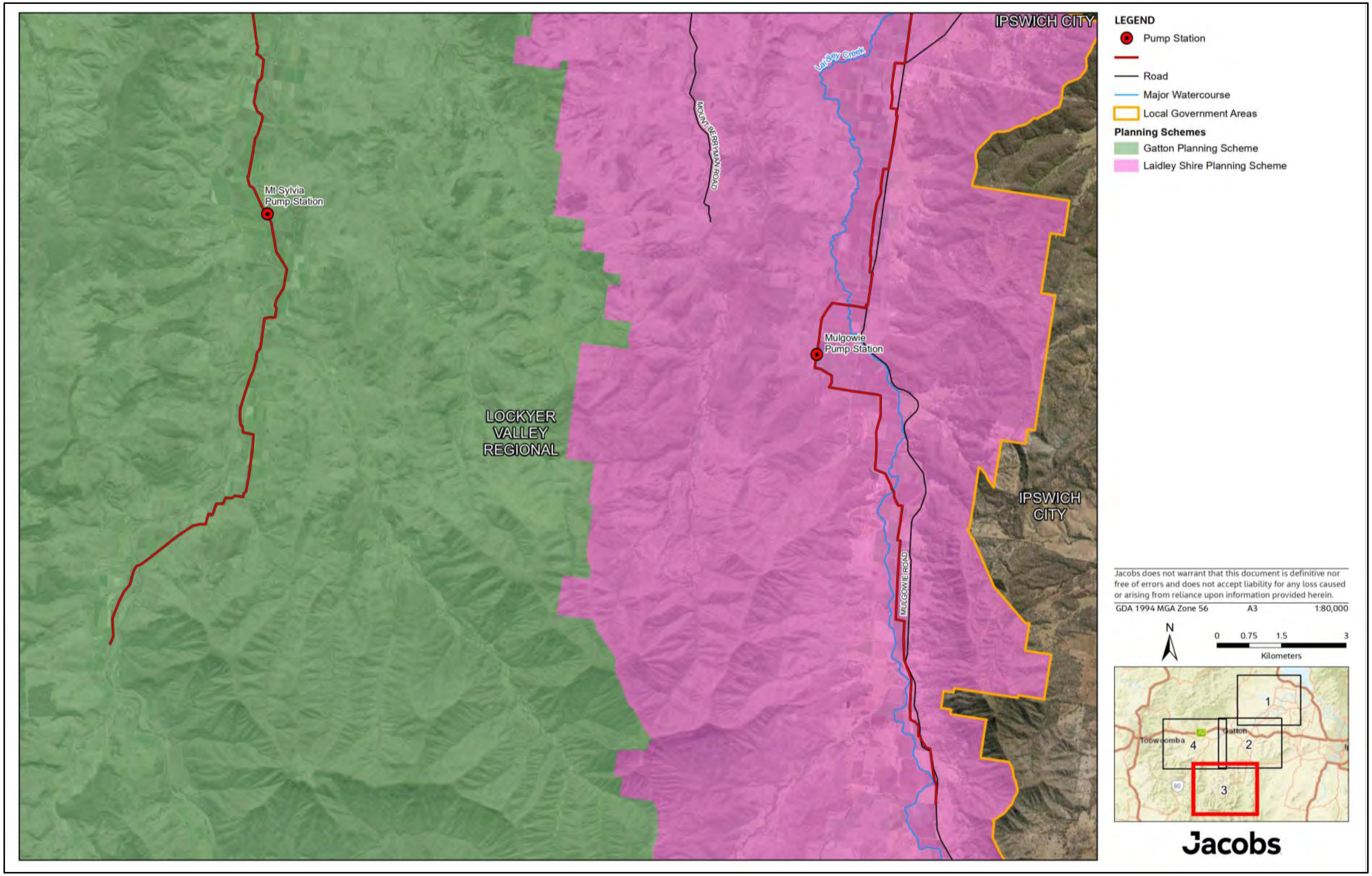
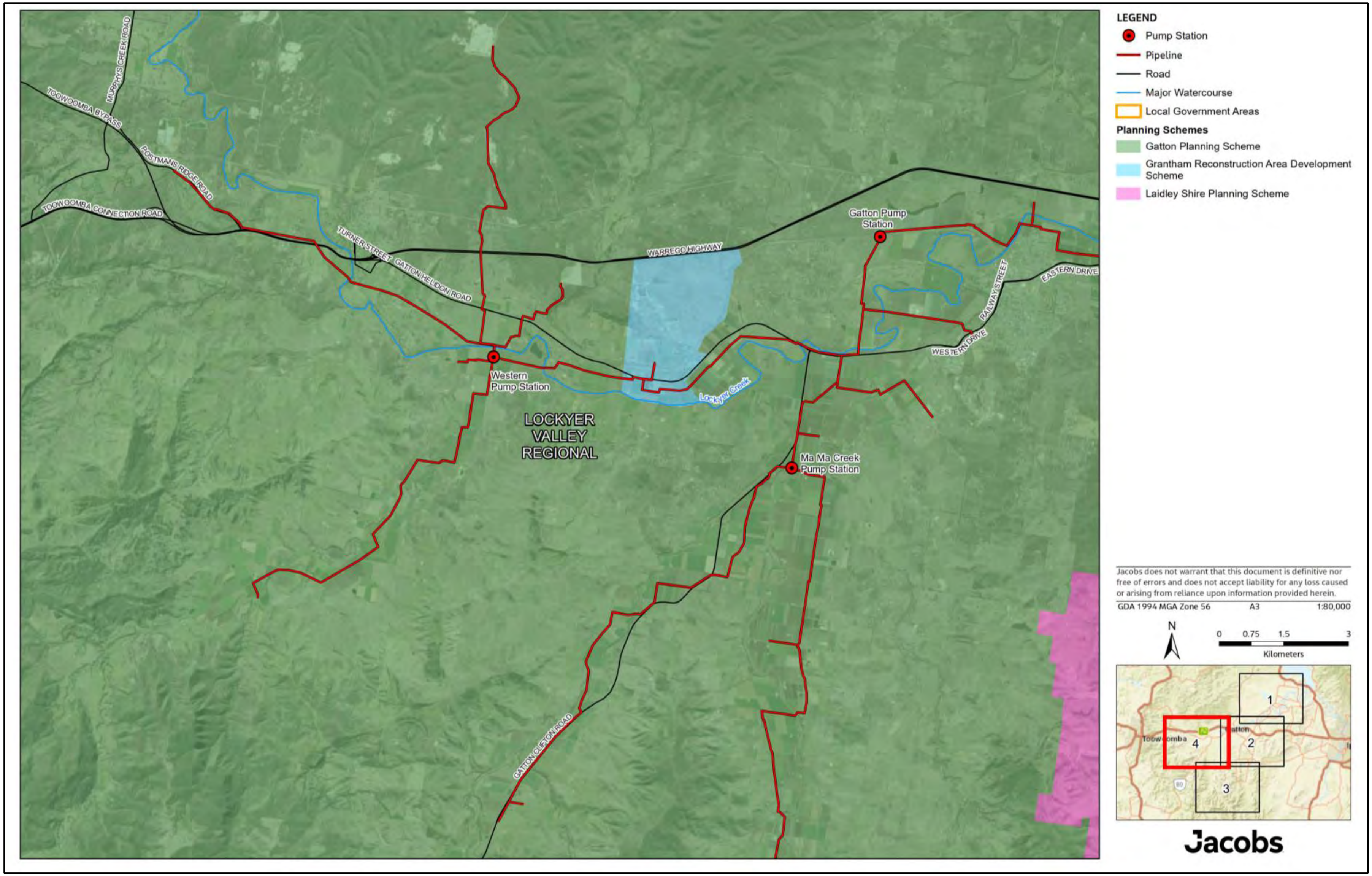


Figure 12.8: Planning scheme 4 of 4



A draft planning scheme for the Lockyer Valley Regional Council local government area is currently being prepared, which will provide a single planning instrument for the whole of the Lockyer Valley and replace the three planning schemes currently in effect. Given that this draft planning scheme is being reviewed by the Queensland Government and has not yet been released for public consultation, it has not been relied on the for the purpose of this assessment.

Planning schemes are the principal tools governing land use and development within the project area. The planning schemes generally identify similar strategic planning objectives for their respective areas. Those objectives that are relevant to the project include:

- acknowledging the role that agricultural land uses play in providing for economic growth and prosperity and seeking the protection of good quality agricultural land from incompatible land uses
- supporting the continued operation and expansion of rural activities within the region
- capitalising on the strategic location and competitive economic advantages of the region, particularly around rural industry and agriculture
- providing for local and national food security
- protecting scenic and visual amenity within the region to protect and enhance natural features and landscape values and preserve rural character
- protecting the natural environment and areas of high ecological significance from encroachment and fragmentation
- providing, efficiently and timely, infrastructure that supports economic growth and development.

Further, the planning schemes have identified a number of areas as having the potential for future urban growth, including:

- the emerging community core within the Gatton Shire Planning Scheme
- potential future growth areas in the Somerset Region Planning Scheme.

These future growth areas are predominantly located in well-serviced areas on the fringe of existing townships in the project area. A review of these areas relative to the proposed pipeline alignment has determined that the project is unlikely to have a significant impact on these areas.

The project is predominantly located on land zoned for various rural purposes under the planning schemes within the project area. Generally, land zoned for rural purposes is intended to provide for productive rural activities, such as agricultural production, livestock grazing and other land uses that are generally complementary to rural activities. However, it should be noted that some areas within and adjoining the project area are zoned for urban purposes (e.g. low-density residential, rural residential, industry and community facilities). Areas zoned for urban land uses are typically located where the project is in close proximity to established urban areas and townships within the region.

The project would support the objectives and intended settlement pattern of the planning schemes by supporting the long-term economic sustainability of the region’s agricultural industry through increased water security, opportunities for economic growth and investment, improved agricultural production and opportunities for the development of new agricultural industries within the region. The development of the project generally aligns with the expressed land use intent of the planning schemes, as it would encourage the development of land uses that are to be expected on land zoned for rural purposes. Further, it is considered that the development of an underground pipeline network with a minimal clearing corridor is unlikely to compromise the scenic and vision amenity values of the region. It will also have a minor impact on areas of high ecological value.

12.5 Land use and tenure

12.5.1 Existing land use and tenure

The project is situated in a well-established agricultural region of South East Queensland, which boasts some of the most productive agricultural land in Australia. Accordingly, existing land uses within the project footprint mainly comprise irrigated perennial and season horticulture, such as fruits and vegetables and open pastures used for livestock grazing.

Given that the project connects various agricultural areas along a 297 km pipeline, the proposed pipeline network is located within close proximity to a number of rural townships and activity centres, including the larger settlements of Gatton and Laidley and smaller townships such as Helidon, Grantham, Forest Hill, Coominya and Clarendon. A detailed overview of land use in the vicinity of the project area is provided in Figure 12.9 to Figure 12.12.

The project is also located close to natural features, landscape values and areas of high biodiversity value, including:

- protected areas of high biodiversity value, including Gatton National Park, Tenthill Conservation Park, Mount Beau Brummell Conservation Park, Lockyer National Park, Lockyer State Forest and Lockyer Resource Reserve
- landscape features including Mount Mulgowie, Mount Stradbroke, Mount Grandchester, Paradise Mountain, Mount Cooper, Mount Beau Brummell, Mount Haldon, Mount Ma Ma and Stringybark Mountain
- watercourses including Lockyer Creek, Laidley Creek, Tenthill Creek, Ma Ma Creek, Sandy Creek and Deep Gully
- natural and artificial water bodies including Wivenhoe Dam, Seven Mile Lagoon, One Mile Lagoon, Schlecht Lagoon, Lake Freeman, Lake Clarendon, Atkinsons Lagoon, Lake Dyer and Lake Apex.

Land within and directly adjoining the proposed pipeline route is predominantly freehold tenure, whereas parkland and other areas containing natural features are typically state land or reserve land that is vested to government agencies. Areas that are located within identified road reserves and rail corridors are generally identified as road reserve and leasehold land respectively.

Figure 12.9: Land use 1 of 4

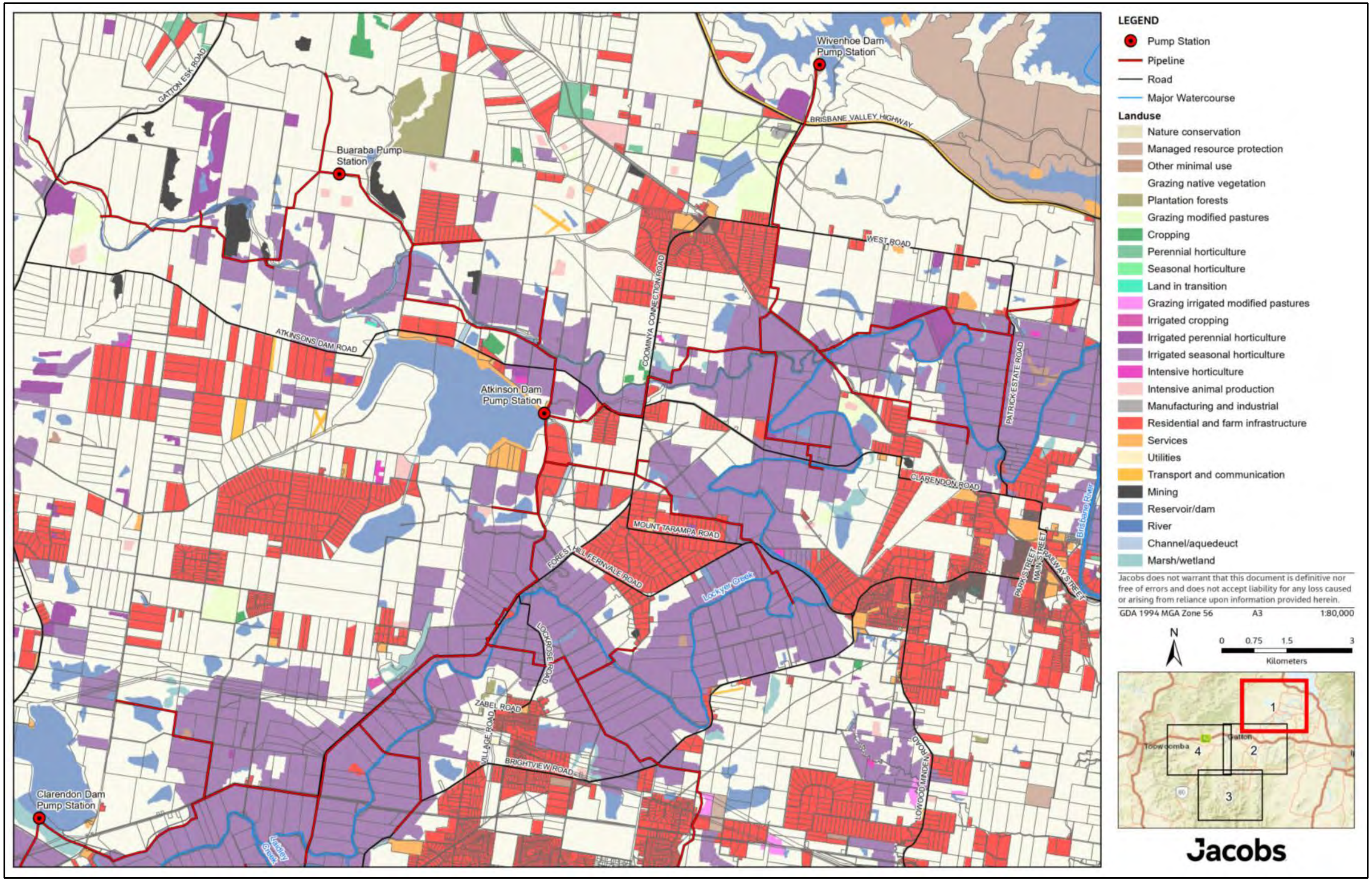


Figure 12.10: Land use 2 of 4

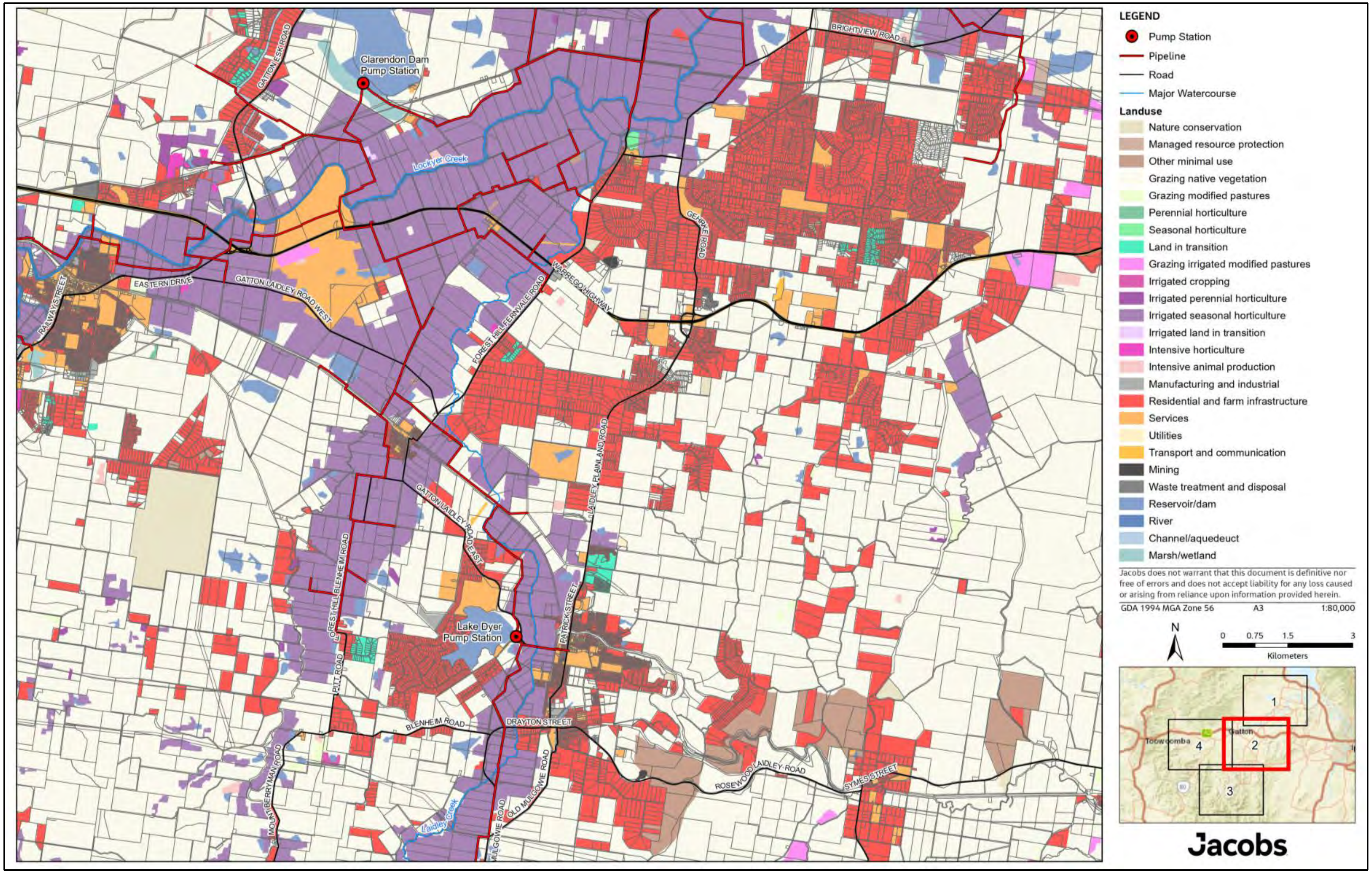


Figure 12.11: Land use 3 of 4

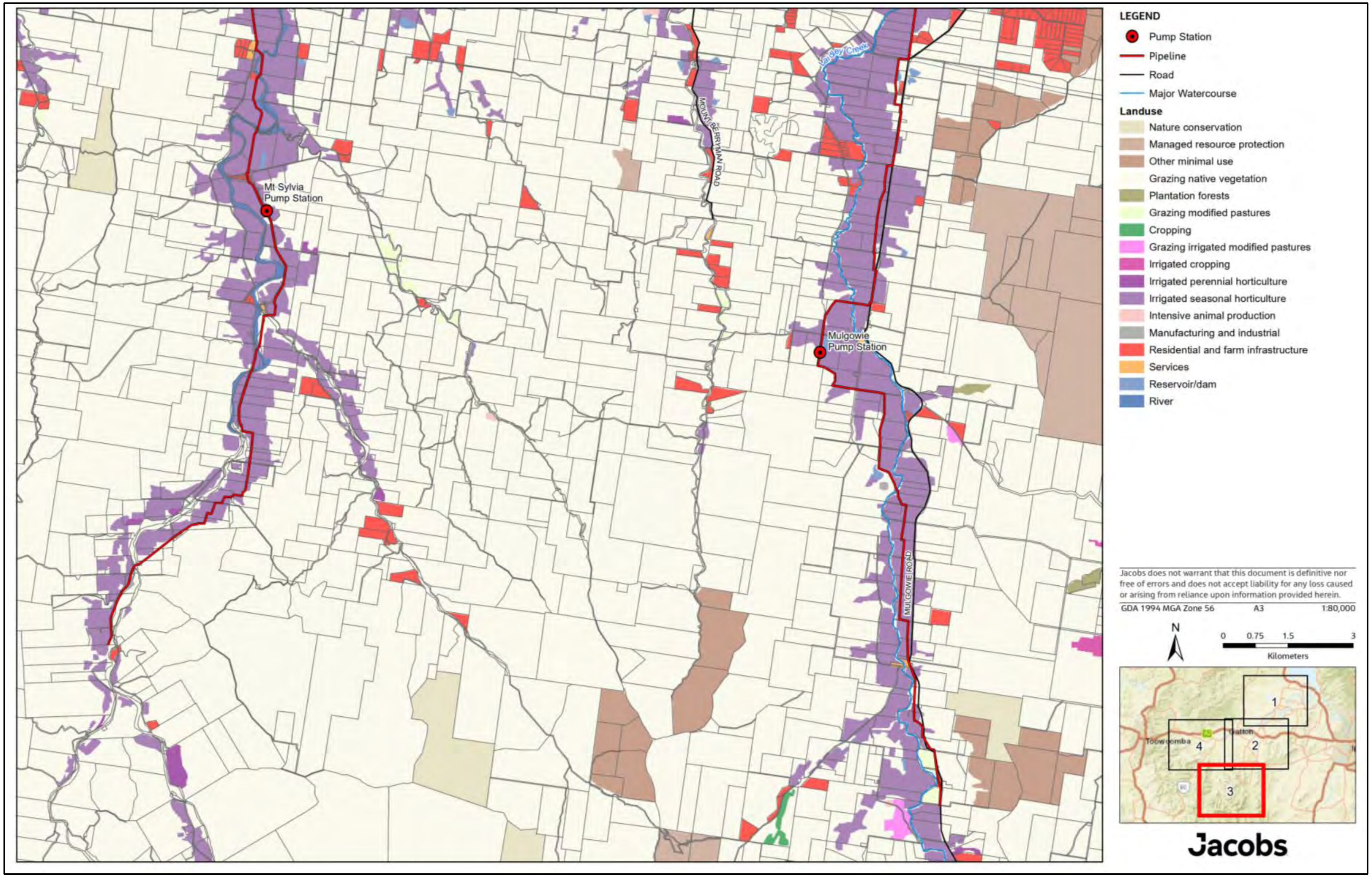
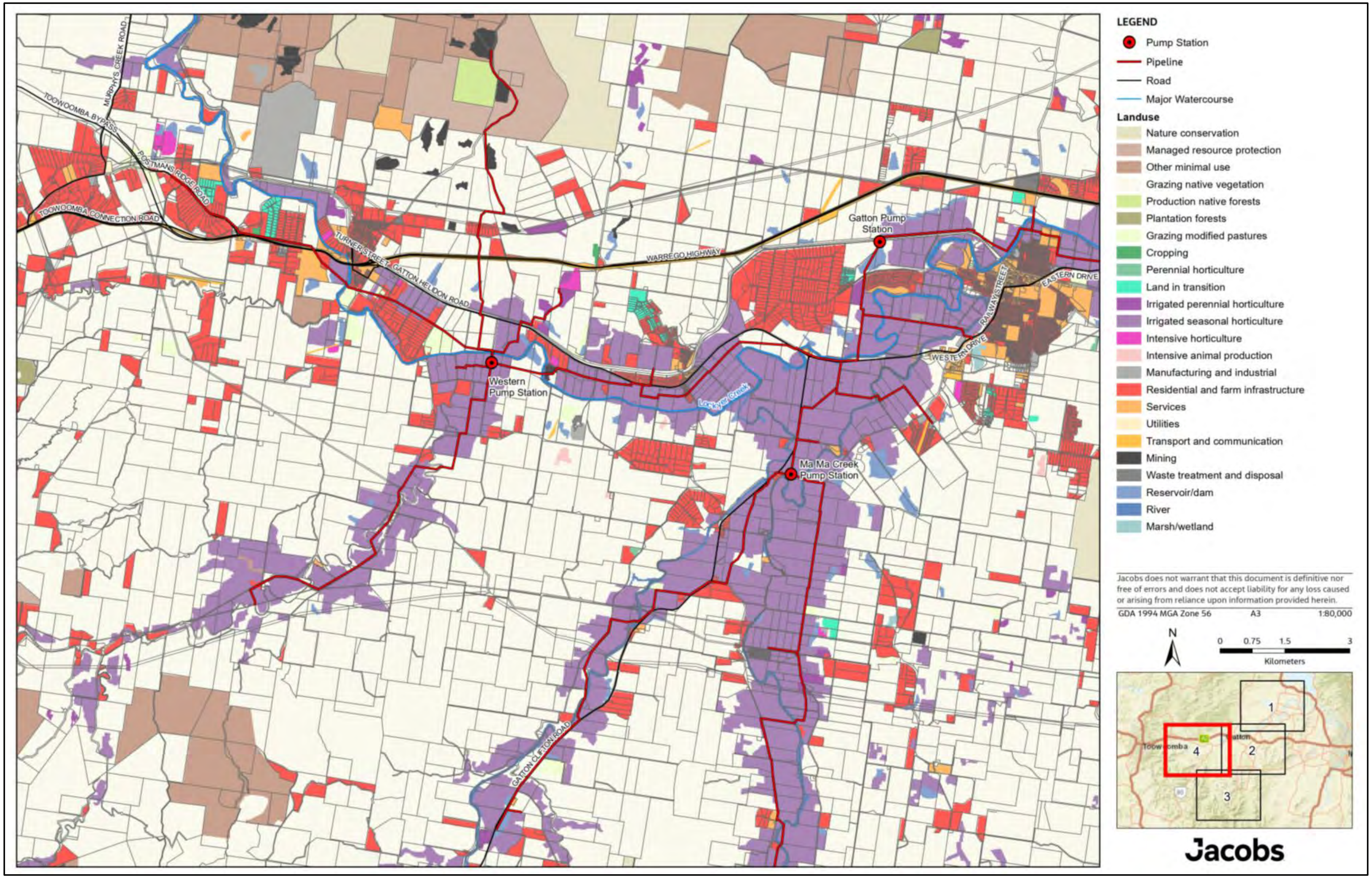


Figure 12.12: Land use 4 of 4



A detailed overview of land tenure for properties that intersect with the proposed pipeline network is provided in Table 12.3.

Table 12.3: Land tenure intersecting the proposed pipeline network

Tenure type	Number of parcels
Easement	142
Freehold	901
Leased land	40
Reserve	12
Road reserve or other	651
State land	3
State forest	1
National park	1
TOTAL	1,751

Figure 12.13 to Figure 12.16 provides an overview of land tenure that is generally located in the vicinity of the proposed pipeline network.

Figure 12.13: Tenure 1 of 4

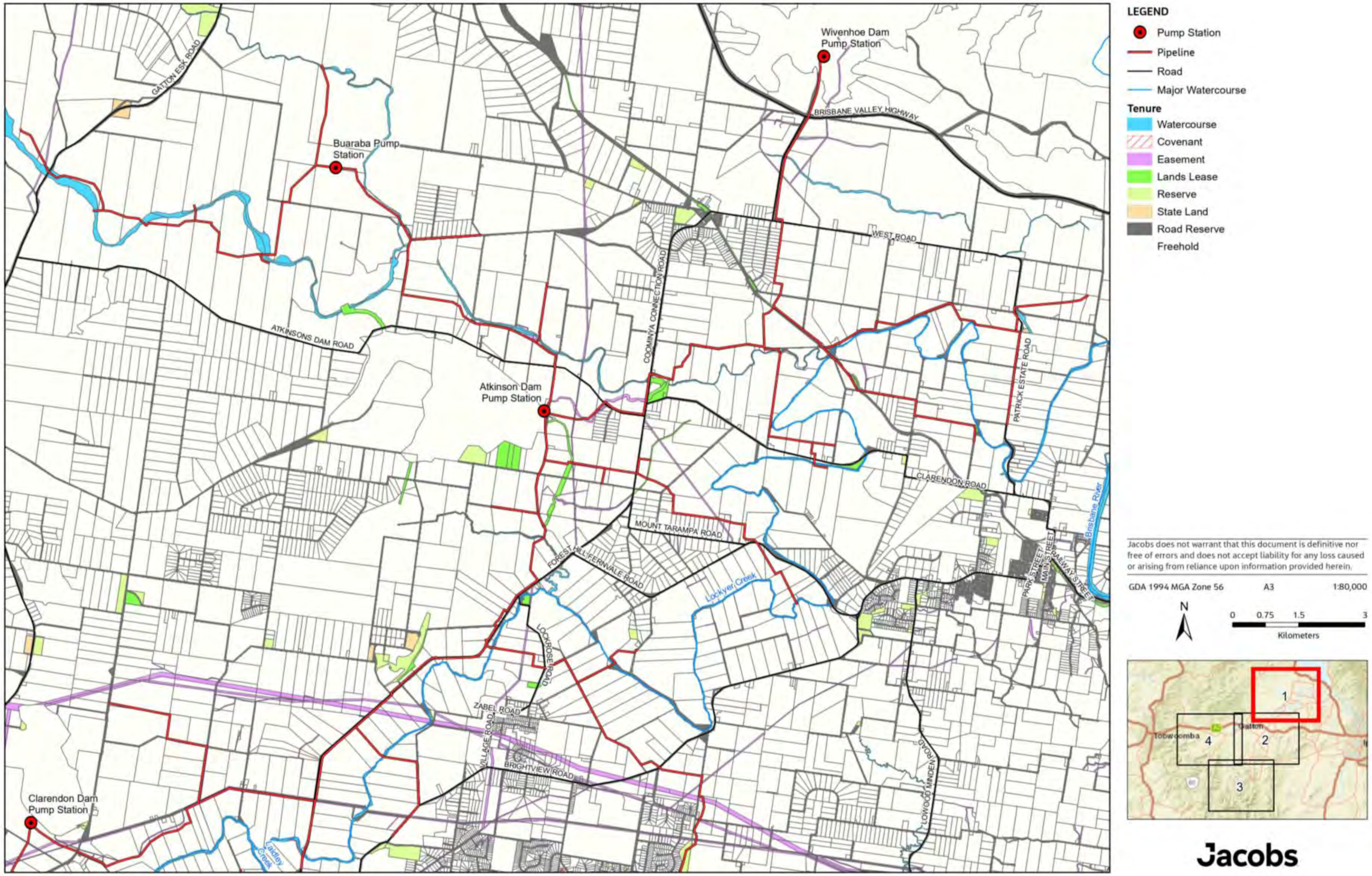


Figure 12.14: Tenure 2 of 4

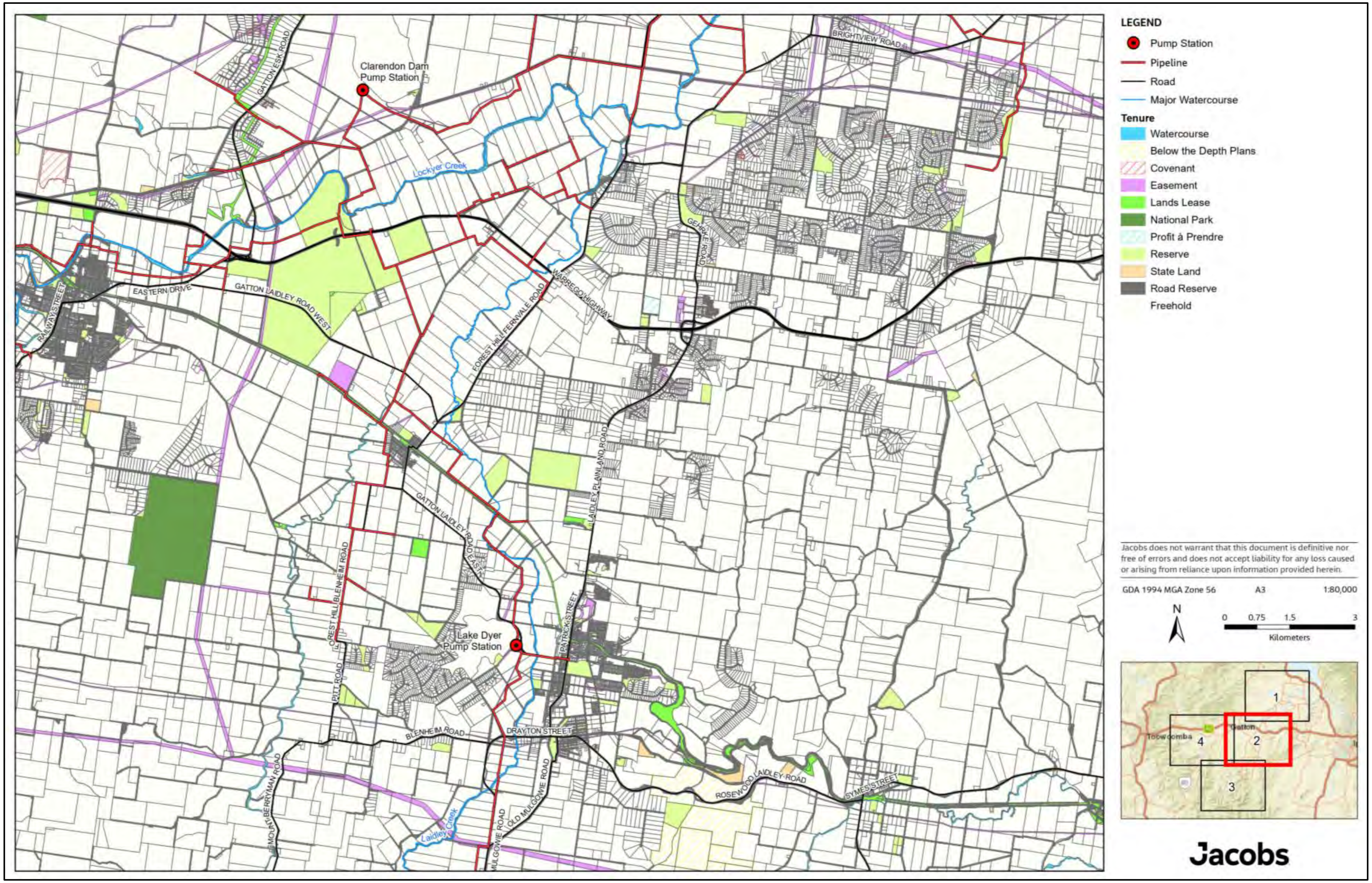


Figure 12.15: Tenure 3 of 4

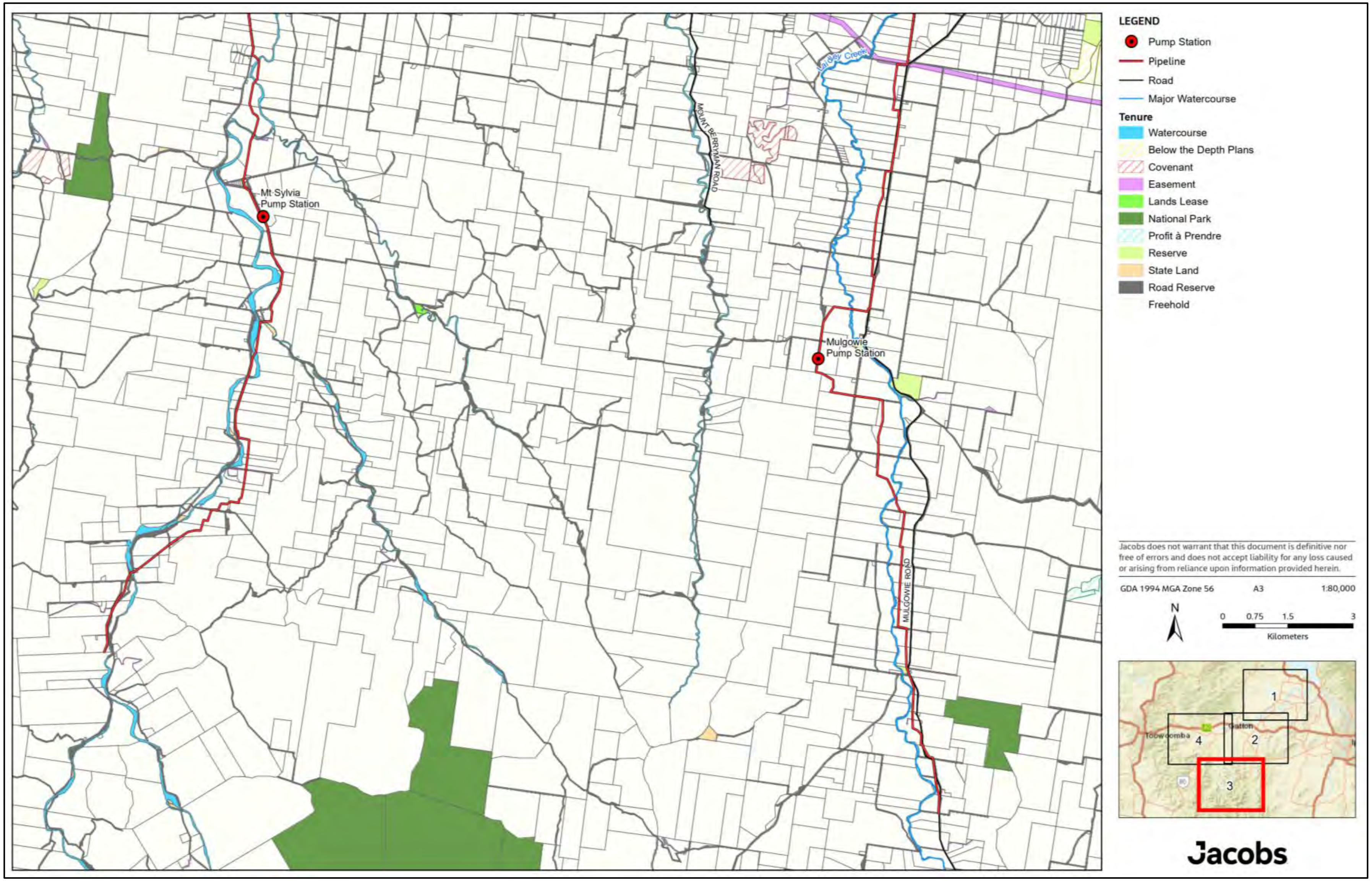
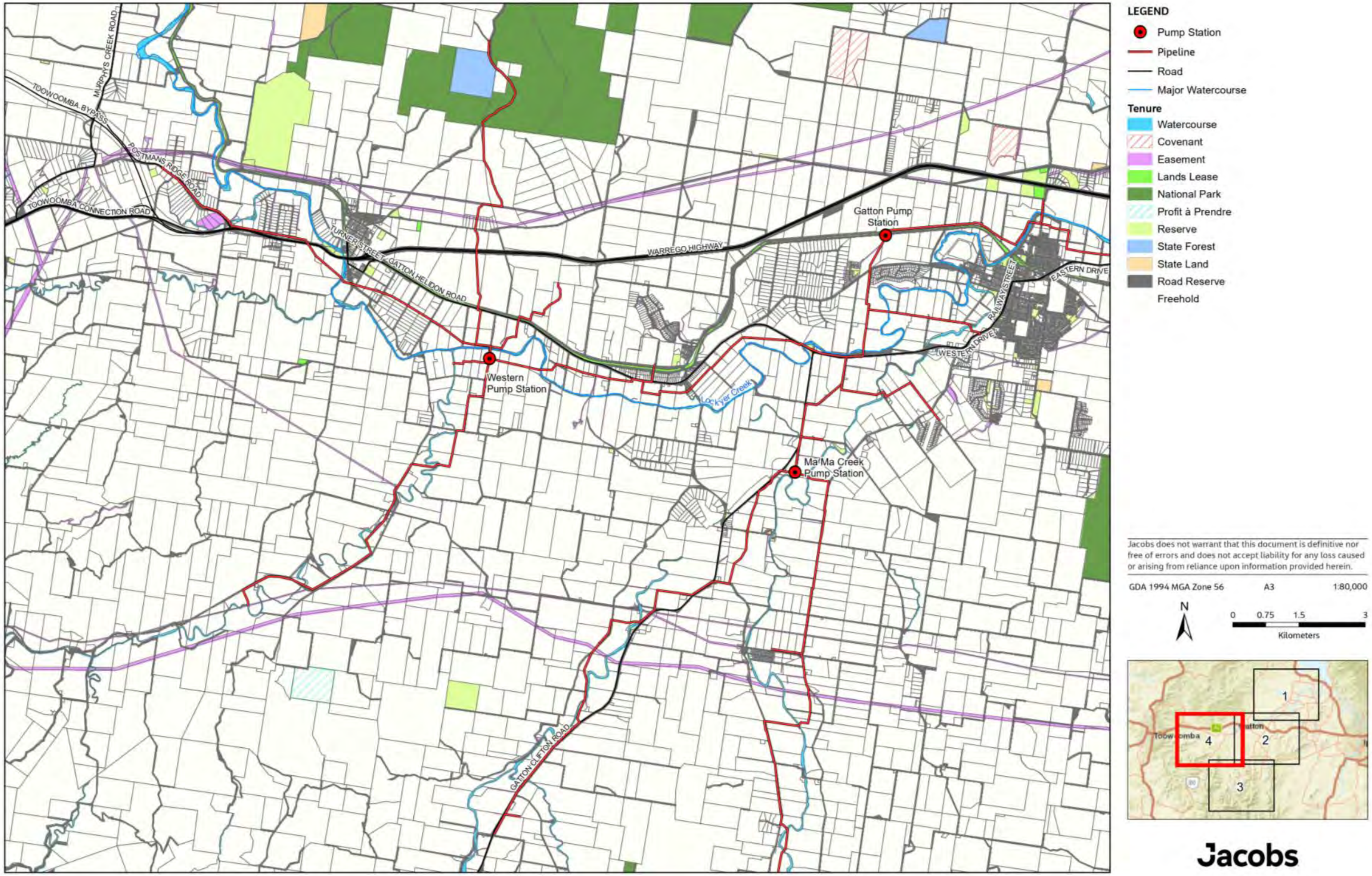


Figure 12.16: Tenure 4 of 4



A description of the identified tenure types and interests that apply to land intersecting the proposed pipeline network is provided in Table 12.4.

Table 12.4: Relevant land tenure or interests in land

Tenure or interest type	Description
Freehold	Land for which the property title has been purchased in fee simple from the state, giving the title holder the right to use and occupy the land.
Leased land	Lands made available to a party by the state for exclusive possession for a particular purpose (e.g. agricultural, tourism, business, or residential purposes). Leased land is typically granted for a specific period of time, at which time the lease expires, and the leaseholder loses possession of the land.
Reserve	Unallocated state land dedicated as a reserve for a community or public purposes (e.g. open space, parks, public halls). Trustees may be appointed to run the reserves; however, the state retains ownership of the land.
Road reserve	Land dedicated and opened for public use as a road.
Easement	A right to use and/or enter onto land that is owned by another party without possessing it. For example, an easement may provide access through a parcel or allow access for the purpose of maintaining public infrastructure on the land.
State land	Land held by the State of Queensland as unallocated state land and other areas vested in the state (or Crown) but not held in fee simple or as a lease issued under the Land Act (e.g. protected areas).

12.5.1.1 Potential land use and tenure impacts

The project is expected to have a range of impacts on land use and tenure within the project area. Construction-related impacts are expected to be short-term, while operational impacts result in permanent changes to the use of land or tenure within the project area.

A summary of potential land use and tenure impacts and relevant mitigation and management measures is provided in Table 12.5.

Table 12.5: Potential land use and tenure impacts

Project phase	Impact	Mitigation measures
Pre-construction	Native title implications associated with development on Crown Land and land not subject to a previous exclusive possession act	In Queensland, the native title work procedures have been established to ensure that land dealings involving all state government departments and agencies appropriately consider and satisfy the requirements of the Commonwealth NT Act. All land dealings within the corridor are required to be assessed in accordance with the native title work procedures to ensure that native title rights and interests are appropriately considered and addressed.
Construction	Key infrastructure in the project area includes a number of state-controlled roads, railway corridors and electricity infrastructure corridors	All required approvals and permits to conduct project works within these key infrastructure corridors must be secured from the relevant operating entities. Where required, horizontal directional drilling will be used under these corridors to mitigate impacts from construction.
Construction	Additional private land along the pipeline route will be temporarily required for construction of the pipeline and associated worksites and laydown areas	Where construction of the pipeline must occur on private properties, landholder agreements with affected property owners will be established. The land will be fully reinstated following construction.

Project phase	Impact	Mitigation measures
Construction	Temporary disruption to private property access	Property access impacts will be managed through consultation with affected property owners and the establishment of landholder agreements for temporary construction activities.
Construction	Vegetation clearing activities	The pipeline design has sought to minimise impacts on remnant vegetation, riparian areas and sensitive ecological areas by following road reserves and established pathways, traversing property boundaries and keeping within cleared areas where practicable. Horizontal directional drilling will be used under riparian corridors to mitigate impacts to riparian values where practicable.
Construction / Operation	Construction and maintenance of irrigation scheme infrastructure assets	Where private land will be occupied by permanent project infrastructure and assets, easements will be established to secure the use and access rights. Easements over private land will be perpetual and in favour of the owner of the irrigation scheme.
Operation	Pipeline network operation	As the pipeline will be buried, the project is not anticipated to have significant long-term property impacts on properties whilst operational. Some short-term impacts may occur during future maintenance works along the pipeline corridor.
Operation	Increased water availability and security for customers, increasing the agricultural land base and supporting the establishment of new and diversified agricultural uses and associated rural industry uses (i.e. processing of produce or crops or distilleries)	No mitigation/management measures are required.

In addition, it is considered that the project is likely to result in residual impacts relating to the loss of amenity for private properties near pumping stations that are subject to easement negotiations. These impacts are discussed further in the Social Impact Evaluation chapter.

Given that the pipeline alignment will be finalised after binding water sales, it is recommended that the impacts to land use and tenure that have been identified are reviewed and updated in future project stages.

12.6 Topography, geology and soils

12.6.1 Approach/methodology

The ground condition interpretation and associated design and constructability considerations for the project involved an initial desktop review undertaken in June 2020. The methodology for the desktop review included:

- a review of publicly available information sources, including geological and soil maps and installed pumping well records
- a review of geotechnical investigations undertaken for relevant infrastructure projects in the vicinity of the project area, including Department of Transport and Main Roads (DTMR) projects and the Inland Rail corridor
- an aerial photography interpretation exercise that was undertaken to establish the potential geomorphological characteristics of the multiple floodplains associated with primarily Lockyer Creek.

The desk study and remote sensing exercise was further augmented by a walkover of the main components of the proposed distribution network undertaken in June 2020. This field work was centred on reviews of major potential crossing points such as the potential multiple traverses of Lockyer Creek, the Warrego and Brisbane Valley Highways, as well as general observations of ground conditions and pumping station locations.

The findings of both the initial desktop and field inspections were used to define an interpreted ground model of the proposed irrigation network as a basis to inform concept design and constructability aspects of the proposed scheme layout. In addition, experience from previous similar projects (such as the Haughton Stage 2 Pipeline project) was used to define both potential ground risks and related mitigation measures that should be considered in the overall assessment of detailed design, construction methodology, program and cost assessments.

12.6.2 Topography

The proposed pipeline alignment generally traverses a series of floodplains formed by both the Brisbane River, Lockyer, Laidley and Murphys creek systems. The floodplains vary between approximately 40–50 m AHD in and around Clarendon and Fernvale (near Mahons Road) in the north, rising to approximately 100 m AHD at the Warrego Highway along the Main Line.

From the Warrego Highway, the different branches of the proposed pipeline alignment rise moving west, south-west and south to between approximately 150–185 metres AHD (around Flagstone Creek Road, Postmans Ridge Road and Gatton Clifton Road) to a maximum of approximately 230 metres AHD within the vicinity of Mt Sylvia Road, close to the proposed Mount Sylvia pumping station location (Figure 12.17).

The pipeline network generally does not traverse any significant sections of higher topography, being driven along narrow valleys between more topographic highs, due to the distribution of the potential customer locations.

The pipeline network presently is at a high level of design and is yet to be optimised. As such, a number of existing surface water bodies may be required to be linked to provide a more integrate network. Excluding Wivenhoe Dam, these surface water storage bodies include:

- Clarendon Dam or Lake Clarendon
- Atkinson Dam
- Lake Dyer or Bill Gun Dam.

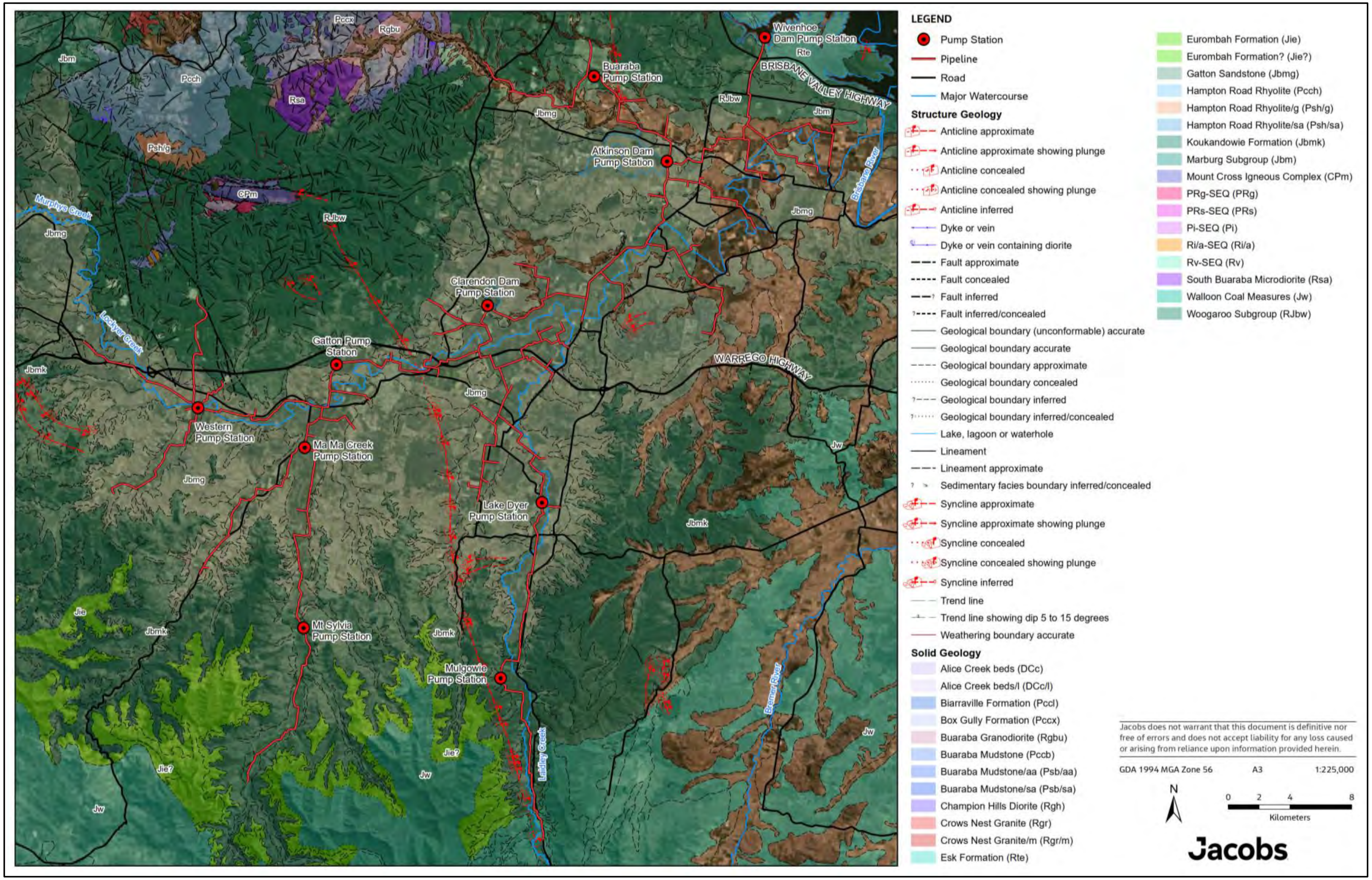
Figure 12.17: Waterways and contours

12.6.3 Geomorphology

The proposed pipeline alignments traverse both the wide floodplain formed by both the Brisbane River to the east and the Lockyer Creek floodplain (Figure 12.17) to the north of the Warrego Highway and east towards Toowoomba. Evidence from a review of existing historic aerial photography indicates that Lockyer Creek and its associated tributaries may have meandered over time, and therefore a number of previous channels and levees may have been reworked. There is also the potential for numerous abandoned channels and oxbow lakes to have formed. These geomorphological features and their possible history of evolution may have a significant impact on the associated extensive alluvial floodplain deposits in terms of their thickness and complex stratigraphy, which could change significantly over short distances.

The proposed pipeline branches off the main line to the south of the Warrego Highway to follow the narrow creek valleys between topographic highs. Here the Laidley Creek Valley formation may have been associated with an interpreted anticline (Figure 12.18). No significant evidence has been identified of major landslides that are associated with the valley slopes above the associated narrow alluvial valleys.

Figure 12.18: Waterways and contours



12.6.4 Soils

The published soils along the proposed pipeline alignments (Figure 12.19) include:

- vertosols with potentially reactive clays occurring over significant portions of the Main Line, including the Lockyer Creek floodplain
- sodosols with a potential to be sodic/dispersive in nature and saline in character (possibility resulting in tunnel erosion and/or piping failures), which are likely to be encountered over the minor branches of the Main Line
- tenosols with a possible high organic content and potentially encountered in the north-western sector of the Main Line and the pipeline branches to the south of the Warrego Highway
- kurosols with potentially strongly acidic soils generally occurring to the western and south-western sections of the proposed pipeline network.

The dispersive nature of sodosols is driven by the high concentrations of sodium within the upper horizons, which clogs soil pores. This clogging results in erosion/dispersion of the upper soil surfaces when overland flow occurs. These soils may have a high potential for shrink-swell, and are extremely difficult for plant to travel over when wet.

The presence of acid sulphate soils over the pipeline alignments is a very low probability (Figure 12.20**)**. This is supported by the elevation being considerably above the 20 m AHD upper threshold levels for these types of soils. However, based on Jacobs' experience in Queensland, there is potential for acid sulphate soils to exist in similar floodplains at similar elevations.

12.6.5 Geology

The proposed pipeline alignment traverses extensive alluvial floodplains where a considerable thickness of surficial deposits of various composition and consistencies may be apparent. These are generally of a quaternary age and only within the northern sector of the network around Buaraba, Clarendon and Wivenhoe Dam (Figure 12.21). Works within this area may encounter tertiary alluvium, colluvium and residual soils of the Gatton Sandstone and Woogaroo subgroup of rocks.

Figure 12.19: Soil types

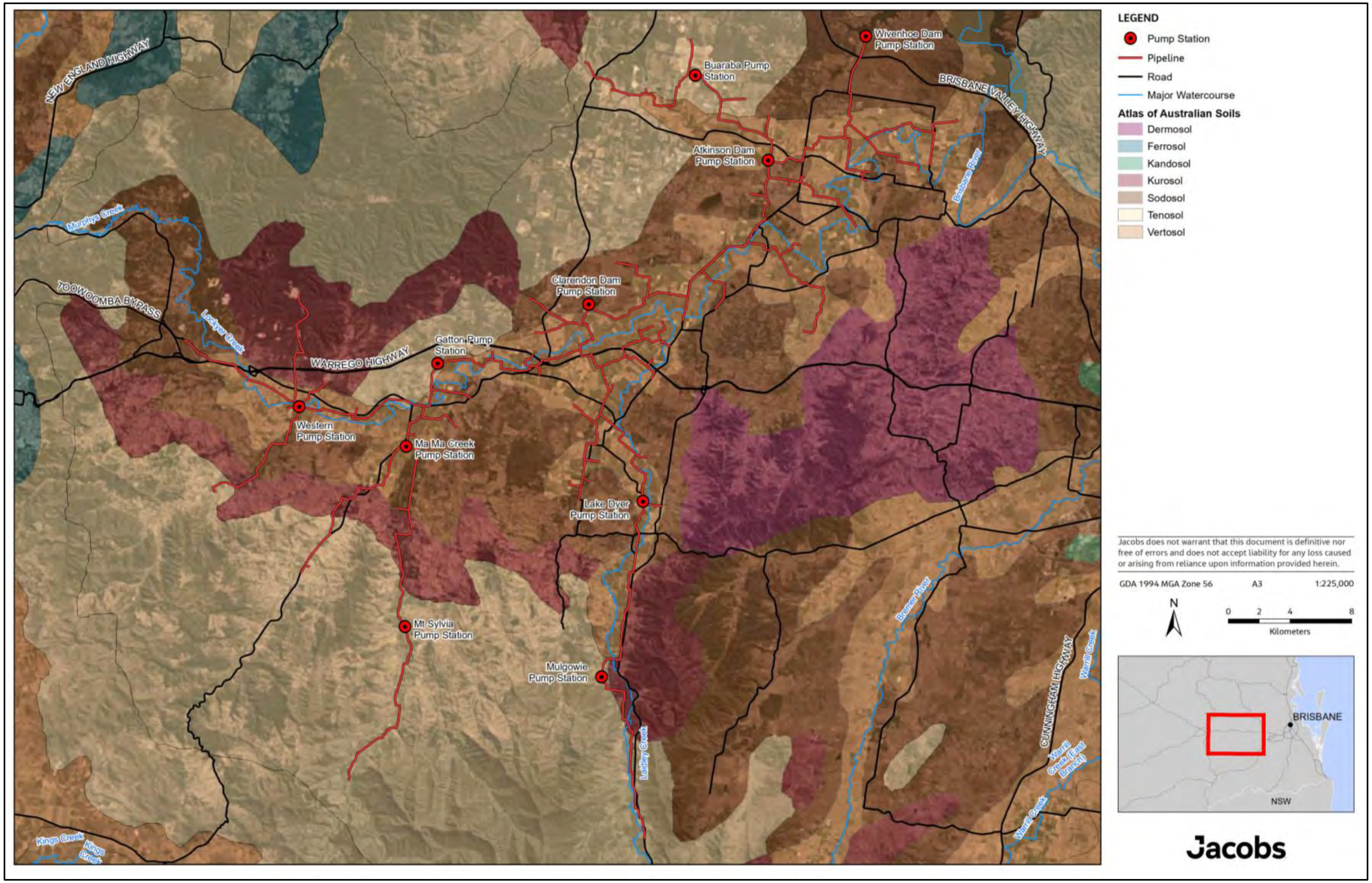


Figure 12.20: Acid sulphate soil

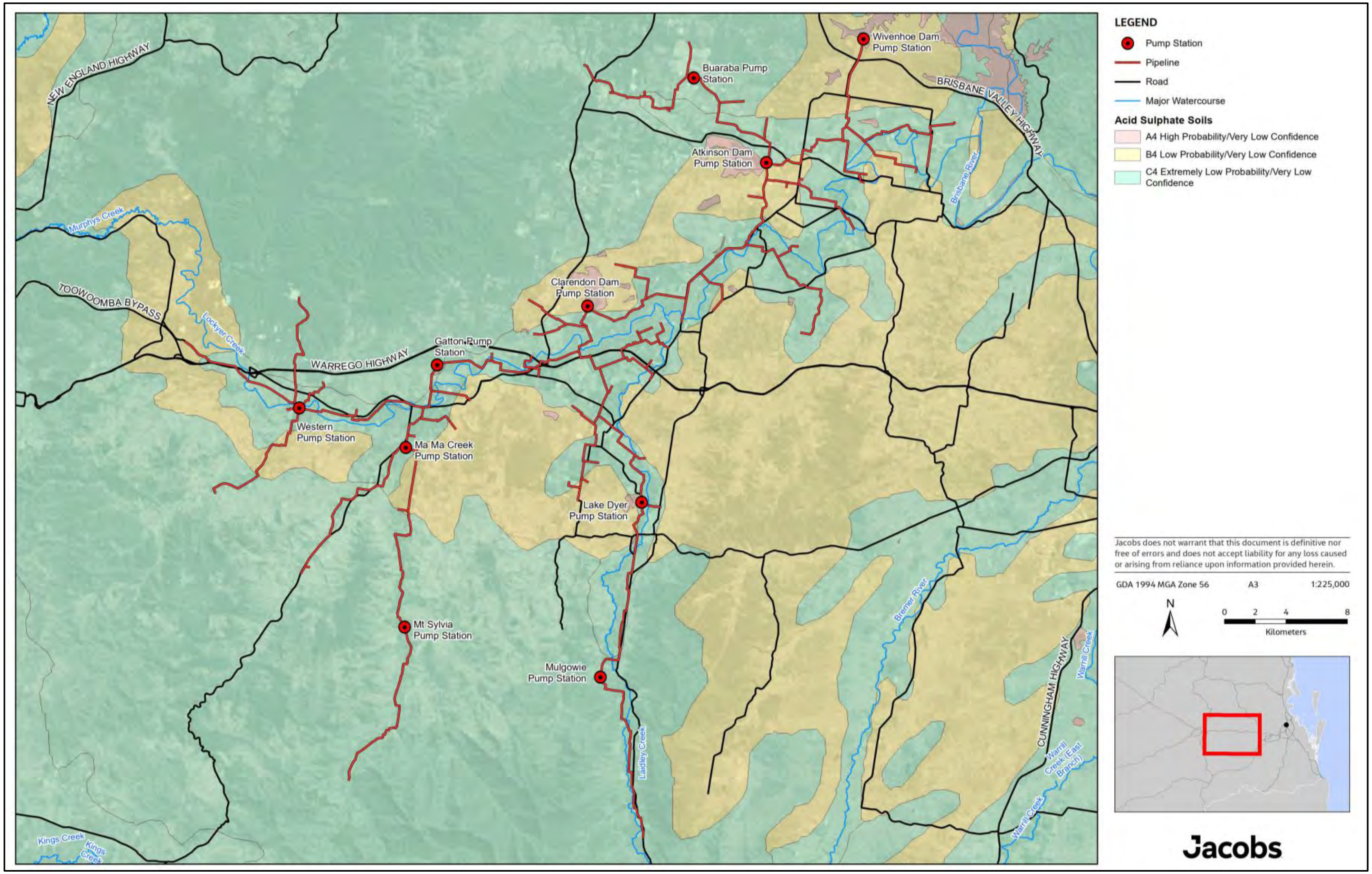
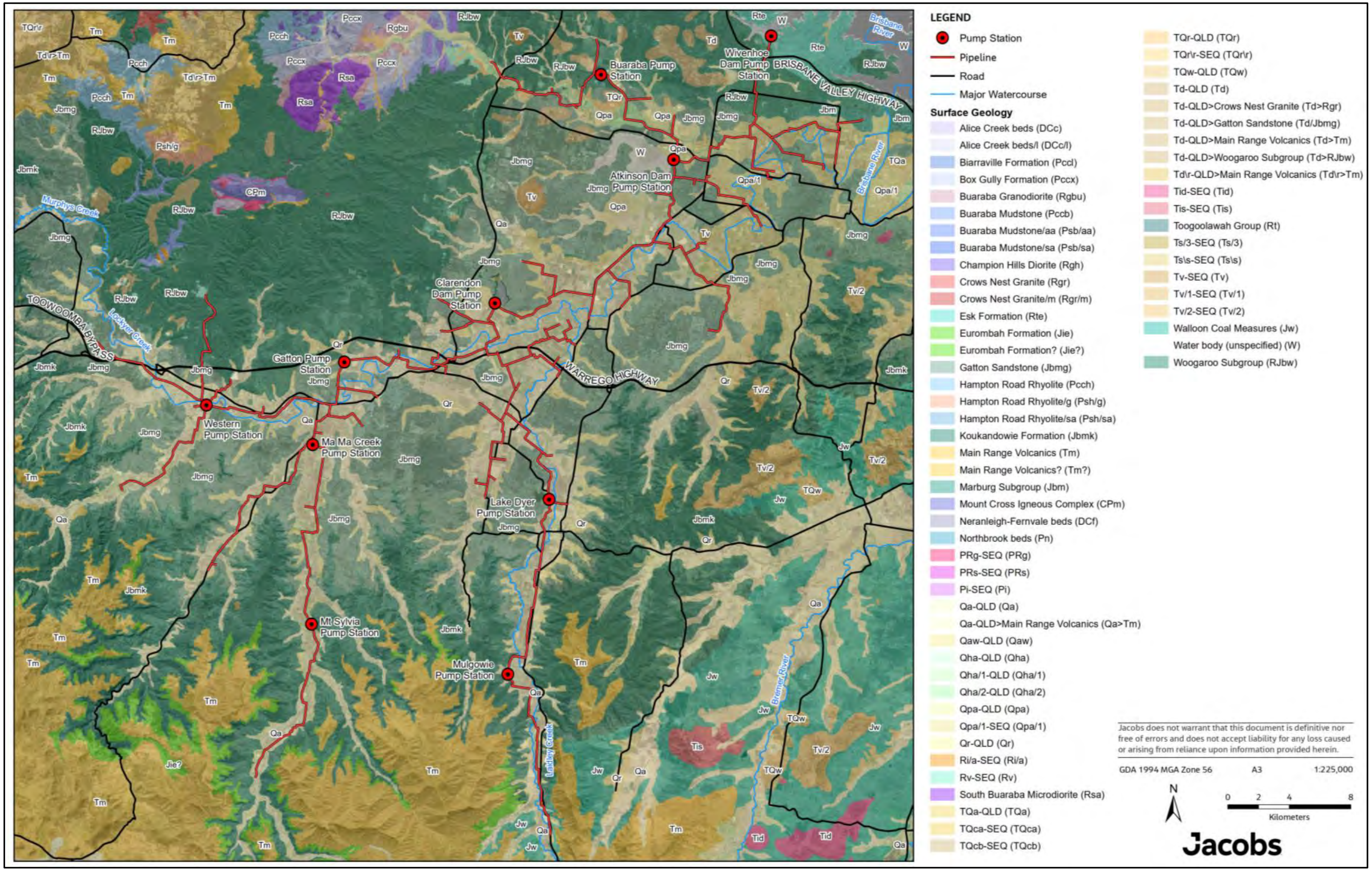


Figure 12.21: Surface geology



The two main rockmass units that the proposed pipeline could traverse are the Gatton Sandstone and the Koukandowie formation (Figure 12.21.

The only major geological structural feature that may lie in close proximity to the proposed pipeline network is the potential north-west south-east trending Anticline between the Lockyer National Park (north of the Warrego Highway) to south of Thornton (Figure 12.21). Therefore, impacts of geological structural features on the proposed pipeline scheme are not interpreted to be significant.

12.6.6 Mitigation and management measures

The following mitigation and management measures should be considered to minimise the impacts of geological structural features on the project design, construction and operational phases of the project.

General control measures include the following:

- Drainage control measures should be considered through the construction and operation phases of the project.
- Erosion and sediment control measures should be considered and captured in a Construction Environmental Management Plan.

Where reactive soils are encountered, the following measures should be considered:

- The pipeline design should consider the use of a non-reactive covering over the pipe surface to manage the impacts of reactive soils.
- Moisture control of these soils should be considered through project design
- A deeper dig out and replacement with inert soils or the use of sandbags, concrete linings or geotextile/fabric wrapping/the use of soil pillows should be considered to reduce swelling pressures.

Where sodic/dispersive soils are encountered, the following measures are relevant:

- Where cohesive dominated backfill soils are encountered, the upper 300–500 mm should be treated with gypsum and mixed zones should be carefully compacted.
- Where granular dominated backfill soils are encounters, a geotextile should be installed 300–500 mm below ground surface prior to the replacement of excavated soils.
- Sand blocks or barriers should be installed within proven tunnel prone areas.

12.6.7 Further investigations

Further site-specific studies of the topography, geology and soils in the project area should be undertaken as part of the EIS or IAR. These investigations would consider further mitigation and management measures that should be implemented during project design, construction and operational phases of the project lifecycle.

12.7 Land contamination

12.7.1 Approach/methodology

Potential contaminated land impacts associated with the project were assessed. It involved a desktop review of:

- relevant legislation including the *Environmental Protection Act 1994*
- the National Environmental Protection (Assessment of Site Contamination) Measure 1999
- data that was extracted relating to the location of resource activities and prescribed environmentally relevant activities (ERAs) from the Queensland Government Open Data Portal into a project-specific Esri interactive webmap.

Given the size, scale and current stage of the project, it was determined that a site-by-site review of the Environmental Management Register (EMR) and Contaminated Land Register (CLR) of all properties within the project area was inappropriate for the preparation of a detailed business case. Accordingly, it was determined that a review of ERAs that have the potential to result in soil contamination would provide sufficient guidance on the likelihood of contaminated land impacts and future steps for the project. It is anticipated that a site-by-site review of the EMR and CLR would be undertaken at the detailed design stage.

12.7.2 Existing context

A review of the proposed pipeline route has identified 19 ERAs (Table 12.6) located within or adjacent to the proposed pipeline network, which are considered to have the potential to result in contaminated lands (Figure 12.22 to Figure 12.25).

Table 12.6: Environmentally relevant activities within the project area

Permit reference no.	Permit type	Environmentally relevant activity (ERA)
EPPG00308113	Resource Activity	Non-Scheduled, Petroleum Activity, Petroleum Pipeline Licence – PPL
EPPG03515815	Resource Activity	Non-Scheduled, Petroleum Activity, Petroleum Pipeline Licence – PPL
EPPG00959713	Resource Activity	Schedule 3, 08: A petroleum or GHG storage activity, other than items 1 to 7, that includes an activity from Schedule 2 with an AES
EPSX00926413	Resource Activity	Non-Scheduled, Mining Activity, Exploration Permit Mineral – EPM
EPPR00489913	Prescribed ERA	ERA 63 – Sewage Treatment, 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (a-i) 21 to 100EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation
EPPR01762513	Prescribed ERA	RA 12 – Plastic product manufacturing, 1: Manufacturing, in a year, a total of 50 t or more of plastic product, other than a plastic product mentioned in item 2
EPPR00769413	Prescribed ERA	ERA 25 – Meat Processing, 2: Processing, including rendering, in a year, the following quantity of meat or meat products, (b) more than 5000 t but not more than 50,000 t
EPVX02148714	Prescribed ERA	ERA 63 – Sewage Treatment, 2: Operating a sewage pumping station mentioned in subsection (1)(b)
EPPR00497113	Prescribed ERA	ERA 16 – Extraction and Screening, 2: Extracting, other than by dredging, in a year, the following quantity of material, (b) more than 100,000t but not more than 1,000,000 t
		ERA 33 – Crushing, milling, grinding or screening, Crushing, grinding, milling or screening more than 5000 t of material in a year
EPPR00528213	Prescribed ERA	ERA 16 – Extraction and Screening, 2: Extracting, other than by dredging, in a year, the following quantity of material, (b) more than 100,000 t but not more than 1,000,000 t
EPPR00504813	Prescribed ERA	ERA 25 – Meat Processing, 2: Processing, including rendering, in a year, the following quantity of meat or meat products, (c) more than 50,000 t
EPPR00524913	Prescribed ERA	ERA 63 – Sewage Treatment, 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (a-i) 21 to 100EP if treated effluent is discharged from the works to an infiltration trench or through an irrigation
EPPR00640413	Prescribed ERA	ERA 63 - Sewage Treatment, 1: Operating sewage treatment works, other than no-release works, with a total daily peak design capacity of (b-i) more than 100 but not more than 1500EP if treated effluent is discharged from the works to an infiltration trend

Figure 12.22: Environmentally relevant activity 1 of 4

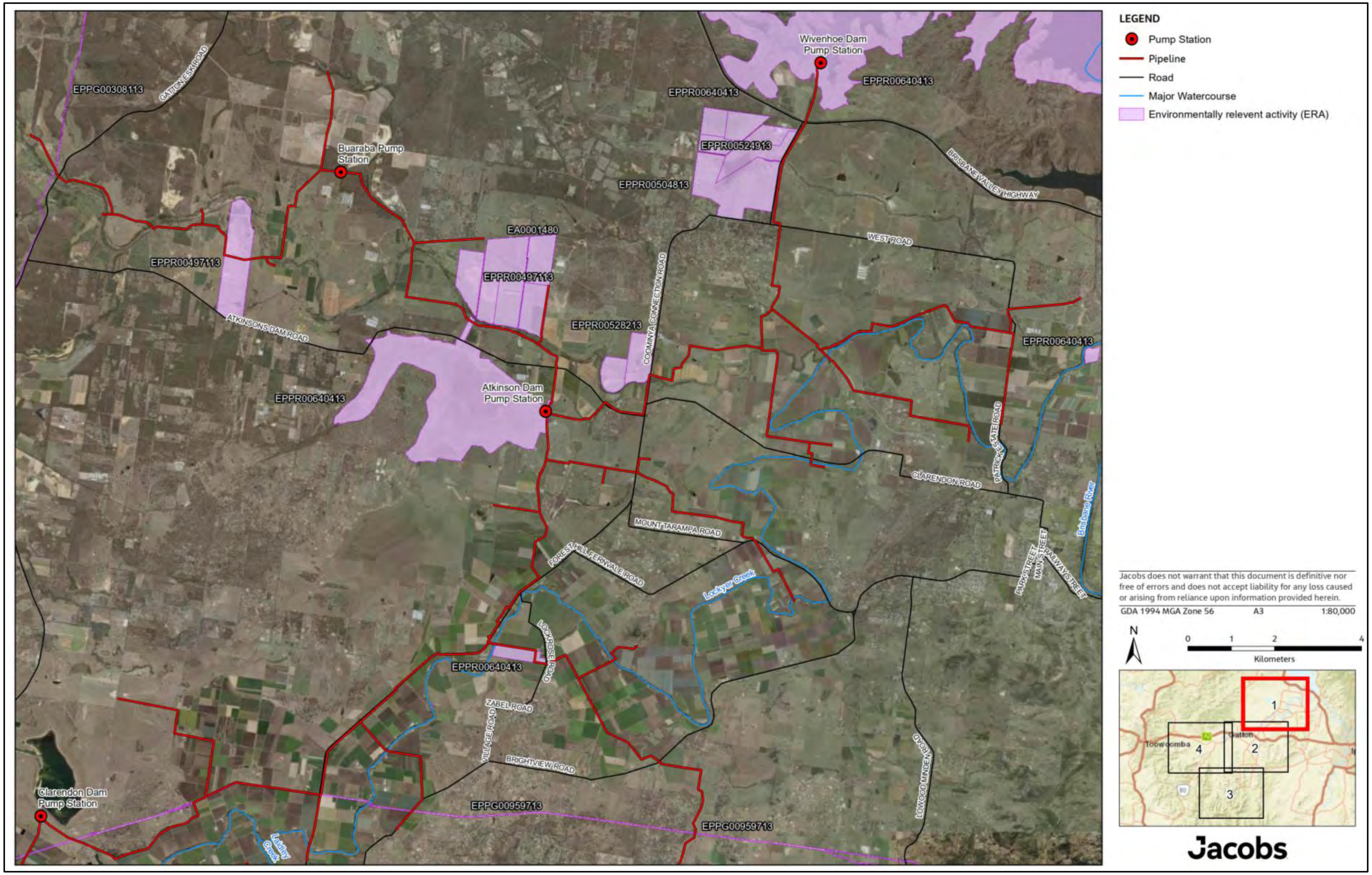


Figure 12.23: Environmentally relevant activity 2 of 4

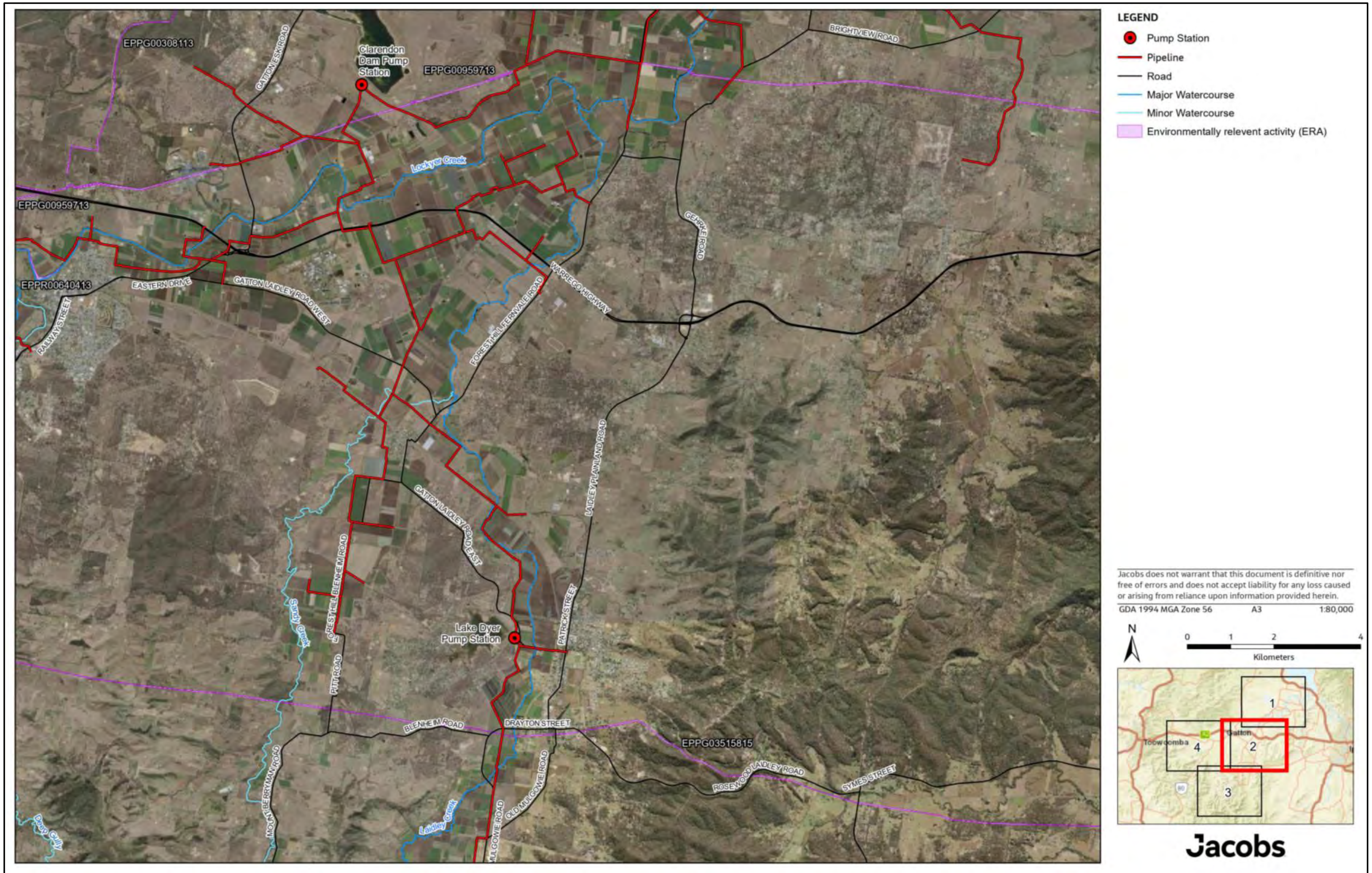


Figure 12.24: Environmentally relevant activity 3 of 4

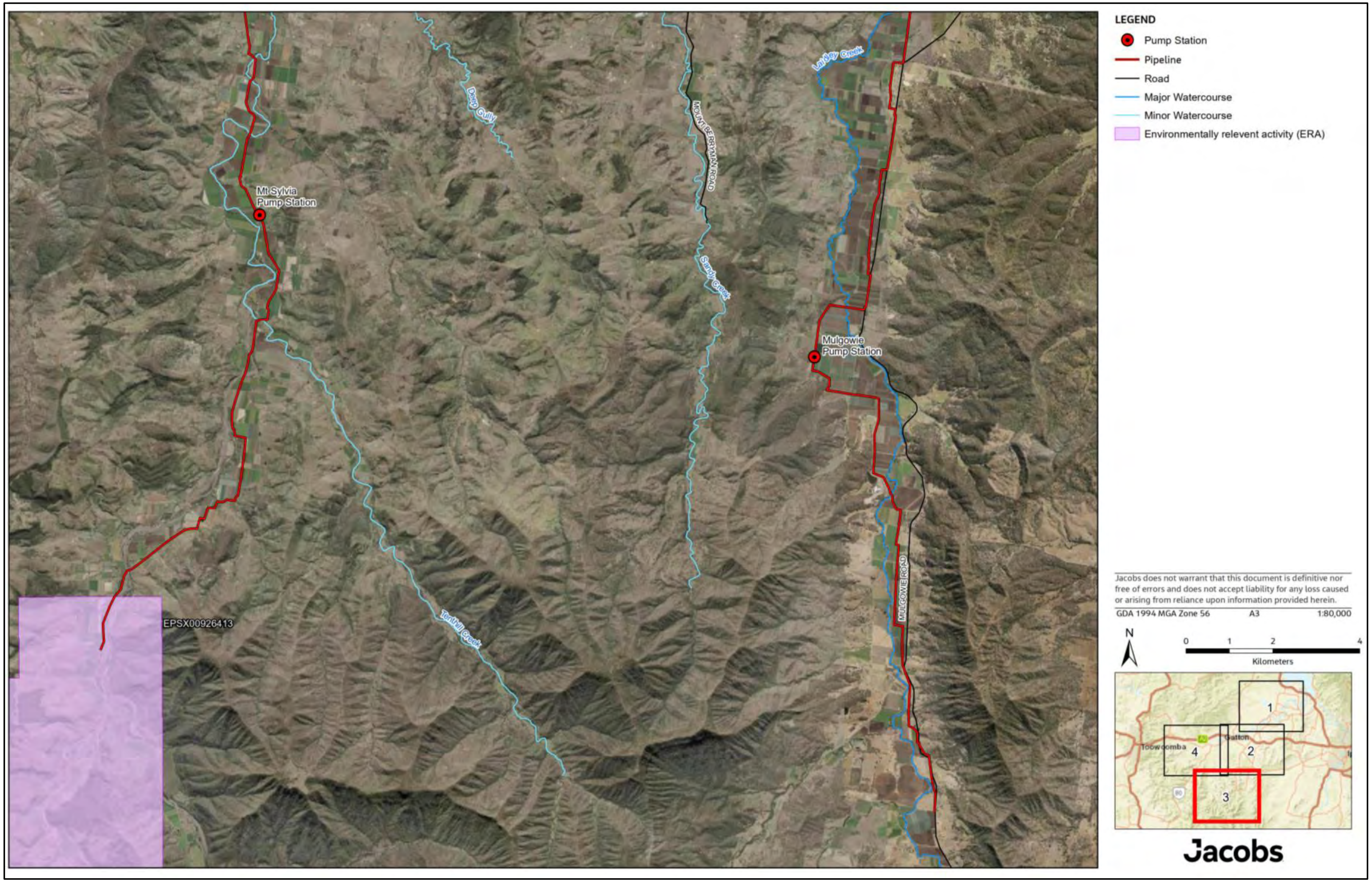
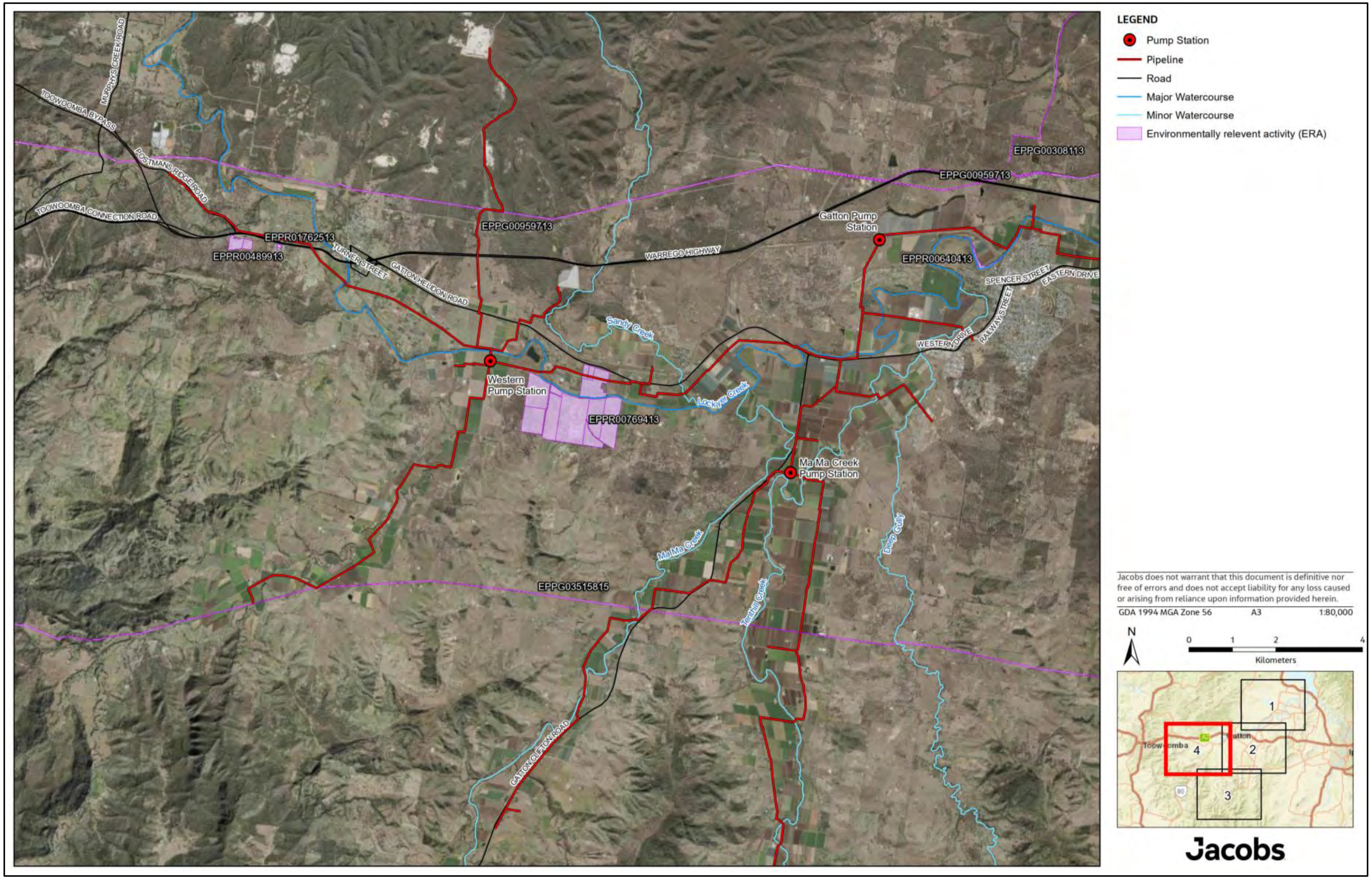


Figure 12.25: Environmentally relevant activity 4 of 4



12.7.2.1 Potential impacts

The presence of the ERAs (Table 12.6) within the project area are considered to be a risk factor for contaminated land impacts. More specifically, it is considered that the identified activities have the potential to have adverse health impacts on site-based staff and adjoining sensitive land uses during construction through physical contact with soils, ground and surface waters containing toxic concentrations of contaminants. It is recommended that the proposed pipeline network be aligned to avoid these ERAs where practicable. This will also aid in reducing the statutory approval requirements for the project.

Soil that is taken from a site that is listed on the EMR or CLR may require a soil disposal permit if the soil is to be removed off-site.

12.7.2.2 Further contaminated land investigations

Further contaminated land investigations would be required as part of a detailed environmental assessment undertaken for an EIS or IAR.

This contaminated land assessment should be undertaken in accordance with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013), which provides a national framework for the staged assessment of site contamination. The staged approach allows information obtained during each stage to be used to inform and update the conceptual site model and plan the subsequent scope of work. The staged approach forms the basis for a risk-based approach to the assessment and management of contaminated sites.

In accordance with this framework, a preliminary site investigation (PSI) should be undertaken as a first step. The PSI consists of a desktop study, a detailed site inspection and a review of the EMR and CLR. A PSI may also include limited sampling and analysis. The information is used to develop an initial conceptual site model. If contamination or potential areas of concern are identified, further detailed site investigation may be required.

12.7.3 Water quality

12.7.3.1 Groundwater

A desktop review of groundwater and groundwater quality for the project was undertaken in August 2020 and was informed by the use of the following information:

- relevant legislation including the *Environmental Protection Act 1994* and *Environmental Protection (Water) Policy 2009*
- the Water for the Lockyer Strategic Business Case Report
- Queensland Government interactive mapping systems and databases, including:
  - Queensland Globe
  - GeoResGlobe
  - the Department of Natural Resources, Mines and Energy (DNRME) Registered Bore Database
- available groundwater-related literature relevant to the Lockyer Creek region.

The following approach was adopted for the assessment of groundwater values for the project:

- An assessment of the project scope of works and proposed construction methodologies was undertaken to identify how the project may influence, or be influenced by, existing groundwater conditions and the environment.
- Relevant legislation and regulations to manage groundwater quality within the project area were identified and reviewed.

- Available data relating to groundwater and environmental conditions within the project area was reviewed.
- Potential construction and operational impacts of the project and appropriate measures to manage and mitigate these impacts were identified.

12.7.3.1.1 Existing values and potential impacts

The following section identifies existing groundwater values within the project area and assesses the impacts of the project on these values.

12.7.3.1.1.1 Groundwater occurrence

Groundwater across the project area is principally hosted within:

- alluvial sands and gravels located along drainage lines, intermittently running parallel to the pipeline alignment
- the Gatton Sandstone bedrock underlying the majority of the Lockyer Valley
- the Koukandowie formation bedrock in the southern reaches of the feeder creeks.

Groundwater locations relative to these features are identified in Figure 12.26 to Figure 12.29.

Figure 12.26: Surface geology 1 of 4

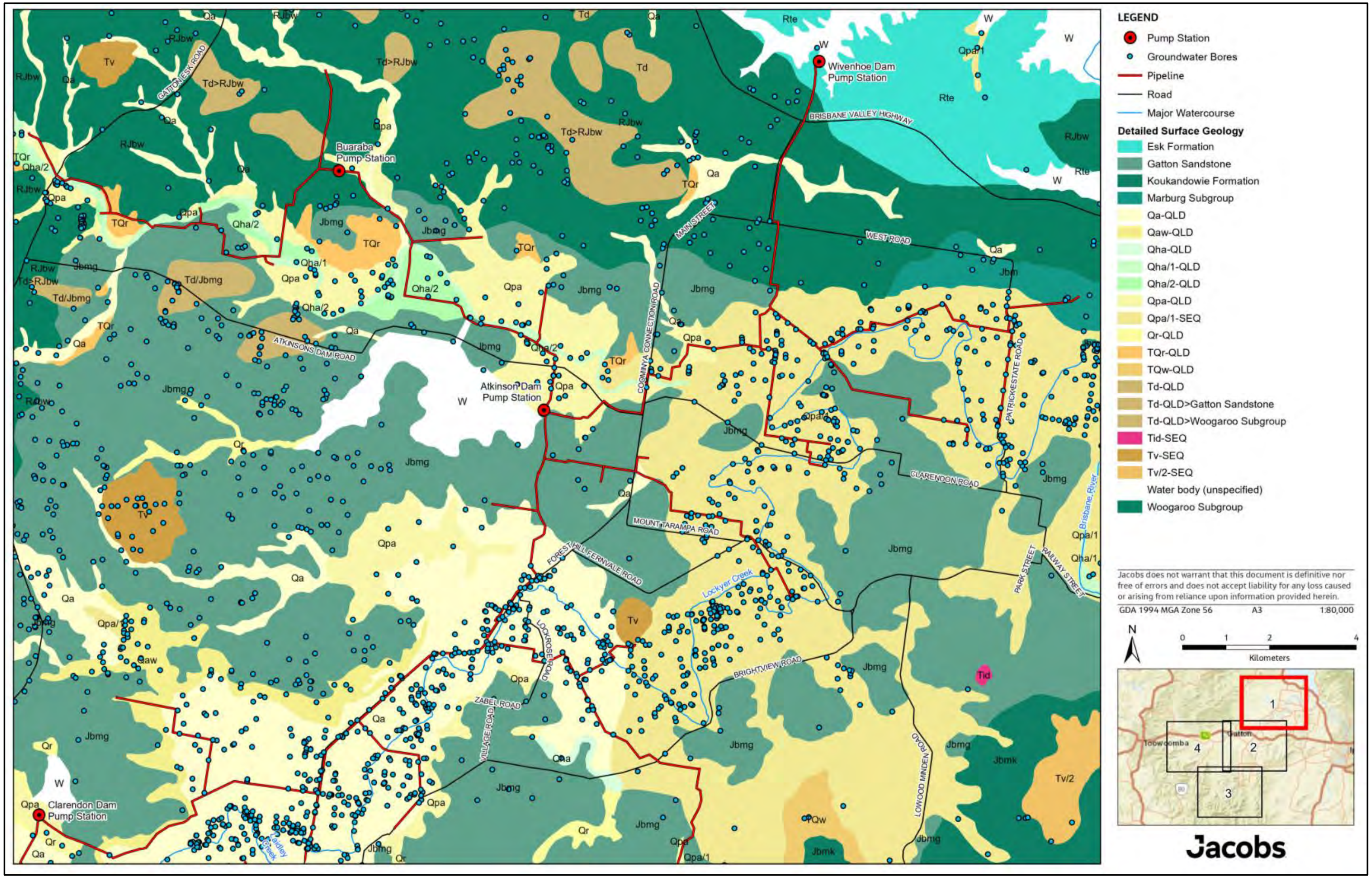


Figure 12.27: Surface geology 2 of 4

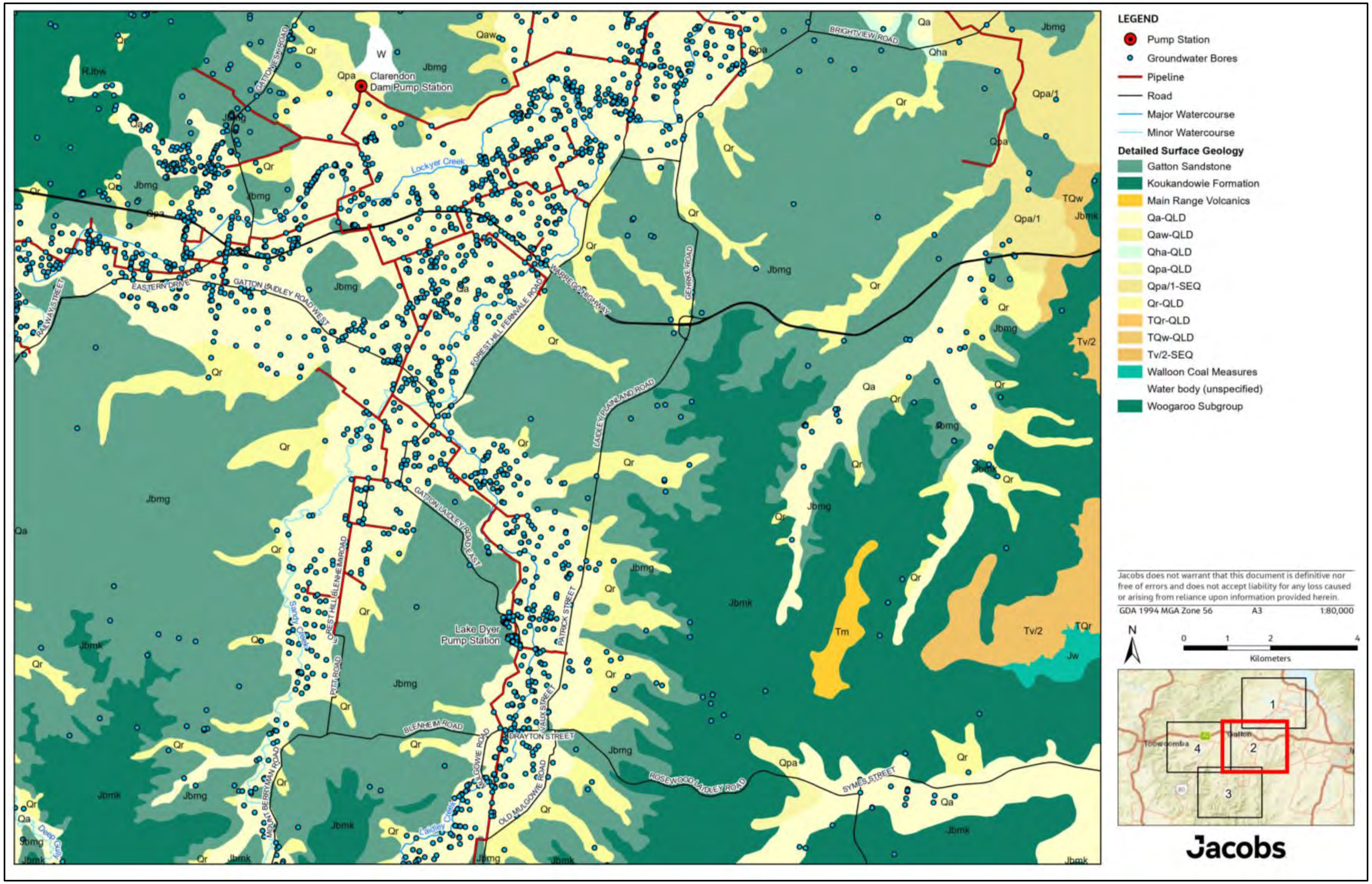


Figure 12.28: Surface geology 3 of 4

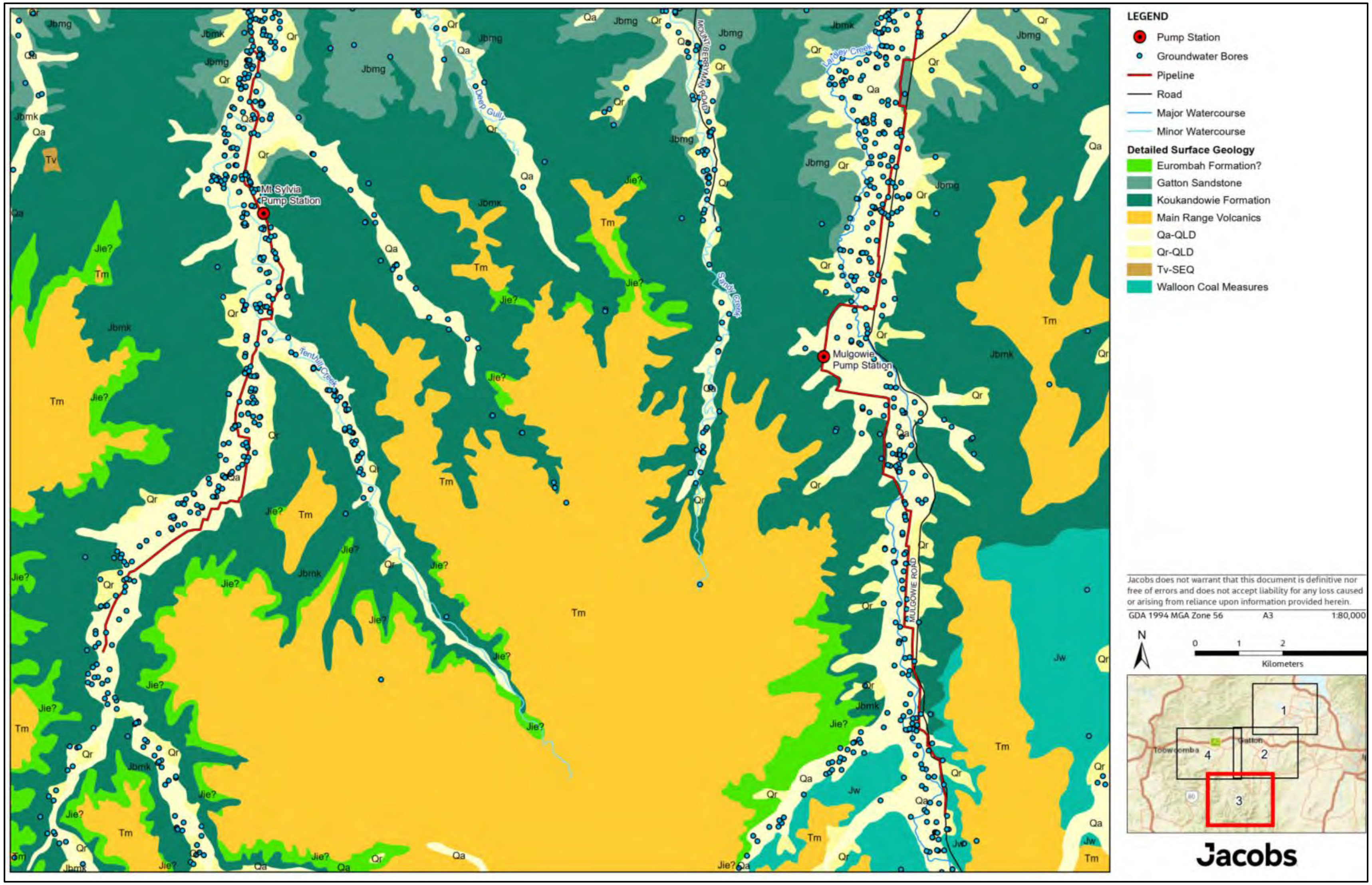
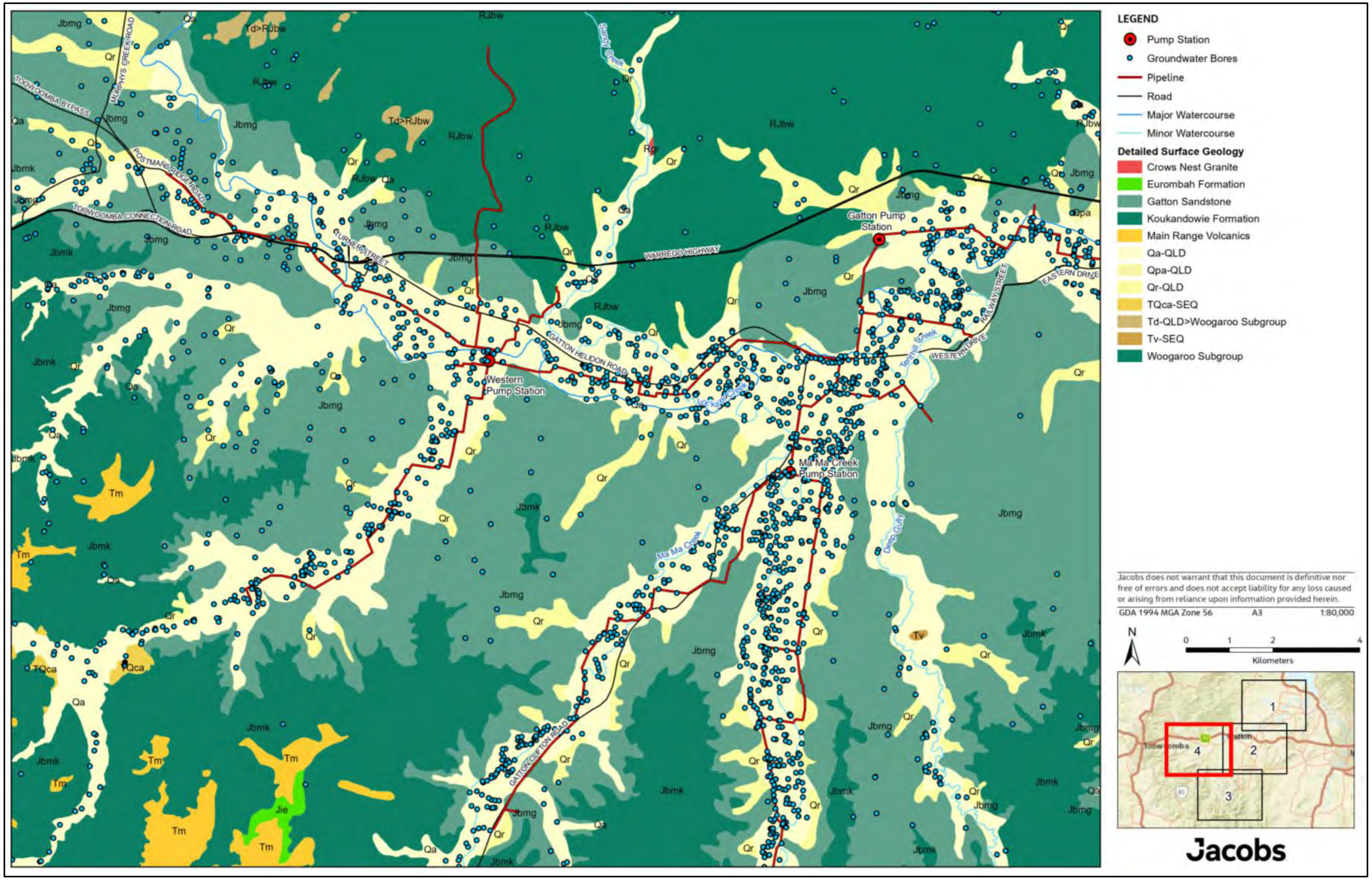


Figure 12.29: Surface geology 4 of 4



12.7.3.2 Groundwater levels

Groundwater levels have been recorded at over 2,700 monitoring and extraction bores across the project area over the previous 20 years. Records indicate that groundwater is present within the alluvium typically less than 20 m deep and commonly less than 10 m deep. Groundwater in both the alluvium and the Gatton Sandstone fluctuates, with characteristically shallow groundwater levels, commonly less than 5 m deep during and following periods of prolonged wet conditions as observed in 2013.

The culmination of prolonged wet climatic conditions and the corresponding reduction in groundwater abstraction from the shallow alluvial aquifer can lead to groundwater levels rising close to ground surface. Groundwater is also present at greater depths in the underlying Woogaroo subgroup strata including the Helidon Sandstone, particularly at the northern fringes of the Lockyer Valley.

Leakage from the pipeline to surrounding sediments has the potential to surcharge groundwater levels locally, although the magnitude of leakage losses from the pipeline on the project scale is expected to be negligible.

Excavation required for the installation and burial of the pipeline is considered unlikely to intersect the water table, although excavations may extend into the capillary zone above the water table, which is particularly characterised by fine-grained sediments. In these circumstances trench stability may be marginally compromised. However, given that the construction methodology indicates that trenching will typically extend to less than 3 m deep, groundwater level impacts are not anticipated along the pipeline alignment.

Groundwater levels within the alluvium are strongly influenced by groundwater extraction and the groundwater level is typically beneath the base level of pipeline trenching. However, in some circumstances where the pipeline runs oblique to surface contours trenching may intersect groundwater. In such circumstances, granular trench fill has the potential to act as a pathway for shallow groundwater drainage. This may affect groundwater levels locally and has the potential to create instability in the pipeline backfill. Where these conditions are identified it may be necessary to introduce low permeability fill barriers to groundwater flow at intervals along the affected section of pipeline.

Excavation for the foundations of the Wivenhoe Dam pumping station, Atkinson Dam pumping station and Clarendon Dam pumping station may extend to greater depth than the majority of the pipeline trenching. In these circumstances, and given that each of these pumping stations is situated beside manmade surface water storage, surcharging of groundwater levels in the alluvium local to the water storages could be expected. Minor temporary groundwater control may be required to manage groundwater seepages or flow ingress.

Groundwater in the vicinity of the Western Boost pumping station is expected to lie at approximately 10–11 m in depth currently, although since 1985, groundwater levels at this site have varied between 6 and 12 m in depth. Groundwater in the vicinity of the Lake Dyer Boost pumping station is expected to lie approximately 16 m deep currently, although since 1988, groundwater levels at this site have varied between 7 and 21 m in depth. Hence, following prolonged wet conditions, shallower groundwater levels may be expected and temporary control measures may be required during construction.

12.7.3.3 Groundwater quality

Groundwater quality within the alluvial sources is highly variable depending on depth, land use and proximity to surface water sources. Nutrient enrichment is evident in many cases with elevated concentrations of nitrate in groundwater. Groundwater within the bedrock is understood to exhibit higher levels of salinity, particularly in the Gatton Sandstone. Water chemistry of groundwater within both units is dominated by sodium and chlorine.

Groundwater quality in the vicinity of the Western Boost pumping station is understood to exhibit moderate salinity (4000–6000 μS/cm), which may require prophylactic measures from attack by aggressive groundwater for ferrous materials and concrete. Data is not available for the immediate vicinity of Lake Dyer Boost pumping station or the source pumping stations, but tests should be conducted where foundations are likely to intersect groundwater.

12.7.3.4 Groundwater users

There are over 7,000 registered bores within the Lockyer Valley. Of the over 2,800 registered bores within a 100 m radial buffer of the proposed pipeline alignment, approximately 2,300 bores remain in use for water supply or monitoring purposes. Groundwater is used for drinking water, irrigation, farm supply and stock watering.

The *Environmental Protection (Water & Wetland Biodiversity) Policy 2019* identifies the environmental values of groundwater for the Lockyer Creek catchment as aquatic ecosystems, irrigation, farm supply, stock watering and drinking water. Water quality objectives (Figure 12.30) have been derived for the alluvial and bedrock formation aquifers of the Lockyer Valley and these are not expected to be compromised by the operation of the pipeline. Consideration should be given to management measures to prevent groundwater contamination during pipeline construction.

Figure 12.30: Water quality objectives

	%iles	Flagstone Ck alluvium	Gatton Ck alluvium	Helidon SST east	Helidon SST west	Laidley Ck alluvium	Lockyer Ck alluvium	Ma ma Ck alluvium	Redbank Ck alluvium	Sandy Ck alluvium	Tenthill Ck alluvium
Conductivity (µS/cm)	20th	1950	1050	1090	250	760	1050	3500	270	1120	1350
	80th	4000	1200	5300	1020	4670	3400	9400	820	6450	2970
pH	20th	7.6	7.7	7.1	6.2	7.7	7.7	7.3	6.7	7.5	7.6
	80th	8.0	8.2	8.1	7.8	8.2	8.2	7.8	7.9	8.2	8.1
SIO_2	20th	20	30	10	10	30	30	30	20	30	30
	80th	30	40	20	50	40	50	40	23	40	40
Total ions	20th	1240	740	600	160	600	730	2190	160	680	870
	80th	2360	860	4740	740	2740	2160	5470	433	3700	1770
Total solids	20th	1050	580	600	160	450	610	2040	140	560	740
	80th	2170	670	3280	620	2600	1880	5330	420	3560	1610
Na	20th	150	70	360	30	50	70	310	30	80	80
	80th	250	90	1300	150	320	360	940	70	670	170
K	20th	2.9	0.7	8.2	2.6	0.8	1.5	4.0	3.6	1.3	1.7
	80th	4.4	1.4	43.3	12.0	2.6	3.8	9.8	5.4	3.5	3.0
Ca	20th	90	50	10	5	40	40	140	10	70	70
	80th	200	70	70	50	170	130	420	40	250	150
Mg	20th	110	60	7	5	40	45	170	5	50	70
	80th	240	70	80	20	210	160	470	30	300	180
Fe	20th	<0.01	0.01	0.01	0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01
	80th	0.04	0.06	1.74	0.02	0.03	0.04	0.18	6.30	0.04	0.04
HCO_3	20th	410	390	140	40	320	320	370	40	300	310
	80th	530	470	1970	360	540	650	590	85	510	450
Cl	20th	420	140	140	40	70	150	920	60	220	230
	80th	1150	170	1040	180	1370	850	3010	200	1960	730
NO_3	20th	1.0	<0.1	0.1	0.5	0.2	0.5	5.8	2.5	0.3	3.7
	80th	19.7	4.8	5.0	0.7	7.7	24.5	67.0	15.8	15.2	20.2
SO_4	20th	35	10	5	5	5	10	80	1	5	40
	80th	60	20	40	10	40	50	320	10	270	80
RAH (meq/L)	20th	-22.9	-1.9	-0.3	-2.5	-21.5	-13.4	-48.7	-3.4	-31.5	-15.5
	80th	-5.4	-0.7	2.0	22.1	0.2	0.7	-13.8	0.1	-1.8	-4.2
SAR	20th	2.2	1.5	1.8	9.0	1.3	1.5	3.5	1.6	1.8	<0.1
	80th	3.1	1.9	5.0	39.6	4.5	6.4	8.2	3.1	8.5	2.0
Hardness	20th	570	330	30	70	250	290	930	50	310	440
	80th	1340	410	200	420	1170	860	2580	210	1550	970

Whilst pipeline operation is unlikely to significantly affect existing users, ground disturbance, including excavation and vibration associated with pipeline construction, has the potential to affect the integrity of surface seals to bore headworks. The use of specialist coatings and sealants on the pipeline has the potential to leach into groundwater. Leakage or spills of hydrocarbons or other construction-related substances also have the potential to seep or leach into groundwater.

12.7.3.5 Groundwater-dependent ecosystems

The vegetation species and regional soil/geology types suggest that the level of groundwater dependence is likely to be relatively low, with the water needs of vegetation likely to be satisfied by moisture retained in soil. Furthermore, the contribution of groundwater to baseflow (groundwater discharge to surface water) does not represent a significant proportion of river flow and is unlikely to contribute significantly to environmental water requirements for vegetation.

Under this proposal, water availability to any potential groundwater-dependent ecosystems is unlikely to change and therefore impacts are not anticipated.

12.7.3.6 Mitigation and management measures

In order to monitor the groundwater impacts in response to construction of the pipelines and pumping stations that have a low likelihood of occurring, the following mitigation and management measures should be considered to minimise risk to groundwater users and the environment:

- A bore census should be conducted to confirm the precise location and operational status of registered and unregistered bores near the proposed route, and measures should be taken to maintain an appropriate offset from existing assets to minimise the risks of ground disturbance affecting those assets. Consideration should be given to the selection of pipeline coatings and sealants and the application or use of other chemicals associated with pipeline construction to ensure their suitability for use in proximity to potable water sources.
- Existing groundwater monitoring assets should be selected for water level and water quality monitoring in proximity to the routes.
- A detailed analysis of existing baseline data should be undertaken to confirm current groundwater levels along the routes.
- The project design should maintain a minimum standoff between existing groundwater assets and the pipelines.
- Construction practices that minimise ground vibration and soil disturbance should be adopted.
- Excavation beneath the water table should be minimised.
- Low permeability backfill barriers to groundwater flow should be included at intervals along affected sections of pipeline.
- Construction materials that are suitable for potable water use should be selected.
- Materials that are suitable for use in mildly aggressive groundwater environments should be selected.

Figure 12.31: Groundwater bores 1 of 4

Figure 12.32: Groundwater bores 2 of 4

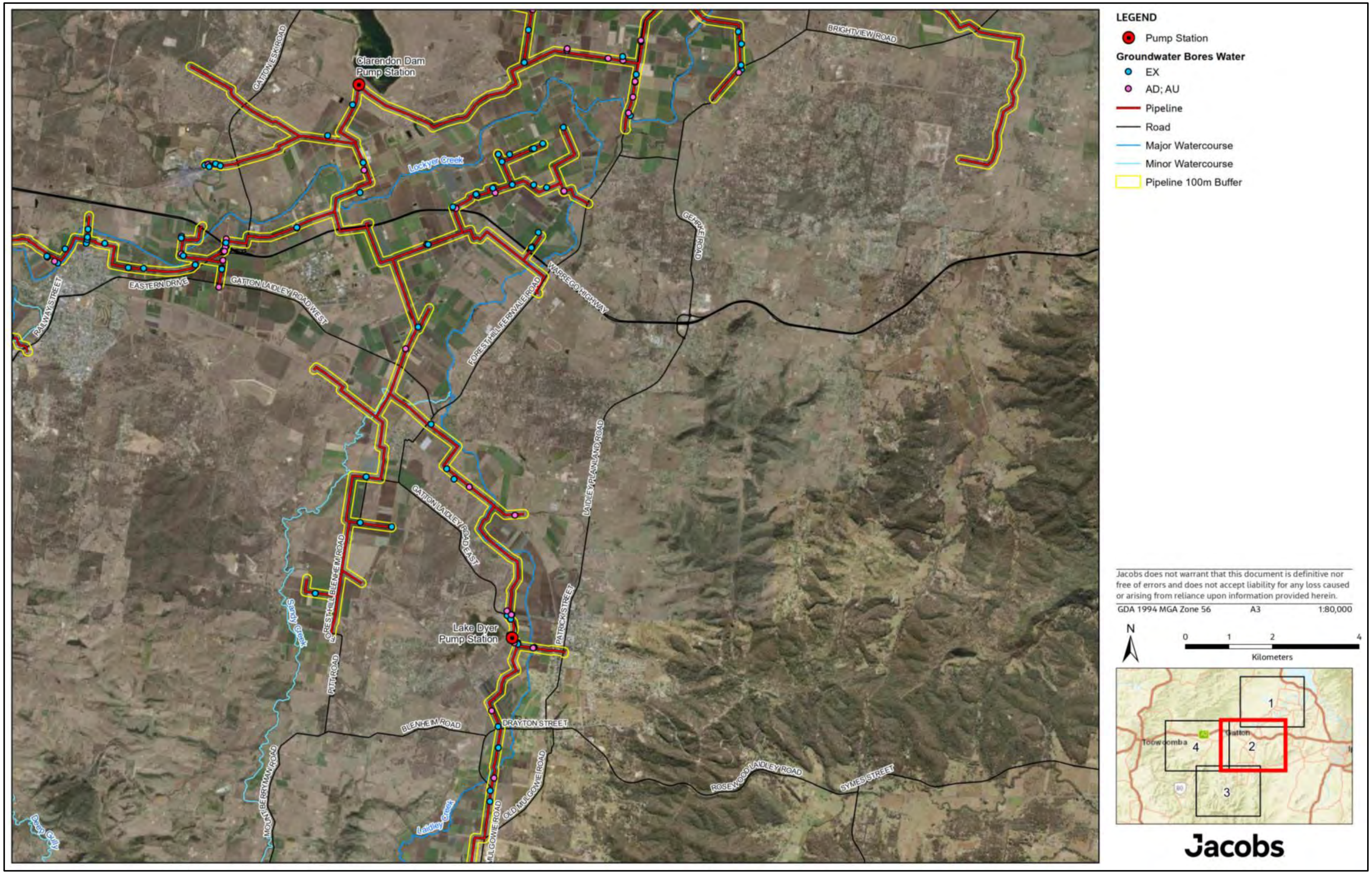


Figure 12.33: Groundwater bores 3 of 4

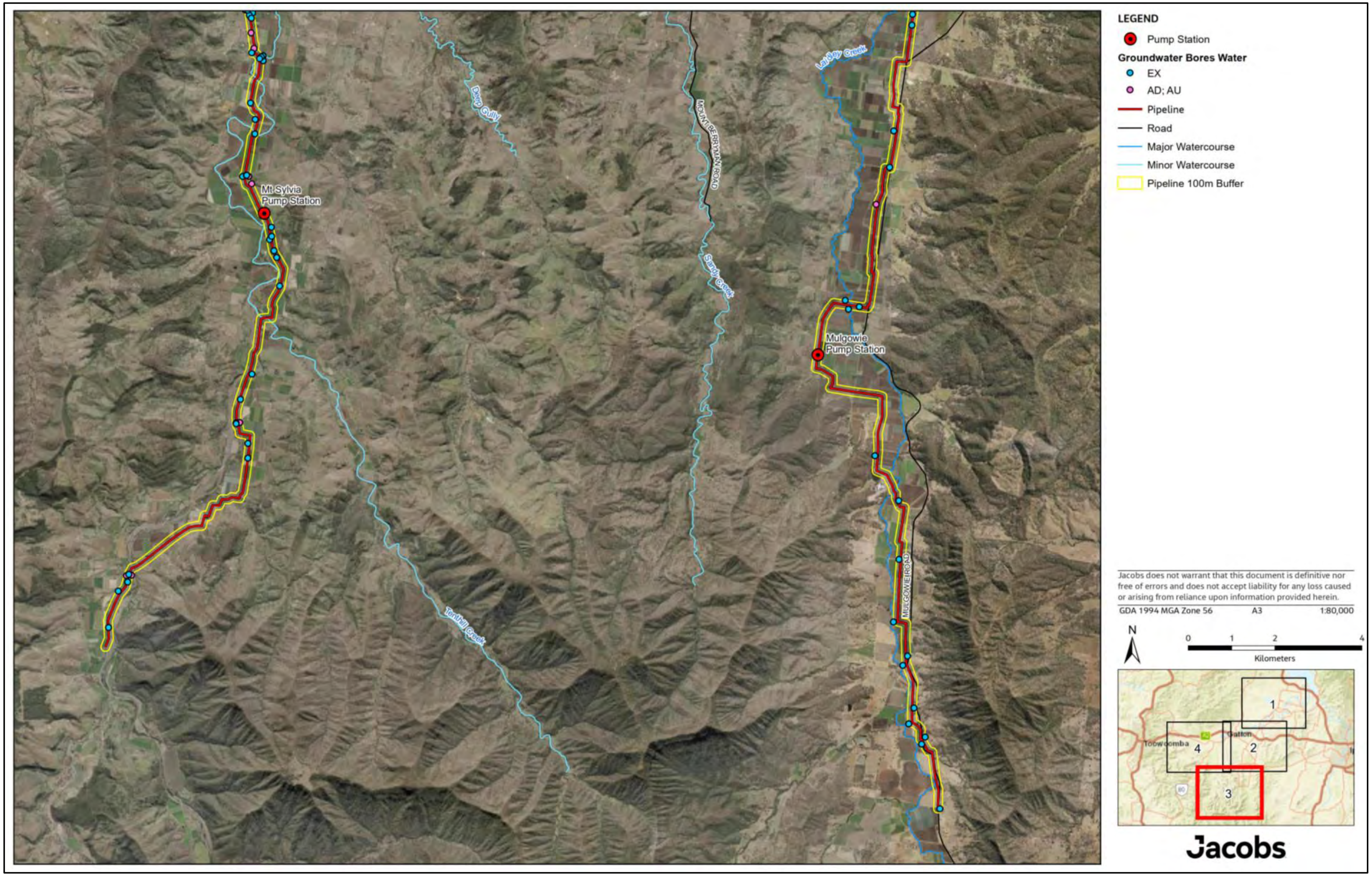
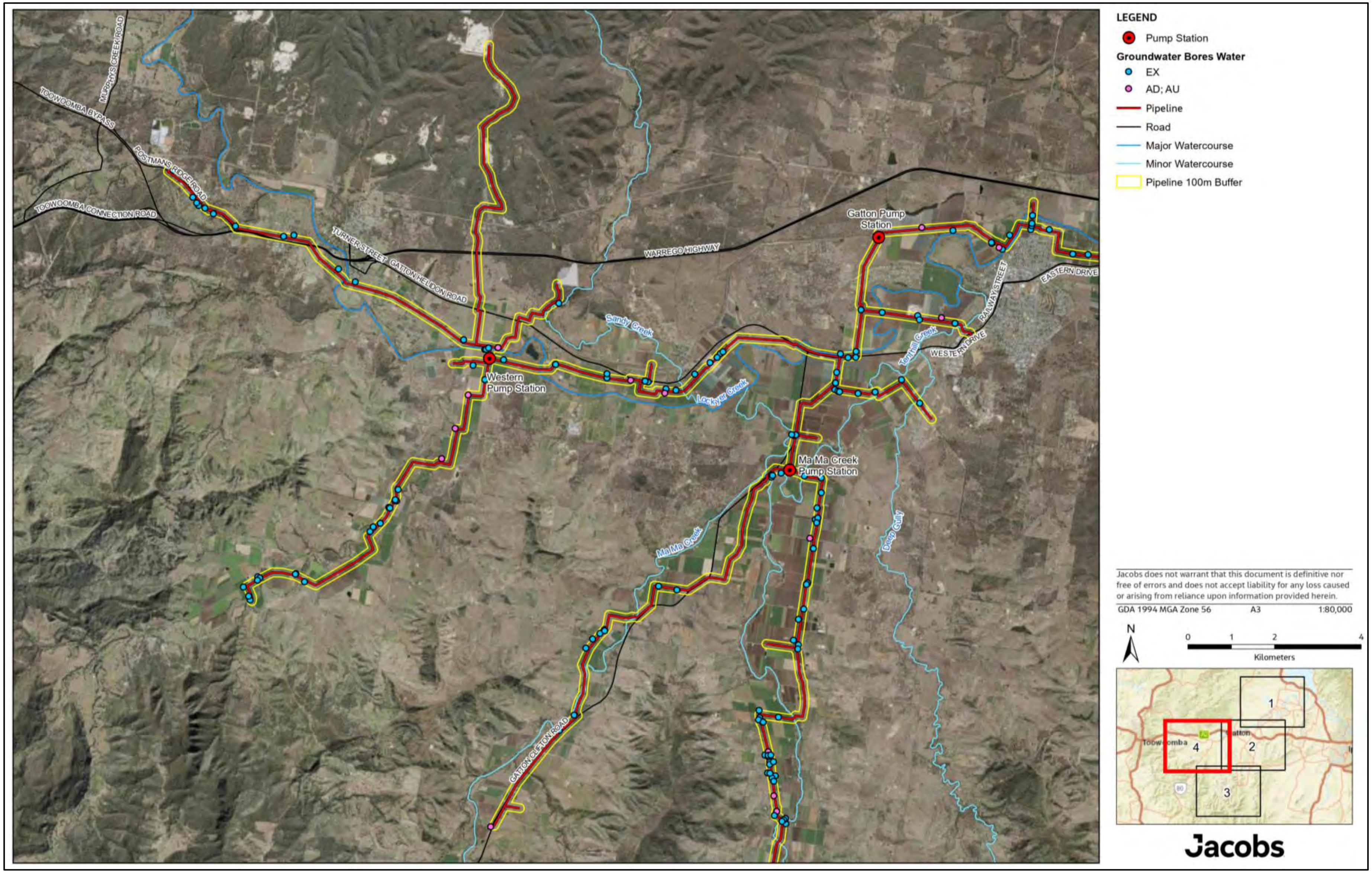


Figure 12.34: Groundwater bores 4 of 4



12.7.3.7 Surface water

A desktop review of surface water quality, undertaken in August 2020, was informed by:

- relevant legislation including the *Environmental Protection Act 1994* and *Environmental Protection (Water) Policy 2009*
- the Queensland Treasury DAMS interactive mapping system and State Planning Policy interactive mapping system
- the Healthy Land and Water Report Card for the Lockyer catchment
- *International Erosion Control Association Best Practice Erosion and Sediment Control*, published by the International Erosion Control Association (IECA) Australasia
- the extraction of data relating to the location of watercourses and other water features from the Queensland Government Open Data Portal into a project-specific Esri interactive webmap.

12.7.3.7.1 Existing environment

The Healthy Land and Water Report Card from the Ecosystem Health Monitoring Program (EHMP) has assigned a D+ to D rating for the freshwater conditions within the Lockyer Creek catchment, for the years spanning 2015 to 2019.

A rating of D indicates poor water quality where 'conditions meet few of the guideline in most reporting areas. Many key processes are not functional and most critical habitats are impacted'. The waterway benefit rating, which takes into account social and economic benefits, has been assigned as 'high' for 2019.

12.7.3.7.2 Surface water quality objectives

The Environmental Protection Policy 2009 for Water (EPP Water) defines the water environmental values (EVs) to be enhanced or protected and outlines the indicators and water quality guidelines to be utilised for protecting those values.

Water quality objectives (WQOs) for specific catchments are listed within Schedule 1 of the EPP Water. The Lockyer Creek catchment is part of Basin No 143, and the EVs and WQOs can be found in the document *Lockyer Creek environmental values and water quality objectives,* published by the Department of Environment and Resource Management (DERM) (July 2010).

12.7.3.8 Potential surface water quality impacts

All potential water quality impacts associated with the pipeline alignment are expected to be associated with the construction phase only and are therefore considered to be short-term.

Potential impacts include:

- discharge of sediments (both air- and water-borne) from exposed ground resulting in localised adverse impacts on receiving environment surface water quality
- possible introduction of pollutants associated with spills/leaks from temporary chemical (e.g. fuel and oil) storage areas into surface water bodies resulting in localised adverse impacts on receiving environment surface water quality
- discharge of stormwater from the project resulting in localised adverse impacts on receiving environment surface water quality
- discharge of stormwater from the project resulting in localised adverse impacts on receiving environment surface water geomorphology and aquatic habitat (e.g. stream bank erosion and scouring from concentrated discharge of stormwater)
- use of local surface water for construction purposes, including recycled or reclaimed water for building or dust suppression that results in runoff

- disposal of hydrostatic test water.

No impact is expected outside of normal maintenance activities during the operational phase.

12.7.3.9 Management measures

All construction activities will be conducted in accordance with best practice guidance and requirements including the following:

- the Australian Pipelines and Gas Association *Code of Environmental Practice (Onshore Pipelines)*
- the International Erosion Control Association *Best Practice Erosion & Sediment Control*
- the Queensland Government Department of Agriculture and Fisheries *Accepted Development Requirements for Operational Work that is Constructing or Raising Waterway Barrier Works* (effective from October 2018).

Further, as the project progresses the following project-specific documents should be developed to identify project impacts and set out measures to protect environmental values:

- a detailed technical assessment of potential impacts on surface water quality
- an erosion and sediment control program and plan
- a construction management plan (CMP)
- an environmental management plan (EMP)
- a vegetation management plan (VMP).

Recommended measures to mitigate and manage impacts include the following:

- Where appropriate, prepare and implement a vegetation management plan containing information on no-go or exclusion zones to minimise disturbance and protect retained vegetation.
- Develop an erosion and sediment control plan in accordance with best practice standards for erosion and sediment control.
- Stockpile all necessary materials in predetermined and appropriate locations in accordance with the Erosion and Sediment Control Plan (ESCP) that minimises the chance of loss into the receiving environment during construction.
- Establish water quality objectives, with the implementation of monitoring and inspections procedures including water quality testing.
- Include appropriate controls in stormwater drainage to trap debris and direct sediment away from watercourses and waterways, to reduce impacts on water quality.
- Undertake dust suppression activities to reduce indirect nuisance impacts on surrounding environments.
- Investigate appropriate sources (bore water, municipal, etc.) of construction water as the project progresses; however, at this stage, it is not intended that construction water will be sourced from any watercourse.
- Prior to the commencement of hydrotesting activities, prepare a hydrostatic testing plan that outlines disposal options for the disposal of hydrostatic test water.

12.7.4 Hydrology and hydraulic investigation

A desktop review of hydrological values and potential hydraulic impacts associated with the project, undertaken in August 2020, was informed by:

- the Queensland Treasury DAMS interactive mapping system and State Planning Policy interactive mapping system
- the extraction of data relating to the location of watercourses and other water features from the Queensland Government Open Data Portal into a project-specific Esri interactive webmap.

12.7.4.1 Existing environment

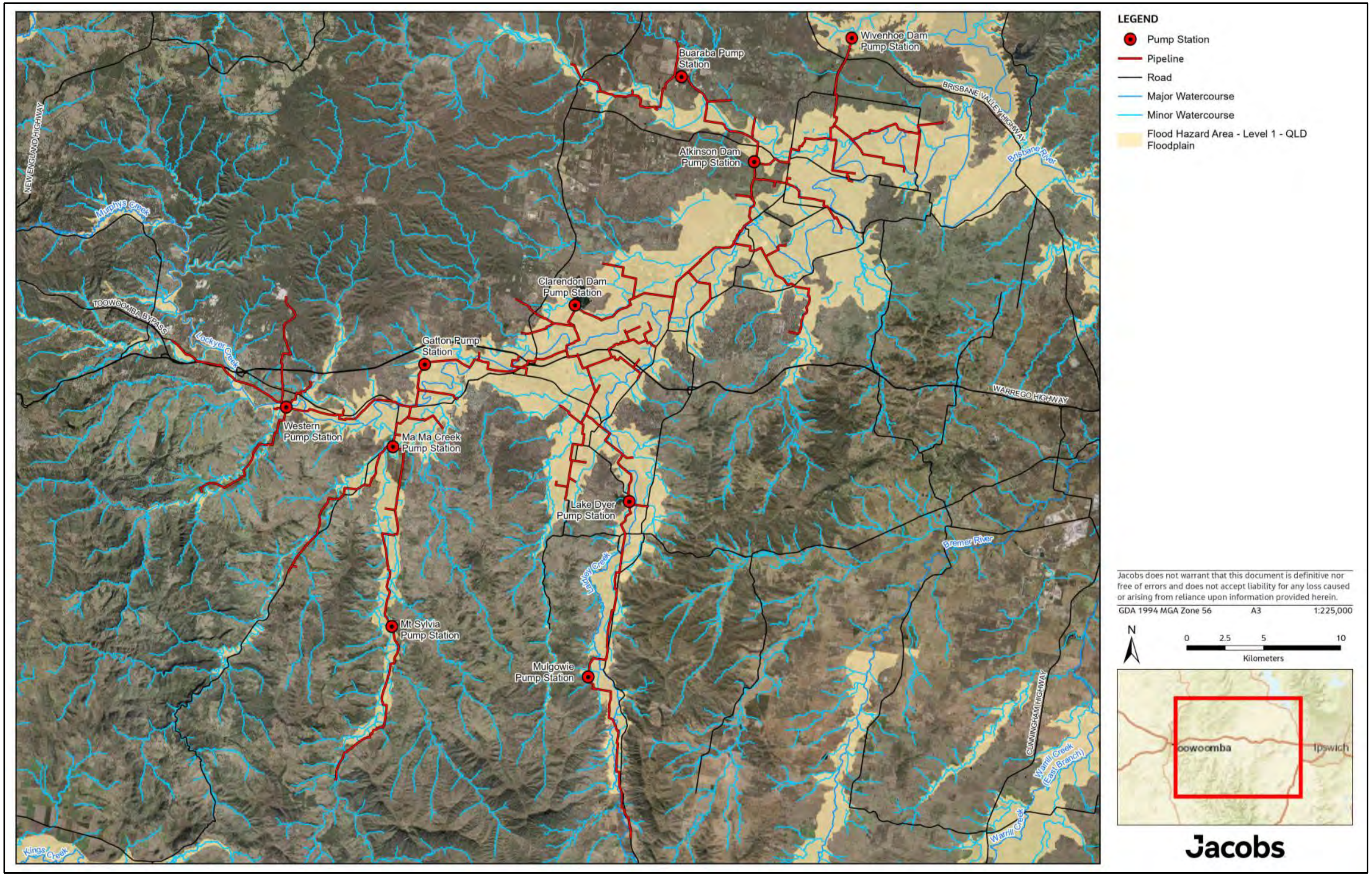
The pipeline alignment is located within the Brisbane Basin and traverses the Lockyer Creek catchment. The Lockyer Creek catchment has an area of approximately 3,000 square kilometres. On a sub-catchment scale, the pipeline alignment navigates through the Laidley Creek, Sandy Creek, Tenthill Creek, Ma Ma Creek and Flagstone Creek sub-catchments.

The tributaries of Lockyer Creek typically flow in a south–north direction before joining into Lockyer Creek and continuing eastward until discharging into the Brisbane River, downstream of Wivenhoe Dam. The minor creek catchments are generally steep and vegetated, with well-defined creeks and narrow floodplains. Consequently, the upper reaches of the catchment can experience high volumes of flow. The floodplains of the Lockyer Creek catchment are used for intensive agriculture, with approximately half the catchment cleared for farming, urban development and industrial land uses.

Several natural and artificial water bodies are located within the Lockyer Creek catchment. These include Wivenhoe Dam, Seven Mile Lagoon, One Mile Lagoon, Schlecht Lagoon, Lake Freeman, Lake Clarendon, Atkinsons Lagoon, Lake Dyer and Lake Apex.

The pipeline alignment lies within the Flood Hazard Area identified within the State Planning Policy Assessment Benchmark Mapping (Figure 12.35).

Figure 12.35: Flood hazard map



12.7.4.2 Watercourse and waterway crossings

The pipeline arrangement would cross a number of minor, unnamed, non-perennial watercourses, as well as major creeks. The named creek crossings that have been identified are:

- Lockyer Creek
- Rocky Creek
- Flagstone Creek
- Ma Ma Creek
- Tenthill Creek
- Deep Gully Creek
- Sandy Creek
- Laidley Creek
- Buaraba Creek.

12.7.4.3 Potential hydraulic impacts

The pipeline alignment traverses the Lockyer Creek catchment floodplain and numerous creek crossings. Most sections are located within the 1% AEP flood extent, which could result in adverse flooding impacts for portions of the pipeline network that may be constructed above-ground. Given that the current design of the pipeline is underground, with horizontal directional drilling proposed at all creek crossings it is expected that the pipeline itself would not result in adverse flood impacts on the floodplain.

During the construction phase of the project, the placement of excess spoil and construction materials may be impacted by flooding. Should these materials be stored in areas that are located within the Flood Hazard Zone, adverse impacts may be experienced on adjoining properties through the migration and deposition of these materials.

During the operational phase of the project, impacts are expected to be limited to flood-related impacts to spoil and construction materials that are disturbed during maintenance activities associated with the irrigation scheme.

12.7.4.4 Mitigation and management measures

Should the project progress, it is recommended that a detailed investigation of the flood impact of proposed spoil disposable locations be undertaken to identify safe storage areas for spoil and construction materials.

Recommended mitigation and management measures include, but are not limited to, the following:

- The design of the pipeline should consider placing the pipeline underground and utilising horizontal directional drilling at all creek crossings to minimise flood-related risks on adjoining properties.
- Excess spoil should be spread on high ground above the 1% AEP flood level to ensure that there is no increase in flood risk to adjacent properties on the floodplain.
- All necessary materials and fill should be stockpiled in predetermined and appropriate locations to minimise flood impacts during construction.

12.7.5 Climate and air quality

12.7.5.1 Climate

The climate section of the environmental assessment provides a description of existing climatic conditions in the project area and discuss the vulnerability of the project to these conditions. The impacts of climate change and detailed flood plain management are not covered in this section of the environmental assessment but are discussed in the Sustainability Assessment Chapter.

12.7.5.1.1 Approach/methodology

A high-level desktop assessment was undertaken to inform the preparation of the project's climate profile, which provides detail on the climate of the Lockyer Valley area and the key drivers of seasonal climate variability.

The following approach informed the preparation of the desktop climate assessment for the project:

- Climate data for this assessment was predominately sourced from Bureau of Meteorology (BoM) Meteorological Station 040082 (University of Queensland Gatton) [Meteorological Station 040082]. The station is located at 89 m above mean sea level and has records available from 1897 (rainfall) and1965 (temperature) until the present (BoM, 2020a). Data sourced from Meteorological Station 040082 includes daily rainfall, daily maximum temperature and daily minimum temperature. The station was determined to be the most suitably located station with long-term and complete meteorological records for rainfall and temperature; however, records for other climate variables were found to be incomplete.
- Climate factors, including mean 9 am wind speed, mean 3 pm wind speed, mean 9 am relative humidity and mean 3 pm relative humidity, were sourced from BoM Meteorological Station Toowoomba Airport (041529) [Meteorological Station 041529] (BoM, 2020b). Monthly climate statistics for wind speed and relative humidity are available from 1996 to 2010 from this station.

This data was used to undertake a high-level assessment of potential climate-related impacts to the design and delivery of the project and inform the identification of management and mitigation measures for these impacts.

12.7.5.1.2 Drivers of regional climate variability

Australia's climate is strongly influenced by year-to-year variations in sea surface temperatures and air pressure in oceans surrounding Australia as well as variations in atmospheric circulation. These variations contribute to recurring cycles of drought and flood and the significant inter-annual variability in climate.

Contrasting patterns of rainfall and air temperature in eastern Australia are associated with the El Niño and La Niña phases of the El Niño-Southern Oscillation (ENSO). Marked reductions in rainfall and higher air temperatures are associated with the El Niño phase of ENSO, whereas enhanced rainfall and cooler air temperatures are typically associated with La Niña events (Kiem and Franks (2001); Verdon et al. (2004)).

Wet conditions in the Lockyer Valley region can be driven by rain-bearing cloud bands and east coast lows during the cooler months of the year. Strong and gusty winds, sustained heavy rainfall and high seas are generally associated with east coast lows and have the ability to cause widespread damage over a very short period of time. Surface mean wind conditions are influenced by the annual cycle of the intensity and position of the sub-tropical ridge of high pressure.

A strong annual cycle of thunderstorm activity occurs throughout the east coast of Australia, with a maximum during the warmer months and a minimum during the cooler months (Dowdy and Kuleshov 2014).

12.7.5.1.3 Historic climate context

The monthly climate statistics for the project, as recorded by BoM Meteorological Station 040082 and Meteorological Station 041529, are presented in Table 12.7.

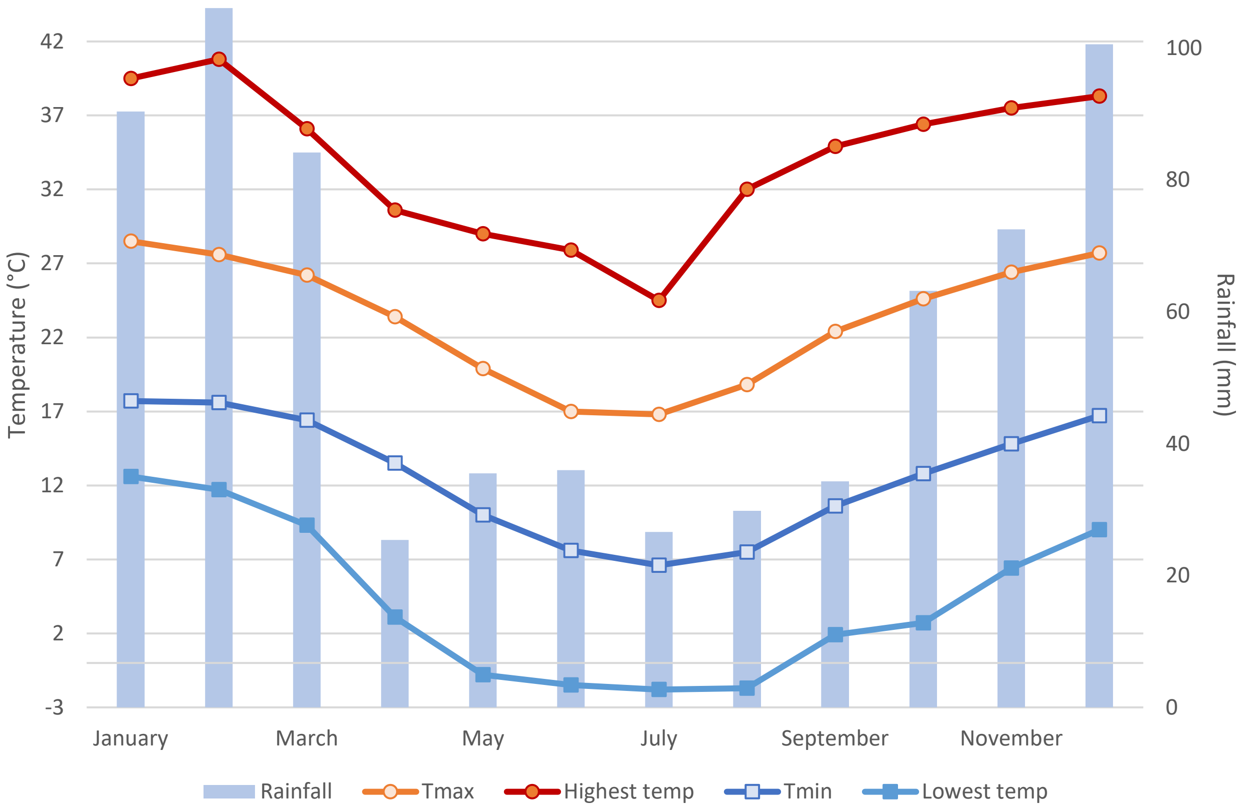
Table 12.7: Monthly climate statistics for the project area

Statistic element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean maximum temperature (°C) (1965–2020)	31.7	30.8	29.6	27.2	23.8	21.1	20.8	22.5	25.6	28.2	30.3	31.4
Mean minimum temperature (°C) (1965–2020)	19.1	19	17.3	13.7	10.2	7.6	6.2	6.7	9.5	13.2	16	18.1
Mean rainfall (mm) (1897–2020)	109.7	99.6	79.2	47.9	44.9	41.3	36	26.5	34.6	64.6	77.9	109.7
Mean number of days of rain ≥ 1 (mm) (1897–2020)	8.1	7.7	7.3	4.7	4.6	4	3.8	3.6	4	6.1	6.5	7.9
Mean 9 am relative humidity (%) (1996–2010)	71	75	73	70	71	76	72	65	62	62	66	67
Mean 3 pm relative humidity (%) (1996–2010)	51	56	52	50	51	54	50	42	40	40	48	49
Mean 9 am wind speed (km/h) (1996–2010)	24.0	23.6	24.6	22.5	19.8	19.7	18.4	20.8	21.1	21.8	21.8	21.9
Mean 3 pm wind speed (km/h) (1996–2010)	23.0	23.2	22.5	21.3	20.3	21.5	21.3	21.8	21.6	21.4	21.7	21.9

Source: BoM, 2020a; BoM, 2020b

The area experiences seasonal patterns in temperature, with warmer temperatures recorded during summer and spring, and cooler temperatures recorded at other times of year. Average daily maximum temperatures range between 20.8°C in July and 31.7°C in January. Temperatures exceeding 35°C have occurred in all months between September and April. Temperatures exceeding 40°C have occurred in all months between October and March. The hottest day on record was 12 February 2017, which reached 45.7°C. Average minimum temperatures range between 6.2°C in July and 19.1°C in January. The coldest temperature on record was -5.6°C, on 11 July 1972.

Figure 12.36: Temperature and rainfall at UQ Gatton



Annual rainfall variability reflects the influence of multi-year climate cycles, such as those associated with the ENSO and Interdecadal Pacific Oscillation. Average annual rainfall is 765.6 mm, with peaks in summer, spring and in March (Figure 12.36), which reflects that warmer air is able to hold more water.

The region experienced flash flooding in January 2011. Between 1 December 2010 and 23 January 2011, the region received between 600 mm and 1000 mm of rain, with most of this rainfall occurring between 9 and 13 January 2011 (BoM, 2011).

Mean relative humidity for the project ranges from a minimum of 40% in September and October to a maximum of 76% in June. Humidity varies throughout the day, with higher humidity recorded in the morning and humidity decreasing throughout the day. The area experiences relatively small fluctuations in seasonal and daily humidity. The greatest fluctuation for humidity between 9 am and 3 pm (daily humidity) occurs in September and October at 22%, and the lowest fluctuation occurs in November and December at 18% (Table 12.7).

The area experiences little change in strength and prevailing direction of daily wind (BoM 2020b). The mean annual wind speed at 9 am and 3 pm is 21.7 km/h and 21.8 km/h respectively. Monthly average wind speeds are lowest through late autumn and early winter and highest in late summer and early autumn. Maximum recorded wind gusts are between 24.6 km/h in March and 18.4 km/h in July.

12.7.5.1.4 Potential climate impacts

Climatic events such as flooding, drought, bushfire, heatwaves, storms and seasonal variations in weather are experienced in the project region and present potential stressors to the design, construction and future operation of the project.

Potential climate-related impacts for the project are presented in Table 12.8.

Table 12.8: Climate-related project risks

Climate factor	Potential impacts
Drought	▪ A reduced availability of water at the source during periods of drought disrupting the water service and leading to financial and adverse reputational risks ▪ Water shortages during the construction phase resulting in increased costs and logistics to obtain water ▪ Risk to increased down-time and maintenance costs due to the potential damage to pipes or other underground infrastructure under climate variations. Examples under drought conditions include: - dry soils and reduced groundwater levels, which can lead to long-term consolidation and settlement issues resulting in movement of and damage to pipes - pipes reaching their thermal tolerance limit – contingent to the surrounding soil types – during extended periods of drought. - potential for vegetation to damage pipes during extended periods of drought. During these drought periods tree roots will often search further down into the soil profile for water and therefore potentially cause damage to the infrastructure.
Flooding	▪ Flooding is likely to increase suspended solids and turbidity in the water during periods of flooding and heavy rainfall. This could result in: - potential impacts to the project's pumping systems, causing risk of repair costs and downtime on the project - escalation to a health risk for end users and produce, if the infrastructure filtration mechanisms cannot adequately meet changes to the quality of the water source. - direct pressure to pipes from flooding and soil deposition - shrink-swell changes in the underlying soil during wetting and drying cycle, which may cause pipes to shift, resulting in damage.
Bushfire	▪ Bushfires causing damage to pumping stations, resulting in a disruption to service and costs of maintenance or replacement of equipment ▪ A bushfire incident near the water source leading to ash particles contaminating the water, and filtration mechanisms not adequately meeting changes to the quality of the water source ▪ Damage to power substations and associated infrastructure resulting in disruption of auxiliary electricity supply with potential power outages and leading to a disruption to service
Storms	▪ Severe wind and lightning during storm events damaging pumping stations and resulting in down-time and maintenance costs ▪ Severe wind during storm events resulting in an increase in the scale and quantity of debris entering the water source and leading to blockages of pumping systems

12.7.5.1.5 Management measures

The following general risks relating to climate impacts should be considered during future stages of the project:

- the general climatic patterns that are relevant to the project area which may present risk to the design of the project, proposed construction methodologies and delivery timeframes
- the vulnerability of the area to natural hazards including floods, bushfires and cyclones. The relative frequency and magnitude of these events should be considered together with the risk they pose to the design, construction and future operation of the project.

All climate-related project risks should be catalogued in the overall project risk management framework.

Management and mitigation measures have been identified (Table 12.9) to reduce the potential for climate-related impacts to the project.

Table 12.9: Climate-related management and mitigation measures

Climate factor	Management/mitigation measures
Drought	▪ Consideration of the availability of water sources for construction during periods of drought and amendments to project timelines, where appropriate. ▪ Consideration of the availability of water at the source under periods of drought to ensure the supply can meet demand across the project's lifespan. ▪ Design of infrastructure to have lower inlets for pumping station to ensure the water can be accessed during times where water level and availability is reduced
Flooding	▪ A procedure for the monitoring of water quality should be implemented during operations to ensure it meets project infrastructure standards under periods of flooding (for example, suspended solids or potential contamination of water during flooding periods). ▪ Infrastructure is designed under 1% AEP flooding event where above-ground (e.g. pumping stations). ▪ Soils with shrink-swell potential are identified and considered in design. ▪ Regular inspection activities and review of management measures should be incorporated, including following weather events that approach or exceed design thresholds.
Bushfire	▪ The use of fire-resistant materials for pumping stations (e.g. concrete) should be considered. ▪ Pumping stations and associated access arrangements should be located away from vegetation. ▪ Water quality testing should be undertaken after bushfire events to avoid blocked irrigation and test for erosion and ash contamination. ▪ Solar power should be considered to provide backup power to pumping stations.
Storms	▪ Pumping stations should be designed to consider wind loading during storm events. ▪ A procedure for the inspection of filtration and pumping systems to clear potential blockages following storm events should be implemented.

12.8 Air quality

12.8.1 Existing context

The proposed location of the pipeline network is close to both urban and rural areas. Existing land uses in the vicinity of the pipeline include irrigated agriculture and livestock grazing in less built-up areas, with a range of rural residential, low-density residential and service-based land uses in the vicinity of local townships such as Gatton and Laidley.

The project area includes a major arterial road, the Warrego Highway, as well as several high-trafficked roads including Gatton-Laidley Road, Gatton-Clifton Road, Gatton-Helidon Road, Forest Hill Fernvale Road, Coominya Connection Road and Gatton-Esk Road. Further, the Main Line railway corridor, which connects Brisbane to Toowoomba, is located within the project area.

The existing air quality environment within the study area would be influenced by the following sources:

- dust emissions generated on local roads, particularly unsealed tracks
- dust emissions from cleared areas and agricultural activities, particularly in times of drought or low rainfall
- dust emissions from resource-based activities such as mining, quarries and associated haulage routes
- dust emissions and combustion emissions generated from rail traffic utilising the Main Line railway corridor
- combustion emissions generated from highways, freight routes and high-trafficked roads.

Given that the pipeline network is proposed to be located within and adjoining established urban areas within the Lockyer Valley, a range of sensitive receptors are close to the proposed pipeline alignment. These sensitive receptors (Figure 12.37 to Figure 12.40) include aged care facilities, hospitals, childcare services, educational establishments and large residential catchments within urban areas.

Figure 12.37: Sensitive receptors 1 of 4

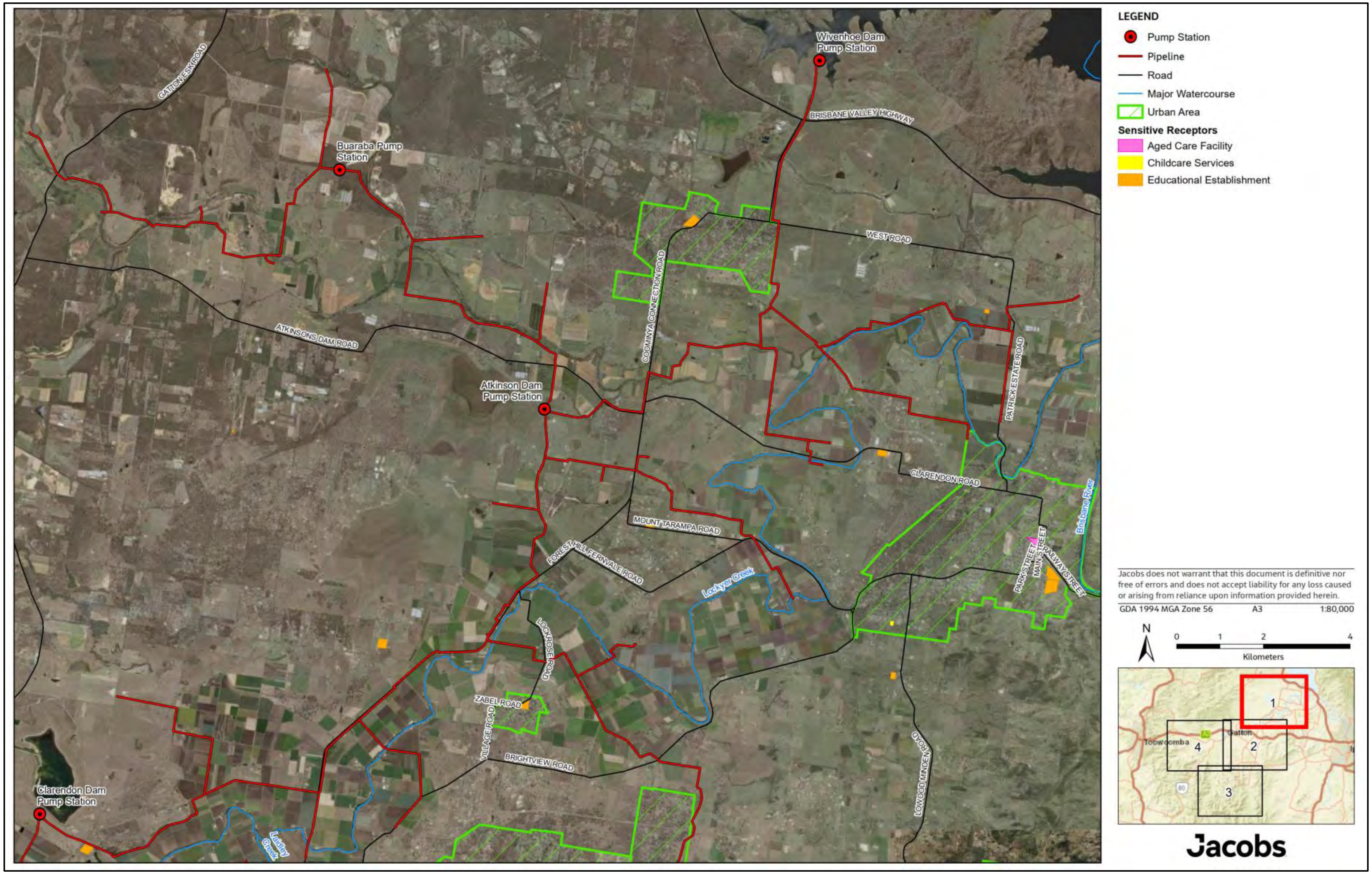


Figure 12.38: Sensitive receptors 2 of 4

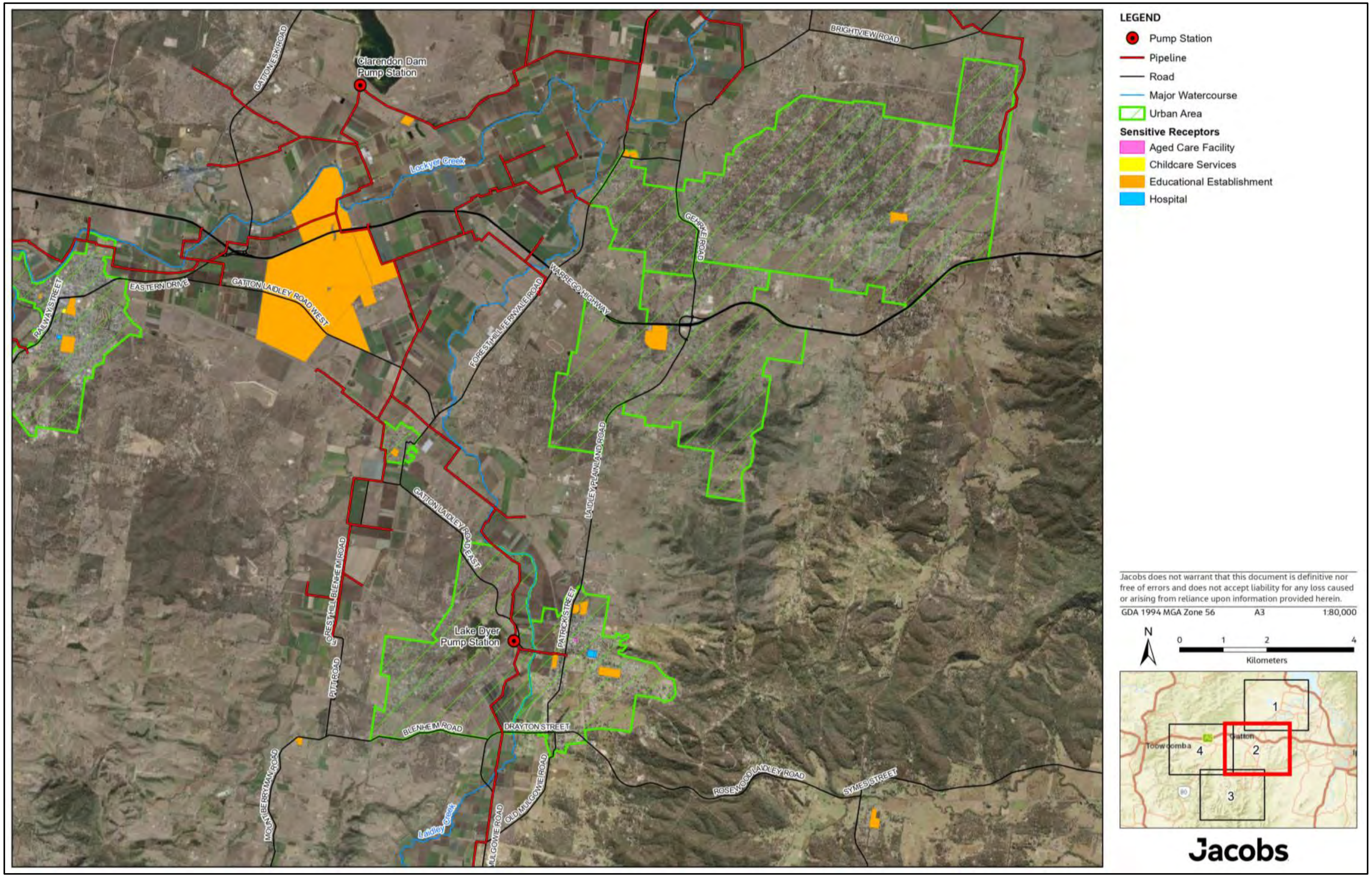


Figure 12.39: Sensitive receptors 3 of 4

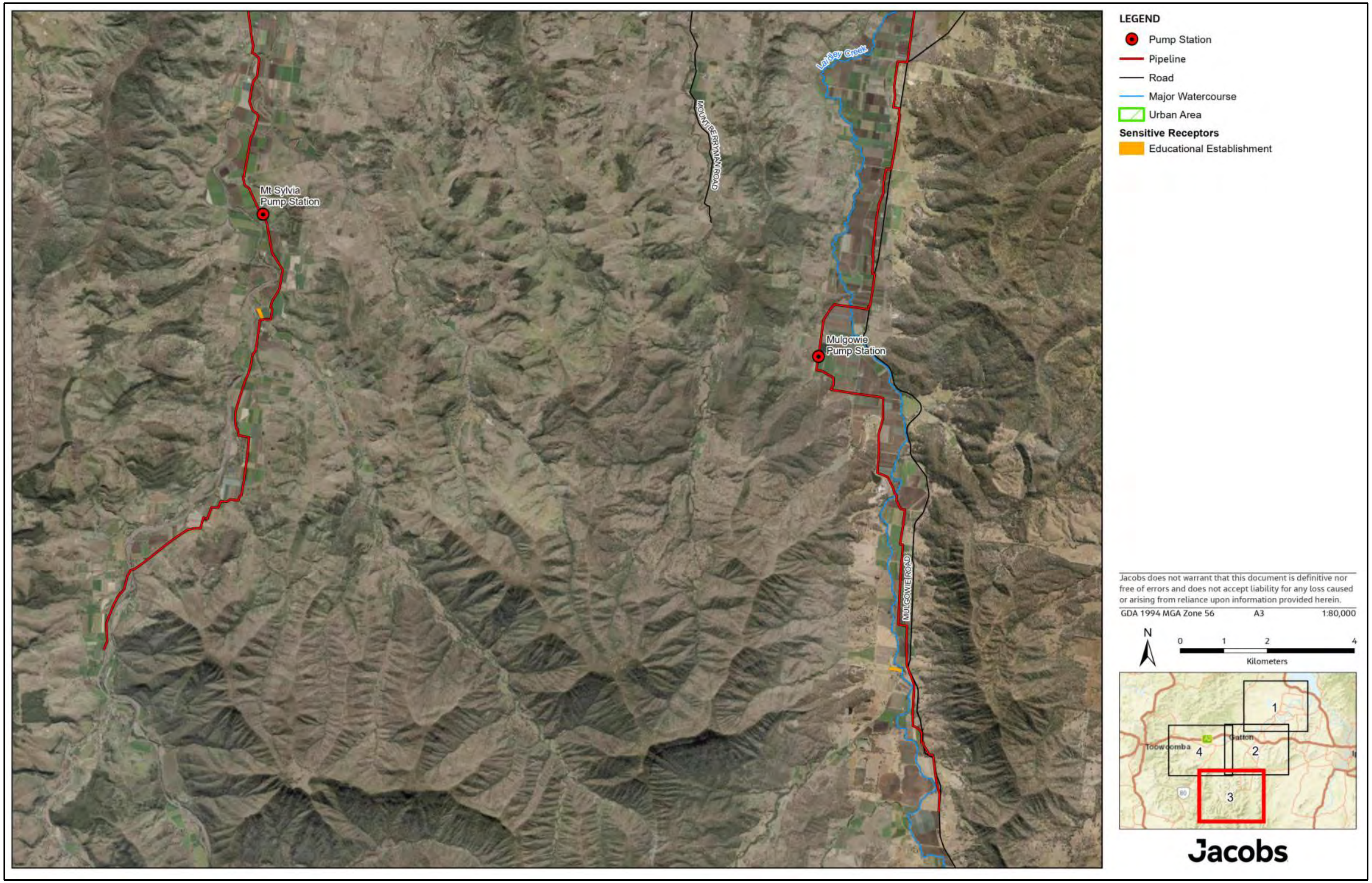
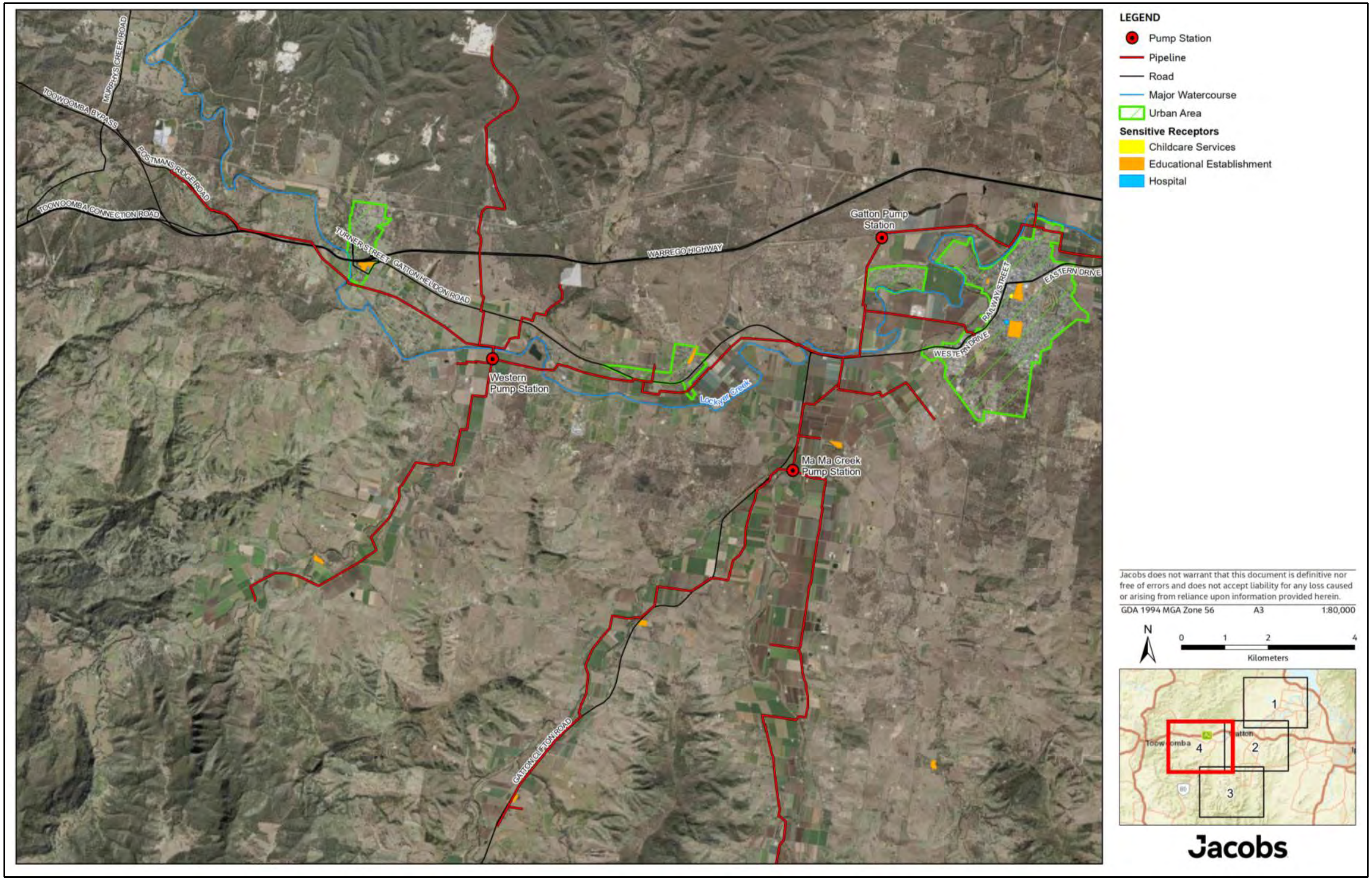


Figure 12.40: Sensitive receptors 4 of 4



12.8.1.1.1 Potential air quality impacts

During construction, air quality impacts are generally expected to be associated with construction activities for the pipeline infrastructure, pumping stations and construction haulage traffic. Given that the project is principally a linear water pipeline, air quality impacts would be transient as the work program (clearing works, trenching, pipelaying, etc.) progresses along the alignment.

Sources of air emissions from construction works associated with the project are likely to include earthworks (e.g. excavation, grubbing and clearing works), the stockpiling of materials, screening and crushing, construction works and vehicular traffic. Emissions that are likely to be generated as a result of construction activities include:

- dust (particulate matter) from activities relating to earthworks, screening, crushing and construction activities
- wind-blown dust from exposed areas, stockpiling areas and locations where vegetation has been cleared
- combustion emissions (nitrogen oxides and sulfur dioxide) and dust emissions generated from plant, equipment and vehicles.

The potential impacts of these construction activities and emissions are expected to be higher when in proximity to sensitive receptors, particularly in urban areas. Further, it is considered that air quality impacts during the operation of the proposed irrigation scheme would be minor and generally limited to maintenance activities.

It is expected that construction and maintenance air quality impacts can be managed through the implementation of a construction environment management plan that identifies appropriate management and mitigation measures to manage air quality impacts, including:

- consulting with potentially affected landowners prior to undertaking construction works
- minimising the disturbance footprint and vegetation clearing, where appropriate
- implementing dust suppression measures for roads and construction sites, such as watering haul roads regularly where necessary
- covering dust-generating materials and stockpiles
- clearing areas progressively and implementing rehabilitation as soon as practicable following construction activities
- selecting equipment with consideration for low air emissions, and high energy and fuel efficiency
- ensuring all plant, equipment and vehicles are maintained in accordance with the manufacturer's recommendations
- considering prevailing meteorological conditions when planning surface excavation activities
- retaining existing vegetation, where practical, between construction activities and sensitive receivers to reduce particulate concentrations and win erosion risk.

12.8.1.1.2 Further air quality investigations

An air quality assessment would be required as part of a detailed environmental assessment undertaken for an EIS or IAR. This air quality assessment should be undertaken in accordance with best practice guidance and should consider potential air quality impacts on sensitive receptors associated with construction activities, including earthworks, land clearing and construction traffic haulage, along with measures to manage or mitigate identified impacts. The findings of the air quality assessment should inform the measures and actions identified in the construction environment management plan for the project.

12.9 Climate change and emissions

The following emissions scopes have been used to assess greenhouse gas emissions against relevant project activities:

- **Scope 1** emissions directly result from the project activities and may include the combustion of fuels associated with vehicle and machinery use, the self-generation of power, construction activities and planned or unplanned releases of gas.
- **Scope 2** emissions result from the indirect generation of electricity, heating, cooling or steam by a third party that is supplied to the project. Scope 2 emissions include electricity purchased from the grid.
- **Scope 3** emissions are indirectly generated in the wider economy as a result of the project but are not generated by the project.

Both scope 1 and scope 2 emissions have been considered as part of this desktop assessment; however, scope 3 emissions are not considered. Scope 3 emissions typically relate to indirect emissions that are generated as a result of activities that may be a by-product of the proposed project (e.g. emissions generated by agricultural land uses benefitting from the proposed irrigation scheme), and accordingly were considered to be out of scope for this assessment.

12.9.1 Greenhouse gas emissions

Carbon dioxide (CO2) is a vital gas for photosynthesis and global climate regulation. Since CO2 and other 'greenhouse gases' trap long-wave radiation, changes in their concentrations in the atmosphere influence the earth's radiation balance and contribute to the warming of both the atmosphere and the earth's surface. This phenomenon is known as the greenhouse effect.

Atmospheric CO2 varies annually, reflecting seasonal photosynthetic activity, its release or uptake from the ocean and fires in forests and tropical savannahs. CO2 concentrations have varied between 180 and 300 parts per million (ppm) over the past 650,000 years prior to the industrial revolution; however, following this period, CO2 concentrations have risen to over 400 ppm.

The combined radiative forcing – the effect of greenhouse gases on global radiation balance – of greenhouse gases such as CO2, methane and nitrous oxide increased almost fourfold between 1950 and 2011 from 0.6 to 2.3 watt per square metre (W/m^2) irradiance, including an increase of almost 50% from 2007. The warming effect of increased atmospheric greenhouse gas concentrations is considered to have contributed to the observed increase in global mean temperature of 0.7°C from 1880 (IPCC, 2013).

12.9.2 Potential impacts

The project involves the provision of water to agricultural land uses within the region. Generally, by extending the water network within the Lockyer Valley region, the project is expected to have a positive impact on greenhouse gas emissions by reducing the reliance of agricultural land uses on alternative sources of water. Typically, these alternative sources can involve the energy-intensive trucking of water to site from long distances, generating significant emissions.

During construction, scope 1 greenhouse gas emissions are expected to be produced during the clearing of vegetation, earthworks and otherwise through the use of construction plant, equipment and vehicles.

During the operational phase of the project, greenhouse gas emissions are expected to include:

- scope 1 emissions produced during maintenance activities for project infrastructure, including the use of vehicles, construction machinery and equipment
- scope 2 emissions produced through the use of electricity to power the pumping stations in the absence of solar power.

12.9.3 Management and mitigation measures

Future stages of the project should assess the project's contribution to greenhouse gas emissions during construction and operation, including:

- considering preferred and alternative measures to avoid and/or minimise greenhouse gas emissions directly resulting from activities of the proposed project, including such activities as transportation of products used during construction, and energy use by the proposed project
- assessing how the preferred alternative measures will minimise emissions and achieve energy efficiency
- comparing the preferred alternative measures for emission reductions and energy consumption against 'business as usual' measures.

Specific mitigation and management measures relating to the construction and operation of the project to reduce greenhouse gas emissions include:

- minimising the disturbance footprint and vegetation clearing required for the proposed pipeline network and pumping stations. Project-related infrastructure should be located within road reserves and areas subject to prior clearing as a priority, where practicable.
- where necessary, undertaking clearing progressively and revegetating cleared areas as soon as practicable following the completion of construction activities
- optimising the use of construction equipment and vehicles through regular maintenance in accordance with manufacturer's recommendations to ensure that they are running as efficiently as possible
- minimising fuel consumption in vehicles through the consideration of transport logistics
- sourcing construction materials from local suppliers, thereby reducing the carbon intensity associated with the transport of materials for construction activities
- designing the proposed pipeline to incorporate gravity-fed pipeline design features, reducing the need for energy intensive pumping activities
- using solar power and other forms of renewable energy on pumping stations where possible.

12.10 Flora and fauna

This high-level assessment of flora and fauna aims to:

- characterise existing flora and fauna species and habitat types within the proposed project area
- confirm the potential for *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and/or *Nature Conservation Act 1994* (Qld) (NC Act) protected species or communities to occupy or use the site
- confirm if the project will require clearing of regulated vegetation or any endangered, vulnerable or near threatened (ENVT) species
- consider habitat connectivity both within the proposed project area and through linkages to adjacent or nearby habitat areas
- identify weeds and pest species potentially occurring within the project area and consider their management implications
- consider remnant vegetation management implications.

A desktop assessment was undertaken to identify and collate existing information on the known ecological values of the environment within the project area and surrounding landscape. Commonwealth, state and local government environmental mapping, legislation, associated triggers and databases were reviewed as part of the flora and fauna assessment for the detailed business case and are listed in Table 12.10. Where applicable, copies of these searches are provided as an appendix.

An Esri interactive webmap prepared for this project was used to view and query a range of spatial resources and create the relevant maps to support this assessment.

The flora and fauna assessment is based on desktop review only; no field verification or investigations have been undertaken.

Table 12.10: Desktop searches undertaken for the project area

Search tool	Administrative body	Search details
Protected Matters Search Tool	Commonwealth Department of Agriculture, Water and Energy (DAWE)	Search of project area using a polygon with the following coordinates with a 1 km buffer applied. A multi-coordinate grid search was used to accommodate the entire project area but avoid large tracts of nearby national park and conservation areas that are not necessarily representative of the project area.
Atlas of Living Australia (ALA)	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Spatial search of project area and surrounds.
Protected Plants Flora Survey Trigger Area Map	Queensland Department of Environment and Science (DES)	Search of project area with a 30 km radius applied to the approximate centre point of the project footprint (i.e. –27.576, 152.3599).
Wildlife Online and Biomaps	Queensland Department of Science, Information Technology and Innovation	Wildlife Online –search undertaken for project area with a 30 km radius applied to the approximate centre point of the project footprint (i.e. –27.576, 152.3599). Biomaps – spatial search of project area.
Regulated vegetation mapping	Queensland Department of Natural Resources Mines and Energy (DNRME)	Search undertaken for project area with a 30 km radius applied to the approximate centre point of (i.e. –27.576, 152.3599).
Map of referable wetlands; Spatial catalogue	Department of Environment and Science (DES)	Search via Queensland Globe and Queensland Spatial Catalogue. Dataset of mapping of water bodies and wetland regional ecosystems at 1:100,000 scale across Queensland, version 5.
Queensland Globe	Queensland Government	Viewed to identify a range of environmental matters including protected areas, waterways for waterway barrier works and watercourses.
South East Queensland Koala Conservation Strategy 2019–2024	Department of Environment and Science, 7 Feb 2020	http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={E4CCDBA7-11AB-45DD-A064-BDBC02899204}

12.10.1 General ecological context

The pipeline network is located within the South East Queensland bioregion within the Lockyer Catchment, west of Brisbane and east of Toowoomba. The South East Queensland bioregion comprises a mixture of non-remnant, remnant and riparian vegetation. The proposed pipeline alignment is located on predominantly flat disturbed areas previously cleared of vegetation and now primarily associated with irrigated cropping and grazing, with only intermittent native vegetation remaining.

Vegetation connectivity along the project alignment is limited – vegetation is fragmented due to agricultural practices. Remnant vegetation corridors which are present along the project alignment are mainly associated with either watercourses or road easements.

The proposed pipeline network does not intersect any national parks or conservation reserves. However, a 3 km portion of the pipeline to the north of Helidon is proposed to be located within the Lockyer Resources Reserve, which is a protected area situated immediately adjacent to the Lockyer Valley National Park.

12.11 Vegetation and flora

12.11.1 Matters of national environmental significance

The EPBC Act is the Australian governments' premier environmental legislation that protects MNES. The EPBC Act Protected Matters Search Tool (PMST) was used to generate a report for the site, to identify any MNES within the project area.

Properties and places

Within the study area there are no World Heritage properties or National Heritage places recorded. The study area is not impacted by the Great Barrier Reef Marine Park or a Commonwealth marine area. There is one wetland of international importance, Moreton Bay, which is located 40–50 km upstream of the project area.

Threatened ecological communities

Threatened ecological communities (TECs) are ecological communities that have been assigned to a particular category related to their conservation status (EVNT) at a national scale. TECs are protected under the EPBC Act.

The PMST identified seven TECs which are known, may, or are likely to occur, within 1 km of the proposed pipeline network and associated infrastructure (Table 12.11). Of these, three are listed as endangered and the remaining four are currently listed as critically endangered. Given that the remnant vegetation throughout the project area has predominately been cleared for agricultural or grazing purposes, the potential for TECs to be present within the project area, and more specifically along the pipeline alignments is considered to be minimal. Where vegetation does occur, much of this is likely to be substantially disturbed and fragmented and missing key attributes that would otherwise enable it to be classified as an intact TEC.

With the exception of regional ecosystem (RE)12.9–10.6, which potentially aligns with the Brigalow TEC, no other RE that is listed as aligning with the identified TECs within the project area was identified as being present in the project area on the DNRME regulated vegetation management mapping. Therefore, while it is not anticipated that the project will impact any of the mapped TECs, field verification of their potential presence will be required to verify this as part of a comprehensive environmental assessment to support an EIS or IAR.

Table 12.11: Threatened ecological communities within the project area

Threatened ecological community (TEC)	EPBC status	Presence
Brigalow (Acacia harpophylla dominant and co-dominant)	Endangered	Community known to occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically endangered	Community likely to occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern	Critically endangered	Community may occur within area

Threatened ecological community (TEC)	EPBC status	Presence
New South Wales and southern Queensland		
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community likely to occur within area
Swamp Tea-tree (Melaleuca irbyana) Forest of south-east Queensland	Critically endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically endangered	Community likely to occur within area

Source: DAWE EPBC Act PMST, August 2020)

12.11.2 Regional ecosystems and vegetation management

The regulated vegetation management mapping prepared by DNRME indicates that the wider project area comprises predominately category X (non-remnant) vegetation. There are small pockets that feature a mixture of remnant vegetation (category B), high value regrowth (category C) and watercourse regrowth (category R). However, very few of these mapped areas are currently traversed or intersected by the proposed pipeline network. These mapped areas should be ground-truthed to confirm their classification as part of the next stage of the project.

Descriptions of REs comprising the polygons of mapped remnant and regrowth vegetation within the project area, together with their status under the *Vegetation Management Act 1999* (VM Act) are provided in Table 12.12. Most of the mapped polygons are category X vegetation and are not expected to be impacted by the proposed pipeline network alignment. The DNRME vegetation mapping relative to the project area is provided in Figure 12.41 to Figure 12.44.

Figure 12.41: Regional ecosystem 1 of 4

Figure 12.42: Regional ecosystem 2 of 4

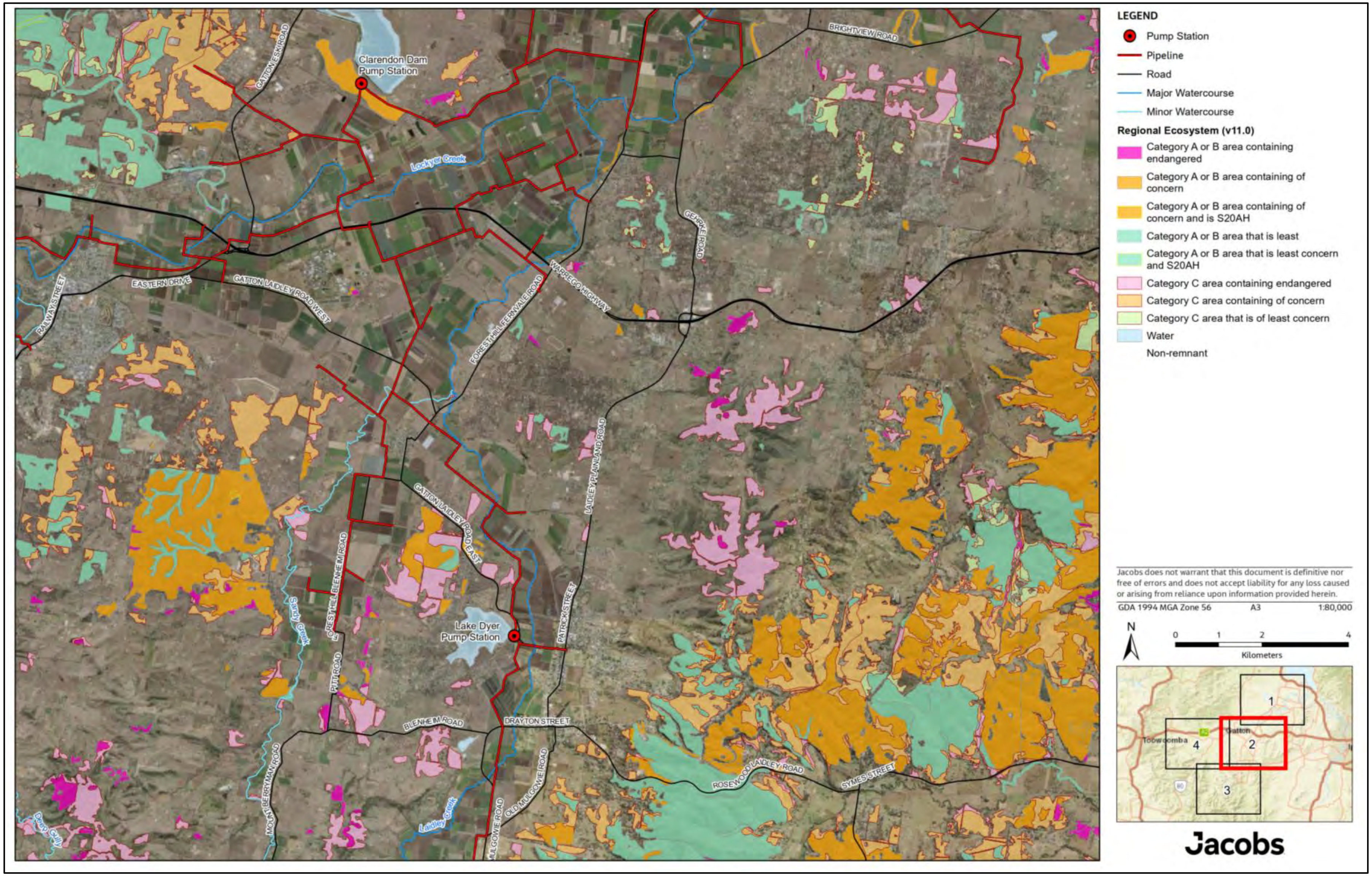


Figure 12.43: Regional ecosystem 3 of 4

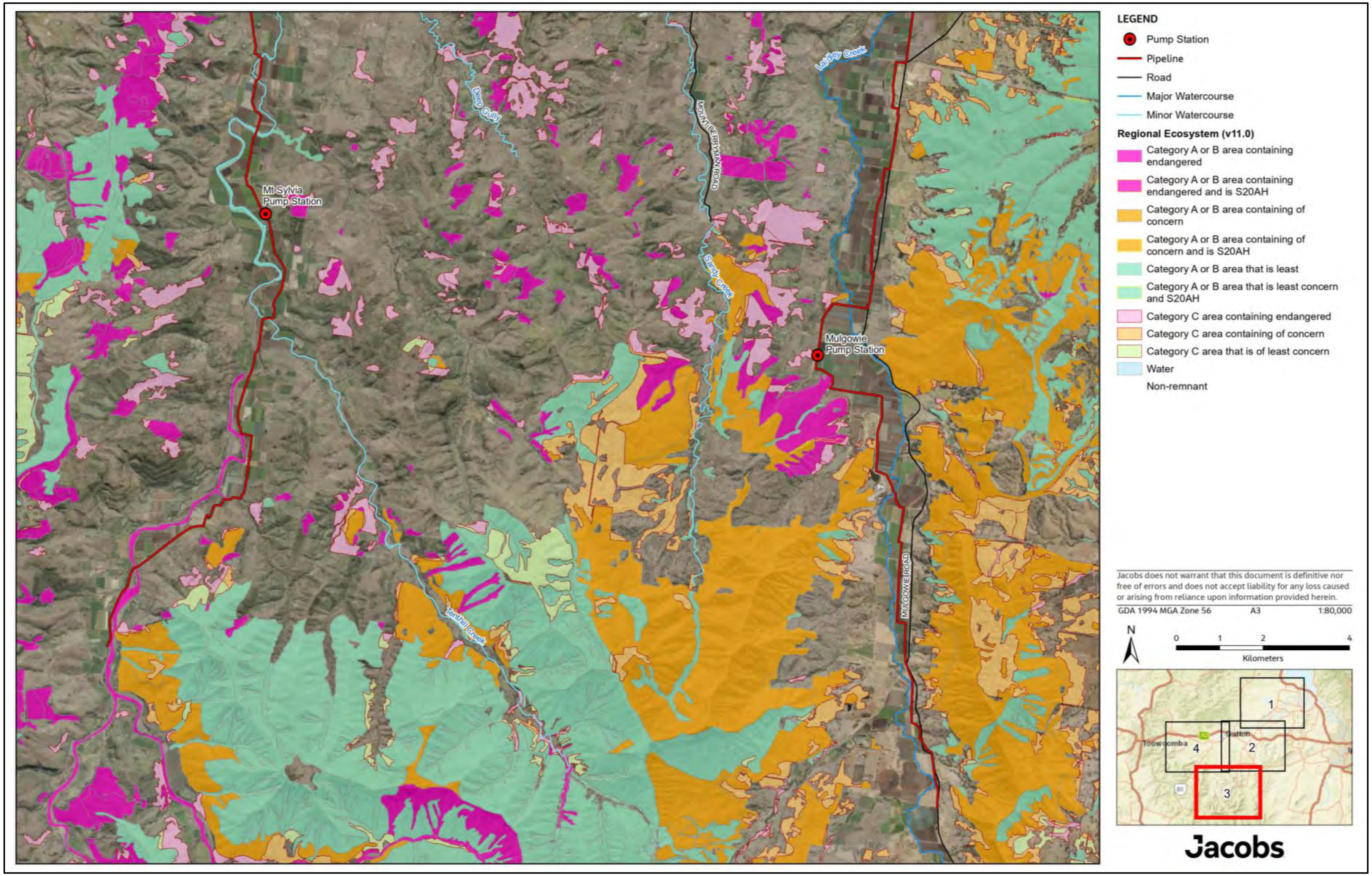
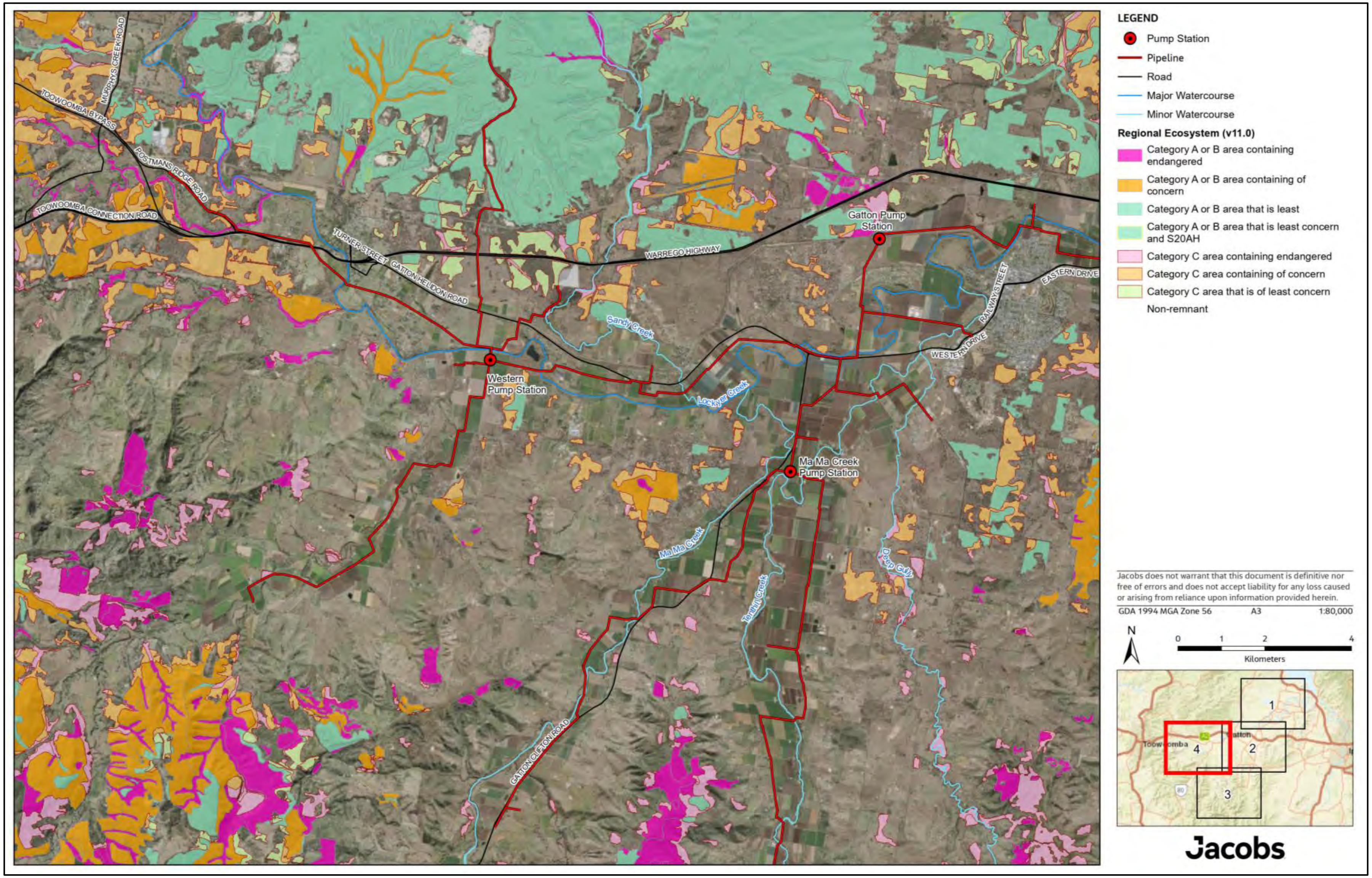


Figure 12.44: Regional ecosystem 4 of 4



Should the project proceed, an ecological assessment of the proposed pipeline alignments will be required. These assessments should include an investigation of the potential for these REs to be present within the project site and determine if there is likely to be any impact on these values as a result of the proposed development.

Table 12.12: Regional ecosystems mapped within project area

Regional ecosystem code	Categories present	VM Act status	Regional ecosystem description
12.3.3	Category C	Endangered	Eucalyptus tereticornis woodland. Eucalyptus crebra and E. moluccana are sometimes present and may be relatively abundant in places, especially on edges of plains and higher-level alluvium. Other species that may be present as scattered individuals or clumps include Angophora subvelutina or A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris, Lophostemon suaveolens and E. melanophloia. Occurs on Quaternary alluvial plains, terraces and fans where rainfall is usually less than 1000 mm per year.
12.3.7	Category B	Least concern	Narrow fringing woodland of Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca viminalis. Other species may include Melaleuca bracteata, M. trichostachya, M. linariifolia. Occurs on fringing levees and banks of rivers and drainage lines of alluvial plains throughout the region.
12.3.8	Category B	Of concern	Swamps with characteristic species including Cyperus spp., Schoenoplectus spp., Philydrum lanuginosum, Eleocharis spp., Leersia hexandra, Cycnogeton procerus, Nymphaea spp., Nymphoides indica, Persicaria spp., Phragmites australis, Typha spp. and a wide range of sedges grasses or forbs. Emergent Melaleuca spp. may sometimes occur. Occurs in freshwater swamps associated with floodplains.
12.9–10.2 / 12.9–10.7a	Category B	No concern / Of concern	12.9–10.2: Corymbia citriodora subsp. variegata open forest or woodland usually with Eucalyptus crebra. Other species such as Eucalyptus tereticornis, E. moluccana, E. acmenoides and E. siderophloia may be present in scattered patches or in low densities. Occurs on Cainozoic and Mesozoic sediments. 12.9–10.7a: Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks.
12.9-10.7	Category C Category R	Of concern	12.9-10.7 - Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks.
12.9–10.7 / 12.9–10.2 / 12.9–10.6	Category C	Of concern / No concern / Endangered	12.9–10.7: Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks. 12.9–10.2: Corymbia citriodora subsp. variegata open forest or woodland usually with Eucalyptus crebra. Other species such as Eucalyptus tereticornis, E. moluccana, E. acmenoides and E. siderophloia may be present in scattered patches or in low densities. Occurs on Cainozoic and Mesozoic sediments. 12.9–10.6: Acacia harpophylla open forest +/- Casuarina cristata and vine thicket species. Occurs on Cainozoic and Mesozoic sediments, especially fine-grained rocks.
12.3.7 / 12.3.3	Category A or B	Of concern/ Endangered	12.3.7: Narrow fringing woodland of Eucalyptus tereticornis, Casuarina cunninghamiana subsp. cunninghamiana +/- Melaleuca viminalis. Other species may include Melaleuca bracteata, M. trichostachya, M. linariifolia. Occurs on fringing levees and banks of rivers and drainage lines of alluvial plains throughout the region. 12.3.3: Eucalyptus tereticornis woodland. Eucalyptus crebra and E. moluccana are sometimes present and may be relatively abundant in

Regional ecosystem code	Categories present	VM Act status	Regional ecosystem description
			places, especially on edges of plains and higher-level alluvium. Other species that may be present as scattered individuals or clumps include Angophora subvelutina or A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris, Lophostemon suaveolens and E. melanophloia. Occurs on Quaternary alluvial plains, terraces and fans where rainfall is usually less than 1000 mm per year.

Source: DNRME, August 2020

12.11.3 Flora of conservation significance

A search of the EPBC Act PMST identified 30 listed threatened flora species with an EVNT status that have the potential to occur within the project area, or within a 1 km buffer of the project area. Of these, five species are listed as known to occur, 17 as likely to occur and eight as may occur within the study area. These species are further described in Table 12.13.

A Wildlife Online search of Queensland threatened species listed under the NC Act was undertaken. However, due to the vast size of the project area and the limitations on conducting searches for such a large project area, a large number of species were identified. Many of these species were not considered to be representative of the project area, given its predominantly cleared nature and limited remnant vegetation. It is noted that both Lockyer Resource Reserve and Lockyer Valley National Park was included in the search area, potentially skewing this data. A more in-depth analysis of the searches will be more relevant during the detailed design stage and when methodological design of fieldwork is being prepared.

An ecological assessment of the proposed pipeline alignments will be required and should include investigation of the potential for Commonwealth and Queensland listed species or their habitat to be present within the project area.

Table 12.13: EVNT threatened flora species likely or known to occur within the project area

Scientific name	Common name	EPBC Act status	Type of presence
Acacia grandifolia	NCN	V	Species or species habitat may occur within area
Arthraxon hispidus	Hairy-joint Grass	V	Species or species habitat likely to occur within area
Bertya opponens	NCN	V	Species or species habitat known to occur within area
Bosistoa transversa	Three-leaved Bosistoa	V	Species or species habitat likely to occur within area
Bothriochloa bunyensis	Satin-top grass	V	Species or species habitat likely to occur within area
Bulbophyllum globuliforme	Miniature Moss-orchid, Hoop Pine Orchid	V	Species or species habitat likely to occur within area
Cadellia pentastylis	Ooline	V	Species or species habitat likely occur within area
Clematis fawcettii	Stream Clematis	V	Species or species habitat likely occur within area
Cryptostylis hunteriana	Leafless Tongue-orchid	V	Species or species habitat may occur within area

Scientific name	Common name	EPBC Act status	Type of presence
Cupaniopsis shirleyana	Wedge-leaf Tuckeroo	V	Species or species habitat may occur within area
Dichanthium setosum	Bluegrass	V	Species or species habitat likely occur within area
Eucalyptus glaucina	Slaty Red Gum	V	Species or species habitat may occur within area
Fontainea venosa	NCN	V	Species or species habitat may occur within area
Grevillea quadricauda	NCN	V	Species or species habitat: known to occur within area
Haloragis exalata subsp. velutina	Tall Velvet Sea-berry	V	Species or species habitat may occur within area
Leionema obtusifolium	NCN	V	Species or species habitat known to occur within area
Lepidium peregrinum	Wandering Pepper-cress	E	Species or species habitat likely to occur within area
Macadamia integrifolia	Macadamia Nut	V	Species or species habitat likely to occur within area
Macadamia tetraphylla	Rough-shelled Bush Nut	V	Species or species habitat may occur within area
Notelaea ipsviciensis	Cooneana Olive	CE	Species or species habitat may occur within area
Notelaea lloydii	Lloyd's Olive	V	Species or species habitat likely to occur within area
Paspalidium grandispiculatum	Grass spp.	V	Species or species habitat likely to occur within area
Phaius australis	Lesser Swamp-orchid	E	Species or species habitat likely to occur within area
Phebalium distans	Mt Berryman Phebalium	CE	Species or species habitat known to occur within area
Picris evae	Hawkweed	V	Species or species habitat likely to occur within area
Rhaponticum australe	Austral Cornflower, Native Thistle	V	Species or species habitat likely to occur within area
Samadera bidwillii	Quassia	V	Species or species habitat likely to occur within area
Sarcochilus hartmannii	Waxy Sarcochilus, Blue Knob Orchid	V	Species or species habitat likely to occur within area
Sophora fraseri	NCN	V	Species or species habitat known to occur within area
Thesium australe	Austral Toadflax, Toadflax	V	Species or species habitat likely to occur within area

**Indicates the Australian conservation status of each taxon under the Environment Protection and Biodiversity Conservation Act 1999; Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).*

NCN – No common name.

Source: DAWE EPBC Act PMST, August 2020

12.11.4 Wetlands

No wetlands of international importance were identified from the EPBC Act PMST search as being present within the project area. Several unnamed wetlands were identified from DNRME wetlands mapping as being present in the vicinity of the Clarendon Dam pumping station and further north.

However, a review of the proposed pipeline network has identified that no wetland areas will be directly affected by the project.

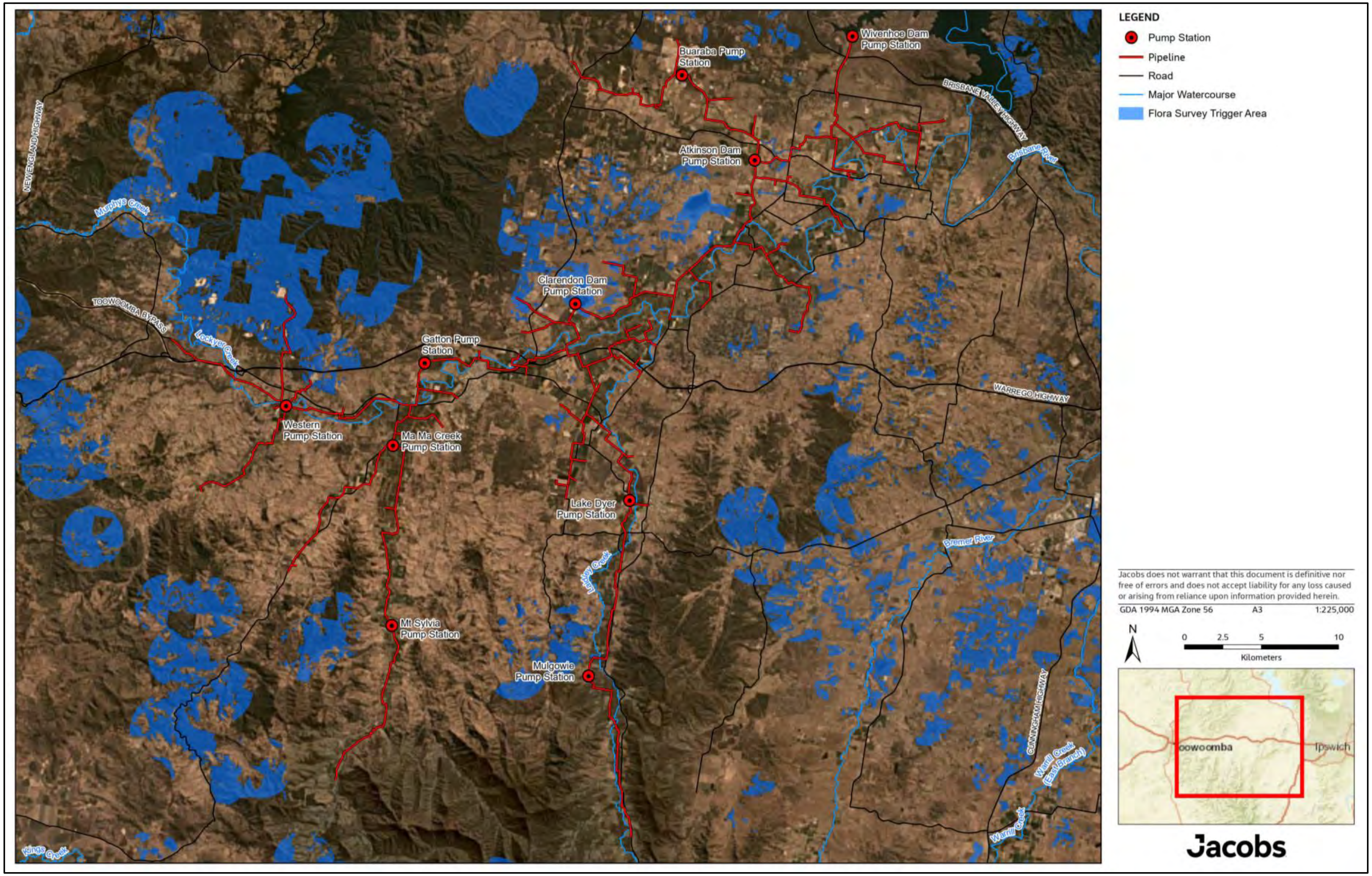
12.11.4.1 Flora survey trigger mapping

In Queensland, native plants are protected under the NC Act. Clearing of protected plants in the wild is regulated under the *Nature Conservation (Wildlife Management) Regulation 2006*, which classifies 'high risk' areas for protected plants.

A review of the DES flora survey trigger mapping (Figure 12.45) identifies that the broader project area has patches of vegetation designated as 'high risk' mainly north of the proposed pipeline network, particularly in the vicinity of the densely vegetated area that includes Lockyer Resource Reserve and Lockyer Valley National Park. The high-risk area is consistent with the RE mapping overlay. Clearing of native vegetation mapped under the high-risk area mapping is anticipated to be minimal to negligible, based on the current proposed alignment for the pipeline network.

Should the project proceed beyond detailed business case stage, an ecological assessment will be required, which should include an assessment of the proposed alignments highlighted above in terms of their proximity to the high-risk areas and potential for impacts to these mapped areas.

Figure 12.45: Flora survey triggers

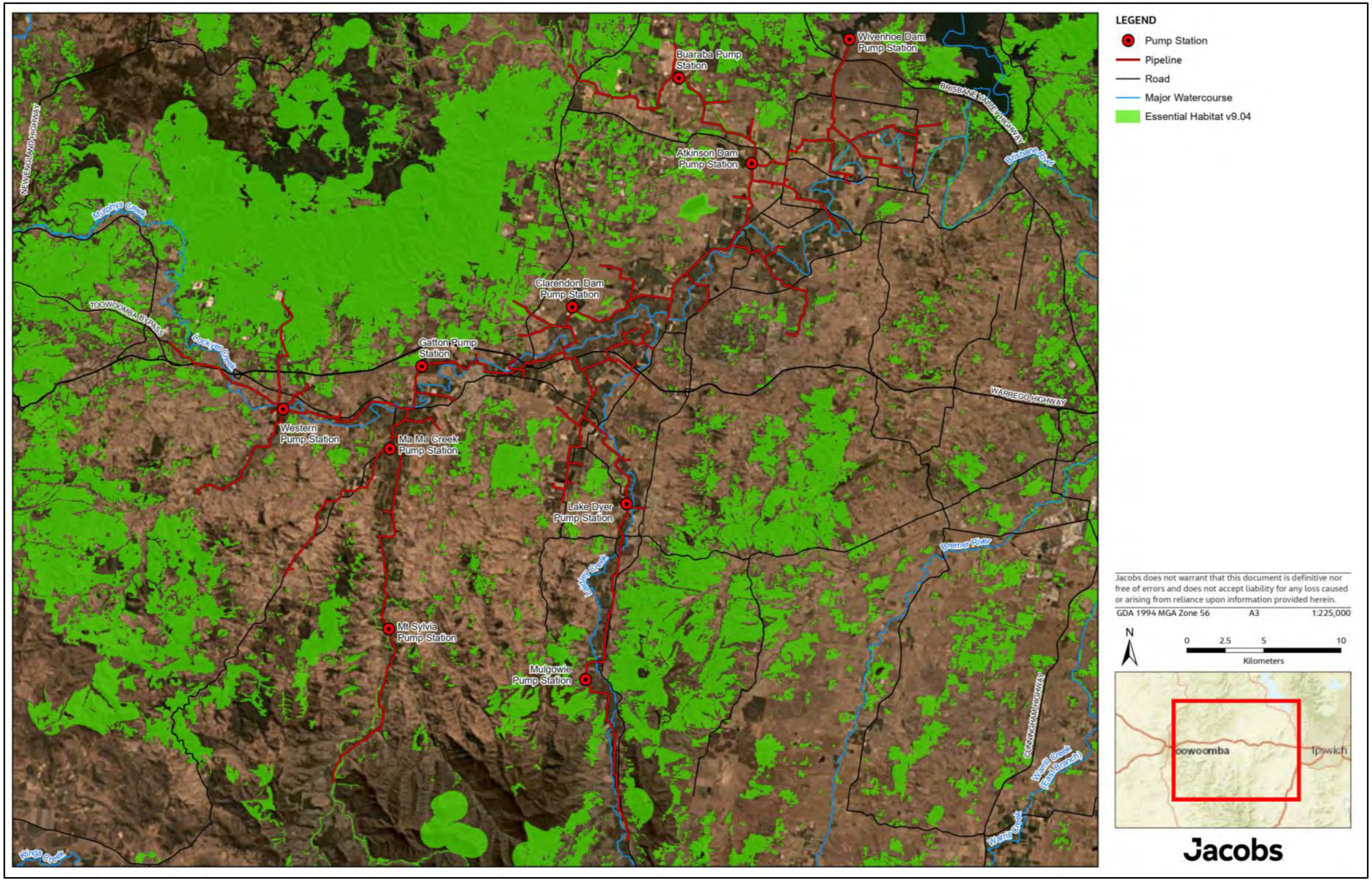


12.11.5 Essential habitat

Essential habitat is defined as the habitat of EVNT fauna as prescribed under the NC Act. Essential habitat mapping is reflective of remnant vegetation or mature regrowth and is based on records of EVNT fauna presence.

The DES vegetation management map indicates that there is essential habitat mapped across the site, which is consistent with the RE mapping and in turn the remaining vegetated areas, which are primarily correlated with the ranges and slopes (Figure 12.46). While some areas marginally impact on mapped essential habitat, the vast majority of the proposed pipeline network is clear of these values. Accordingly, construction of the project is not expected to significantly impact on essential habitat.

Figure 12.46: Essential habitat



12.11.6 Fauna

12.11.6.1 Fauna of conservation significance

A search of the EPBC Act PMST for the project area identified 32 listed threatened fauna species with the potential to occur within the project area. These comprised of 16 birds, nine mammals, four reptiles, two fish and one frog species with an EVNT status. Of these, 17 species are listed as known to occur, three as likely to occur and 12 may occur within the study area. These species are further described in Table 12.14.

A Wildlife Online search of Queensland threatened species listed under the NC Act was undertaken. However due to the vast size of the project area and the limitations on the ability to search large project areas, a large number of species were identified. Many of these species are not representative of the project area, given its predominantly cleared nature and limited remnant vegetation. It is noted that much of the Lockyer Resource Reserve and Lockyer Valley National Park was included in the search area, potentially skewing this data.

A more in-depth analysis of the searches will be more relevant during the detailed design stage of the project, when a more accurate identification of species potentially inhabiting the project area can be undertaken and when methodological design of fieldwork is being prepared.

Should the project proceed beyond detailed business case stage, an ecological assessment of the proposed pipeline alignments will be required and should include investigation of the potential for Commonwealth and Queensland listed species or their habitat to be present within the project area.

Table 12.14: EVNT threatened fauna species likely or known to occur within the project area

Species	Common name	Commonwealth status	Type of presence
Birds			
Anthochaera phrygia	Bitou Bush or Boneseed	Critically endangered	Foraging, feeding or related behaviour may occur.
Atrichornis rufescens	Rufous Scrub-bird	Endangered	Species or species habitat may occur within area
Botaurus poiciloptilus	Australasian Bittern	Endangered	Species or species habitat known to occur within area
Calidris ferruginea	Curlew Sandpiper	Critically endangered	Species or species habitat known to occur within area
Cyclopsitta diophthalma coxeni	Coxen's Fig-Parrot	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus	Red Goshawk	Vulnerable	Species or species habitat known to occur within area
Falco hypoleucos	Grey Falcon	Vulnerable	Species or species habitat known to occur
Geophaps scripta scripta	Squatter Pigeon (southern)	Vulnerable	Species or species habitat known to occur within area
Grantiella picta	Painted Honeyeater	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus	White-throated Needletail	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor	Swift Parrot	Critically endangered	Species or species habitat known to occur within area
Limosa lapponica baueri	Bar-tailed Godwit (baueri)	Vulnerable	Species or species habitat may occur within area

Species	Common name	Commonwealth status	Type of presence
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis	Eastern Curlew	Critically Endangered	Species or species habitat may occur within area
Rostratula australis	Australian Painted Snipe	Endangered	Species or species habitat known to occur within area
Turnix melanogaster	Black-breasted Button-quail	Vulnerable	Species or species habitat known to occur within area
Mammals			
Chalinolobus dwyeri	Northern Quoll	Endangered	Species or species habitat may occur within area
Dasyurus hallucatus	Spot-tailed Quoll	Endangered	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus	Greater Glider	Vulnerable	Species or species habitat may occur within area
Petauroides volans	Brush-tailed Rock-wallaby	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata	Koala	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus	Long-nosed Potoroo	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus	New Holland Mouse	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae	Hastings River Mouse	Endangered	Species or species habitat may occur within area
Pseudomys oralis	Grey-headed Flying-fox	Vulnerable	Species or species habitat known to occur within area
Reptiles			
Anomalopus mackayi	Five-clawed Worm-skink	Vulnerable	Species or species habitat may occur within area
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	Vulnerable	Species or species habitat may occur within area
Delma torquata	Adorned Delma	Vulnerable	
Furina dunmalli	Dunmall's Snake	Vulnerable	Species or species habitat may occur within area
Fish			
Maccullochella mariensis	Mary River Cod	Endangered	Species or species habitat known to occur within area
Neoceratodus forsteri	Australian Lungfish	Vulnerable	Species or species habitat known to occur within area
Frogs			
Mixophyes fleayi	Fleay's Frog	Endangered	Species or species habitat likely to occur within area

Source: DAWE EPBC Act PMST, August 2020

12.11.6.1.1 Koala habitat

The majority of the project area is located outside of the South East Queensland Koala Protection Area (KPA). However, several proposed pipelines encroach into the current KPA mapping. Significant tracts of land are mapped as KPA to the north of the project area that encompass the Lockyer Reserve and Lockyer Valley National Park and extend in a northerly direction toward (but not including) Wivenhoe Dam pumping station. In particular, the portion of pipeline that extends into the Lockyer Resources Reserve encroaches into the KPA, with other portions of the pipeline intersecting the KPA to a more limited extent.

There is a large area of KPA mapped to the south of the proposed pipeline network, with portions of the pipeline running parallel to, but not encroaching into, the KPA for approximately 1 km. A review of the MSES Koala Habitat Area mapping (Figure 12.47 to Figure 12.50) identified that the site contains substantial but sporadic patches of mapped core koala habitat throughout much of the pipeline network, but these values are concentrated in the north, west and south-east. The core koala habitat area is reflective of the regulated vegetation mapping; however, the pipeline alignments are not expected to impact on the core koala habitat area, with the exception of portions in the northern extent of the pipeline network that are currently aligned close to mapped koala habitat.

Field verification of mapped koala habitat close to the project area will be required to confirm whether there will be impacts on koala habitat as a result of the proposed development.

Figure 12.47: Koala habitat 1 of 4

Figure 12.48: Koala habitat 2 of 4

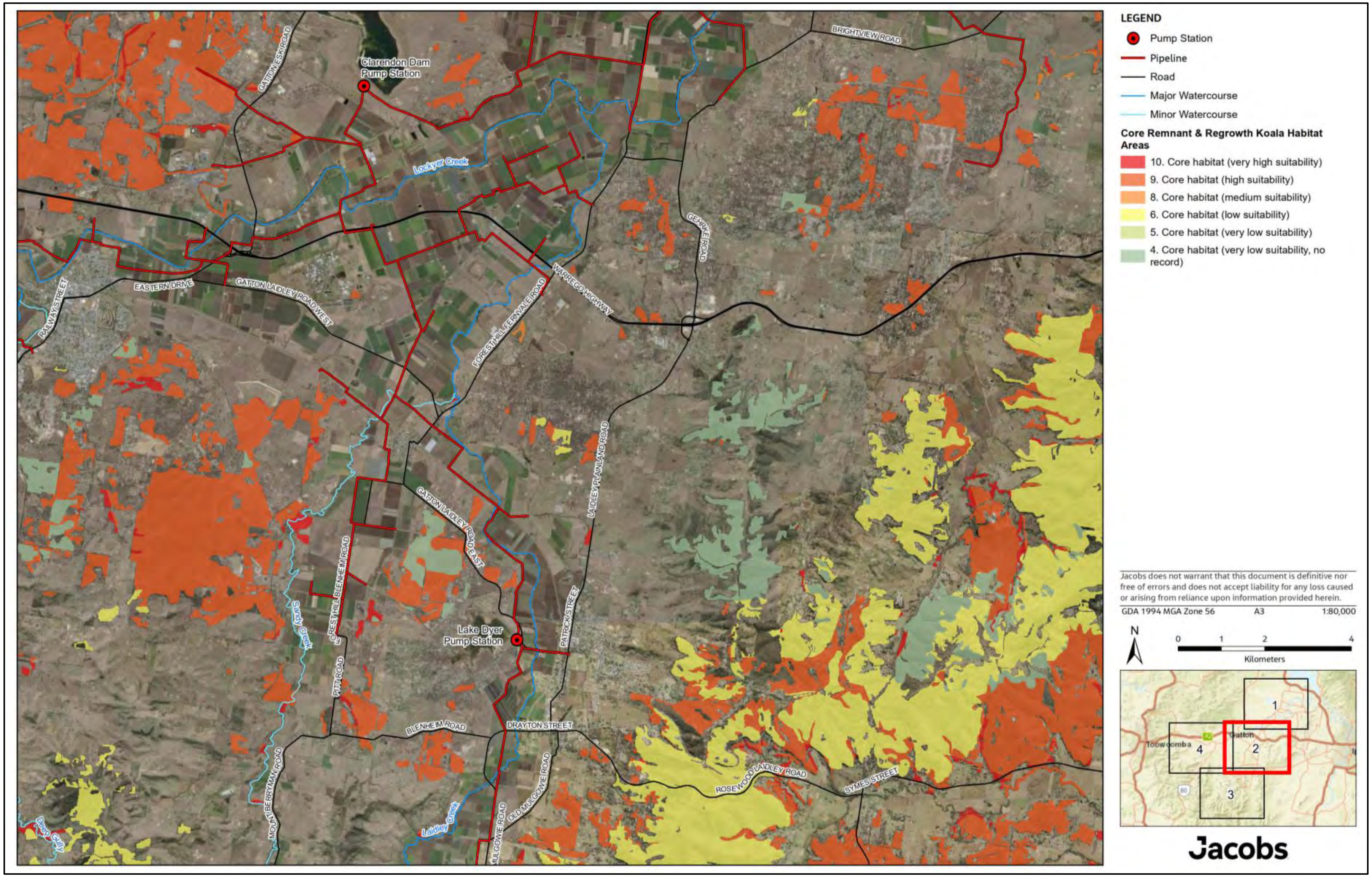


Figure 12.49: Koala habitat 3 of 4

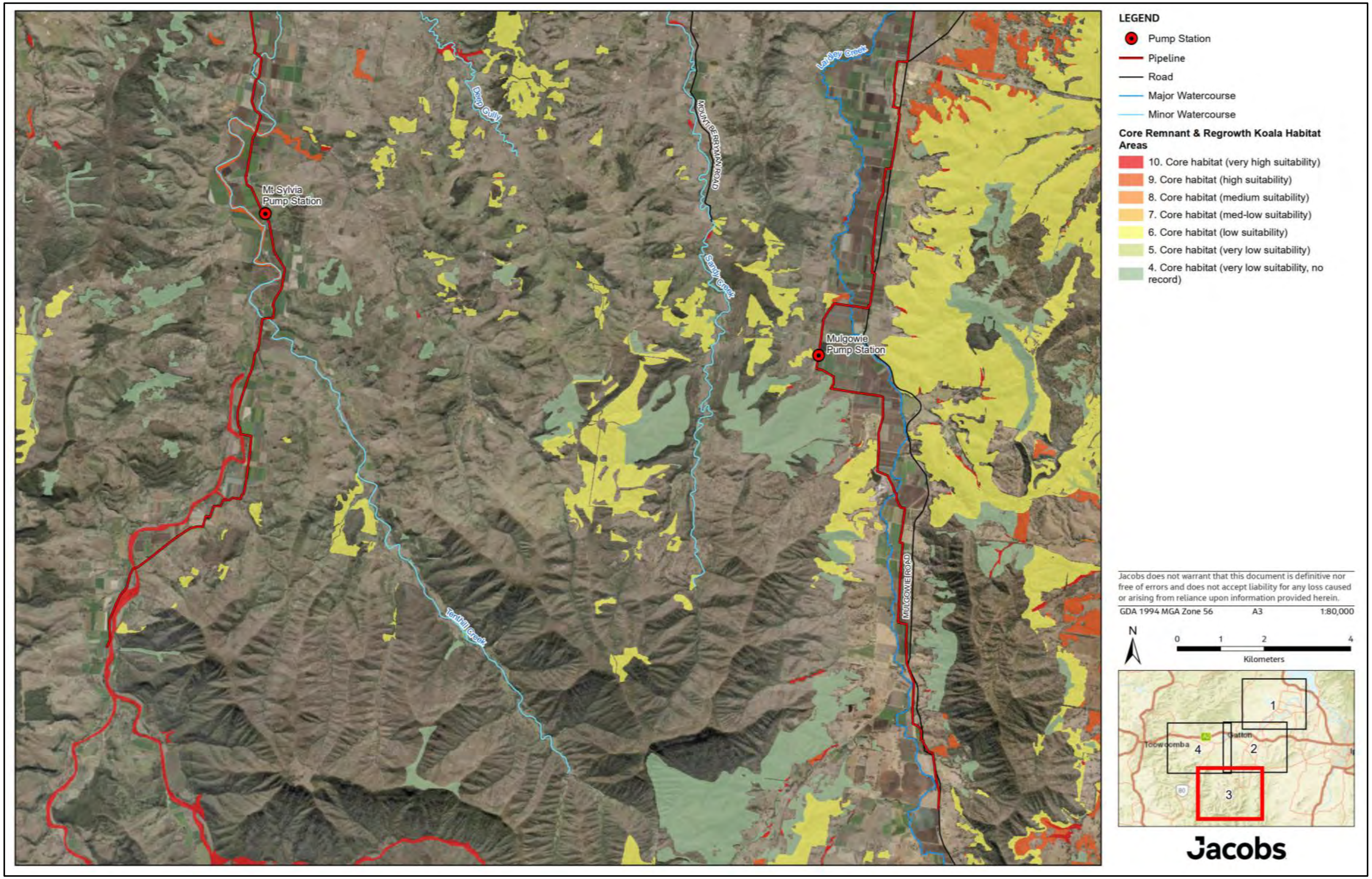
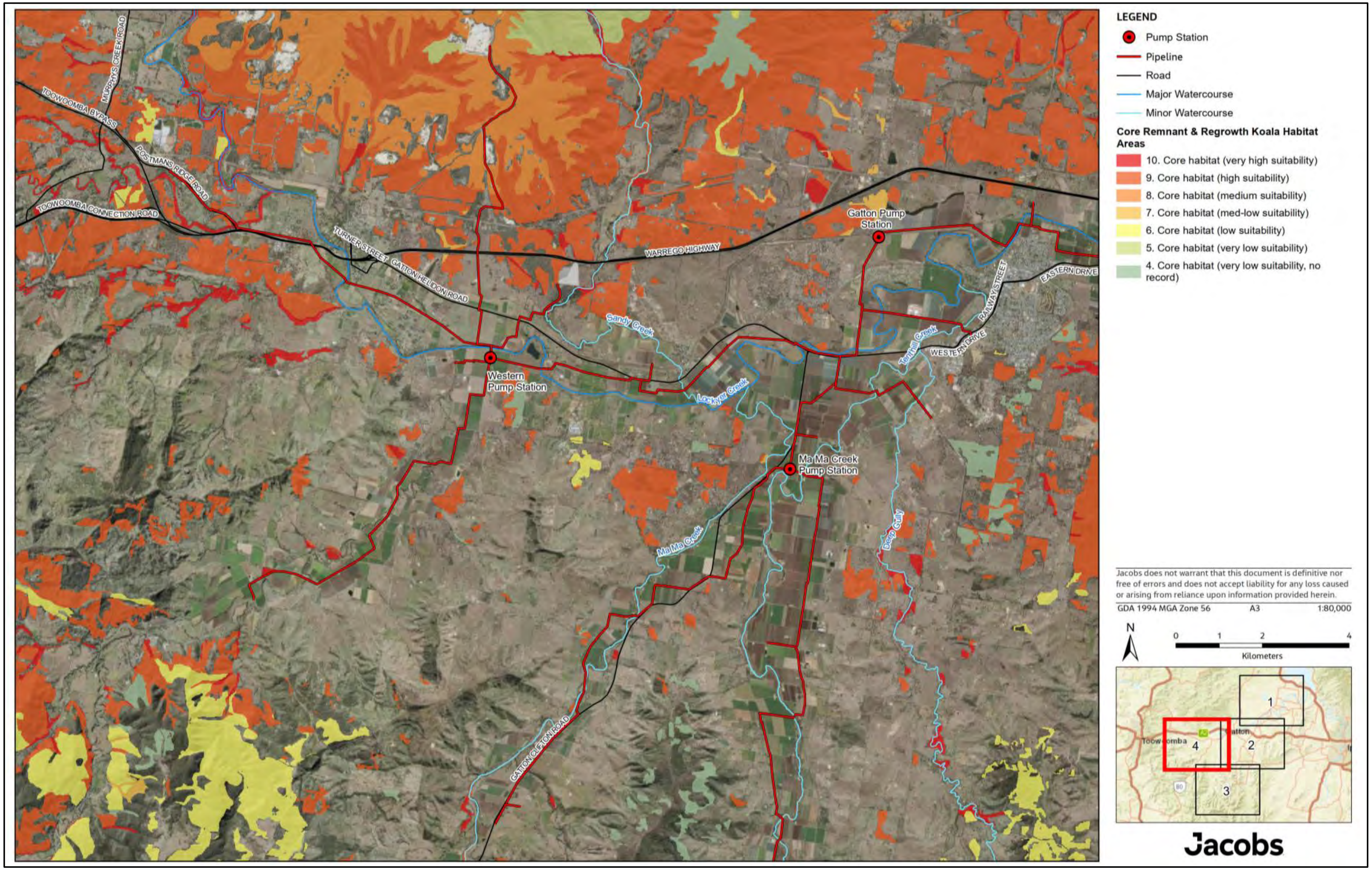


Figure 12.50: Koala habitat 4 of 4



12.11.7 Migratory species

Twenty migratory marine, terrestrial and wetland species are listed from the EPBC Act PMST search as known to be, or likely to be, present within the project area.

Given the nature and extent of potential habitat for these species, potential impacts on these species are expected to be minimal. However, a field ecological assessment should be undertaken to confirm the presence of the listed migratory species and their habitat, including the mapped wetland areas and water bodies located within the project area.

12.11.7.1 Biodiversity and habitat connectivity

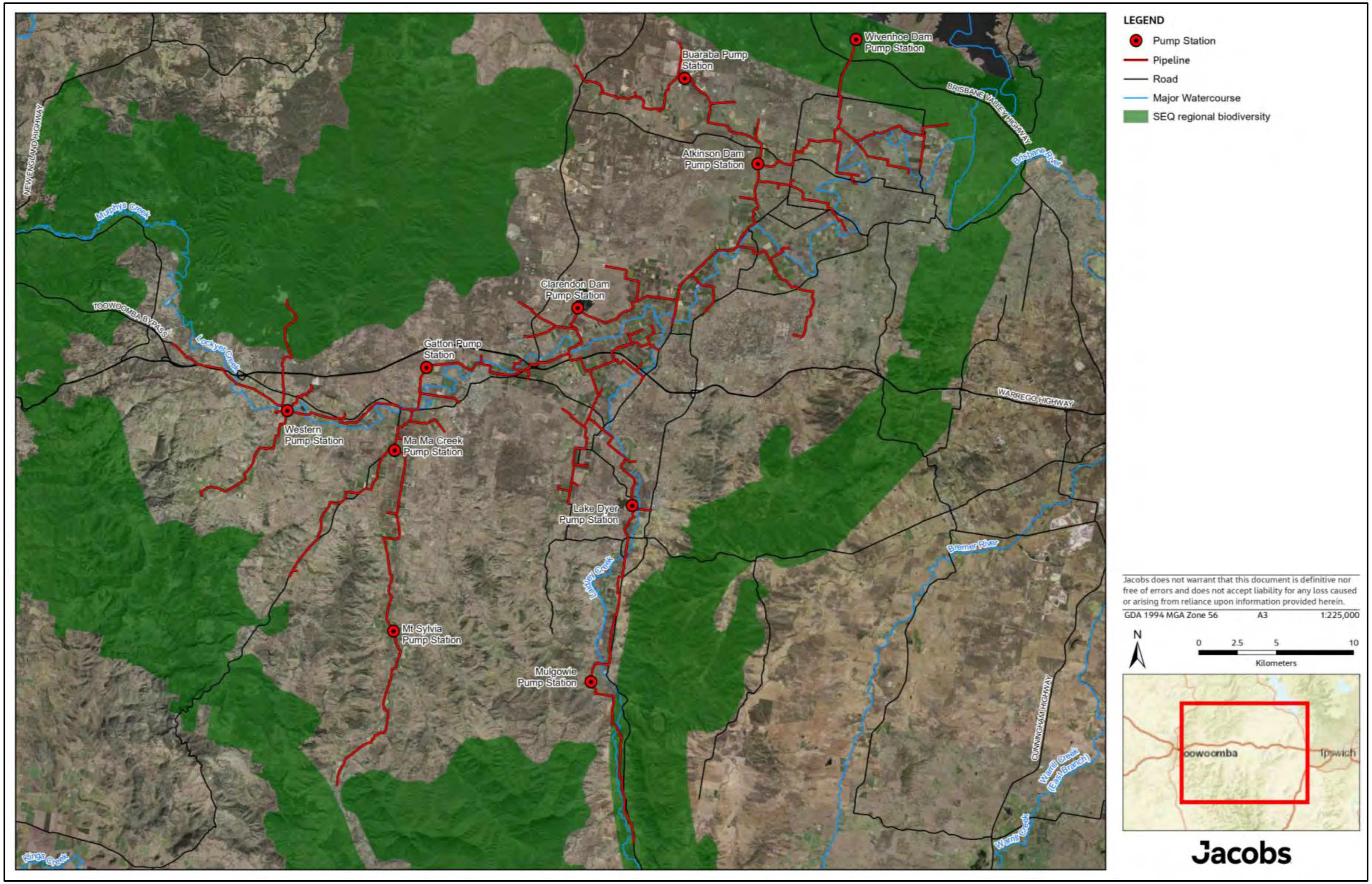
Regional biodiversity corridors connect or improve connectivity through targeted rehabilitation of natural assets, including between existing areas of matters of state environmental significance (MSES) or regional biodiversity values. The majority of the proposed pipeline network is outside of the South East Queensland regional biodiversity corridor that has been mapped within the broader project area.

With the exception of the portion of the proposed pipeline network that extends into vegetated land that forms part of the Lockyer Resources Reserve, portions of the alignment that encroach on land within the South East Queensland regional biodiversity corridor are identified as containing ‘low’ value for biodiversity habitat and providing for corridor linkage and faunal movement. These sections of the pipeline alignment have been situated within predominantly cleared land or land currently being used for agricultural purposes.

Figure 12.51 presents the South East Queensland regional biodiversity corridor within the broader project site, as well as the proposed pipeline network alignments.

Construction works associated with the project are anticipated to require the clearance of vegetation extending into the Lockyer Resources Reserve, which is located adjacent the Lockyer Valley National Park. While there is currently significant vegetation along this proposed alignment, vegetation clearance for construction of the pipeline in this area is not expected to significantly impact or fragment the biodiversity corridor connectivity.

Figure 12.51: SEQ regional diversity corridor



12.11.8 Biosecurity

The EPBC Act PMST identified the potential for 45 invasive weeds or pest species to occur with project designated search area (Table 12.15). A total of 22 weed species were identified as known or potentially occurring within the project area, including 20 weeds of national significance (WoNS) and other introduced plants that are considered by Queensland to pose a particularly significant threat to biodiversity.

The following feral animal species numbers were also reported from the EPBC Act PMST search: These included 8 birds, 1 amphibian, 12 mammals and 2 reptiles.

Feral animals listed include goat, red fox, cat, rabbit, pig, cane toad, feral deer, hare, black rat, brown rat and house sparrow. The full PMST results are presented is an Appendix.

As a result of the presence of WoNS within the project area, an individual national strategic management plan for each WoNS species would have to be considered in the next stage of the project. In addition, the relevant Queensland biosecurity specific weed legislation and policies will also need to be adhered to.

Before construction works start, a field ecological survey should be undertaken that includes an assessment of weeds and pest species within the project area. This assessment will inform the management and mitigation requirements for the construction and operation phases of work.

Table 12.15: Weed and pest species with the potential to occur in the project area

Scientific name	Common name	Declared status (Cth)	Declared status (Qld)
Plants			
Acacia nilotica subsp. indica	Prickly acacia		Class 2
Alternanthera philoxeroides	Alligator weed	WoNS	
Anredera cordifolia	Madeira vine	WoNS	
Asparagus africanus	Climbing asparagus	WoNS	
Asparagus asparagoides	Bridal creeper	WoNS	
Cabomba caroliniana	Common cabomba	WoNS	
Chrysanthemoides monilifera	Bitou bush or boneseed	WoNS	
Cryptostegia grandiflora	Rubber vine	WoNS	
Dolichandra unguis-cati	Cat's claw vine	WoNS	
Eichhornia crassipes	Water hyacinth	WoNS	
Hymenachne amplexicaulis	Hymenachne	WoNS	
Lantana camara	Lantana	WoNS	
Lycium ferocissimum	African boxthorn	WoNS	
Nassella neesiana	Chilean needle grass	WoNS	
Opuntia spp.	Prickly pears	WoNS	
Parkinsonia aculeata	Parkinsonia		
Parthenium hysterophorus	Parthenium weed	WoNS	Class 2
Prosopis spp.	Mesquite	WoNS	
Rubus fruticosus aggregate	Blackberry	WoNS	
Sagittaria platyphylla	Delta arrowhead	WoNS	
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii	Willlows	WoNS	

Scientific name	Common name	Declared status (Cth)	Declared status (Qld)
Salvinia molesta	Salvinia	WoNS	
Senecio madagascariensis	Fireweed	WoNS	
Solanum elaeagnifolium	Silver nightshade	WoNS	
Birds			
Acridotheres tristis	Common myna	Non-declared	Other invasive animal
Anas platyrhynchos	Mallard	Non-declared	
Carduelis carduelis	European goldfinch	Non-declared	
Columba livia	Rock dove	Non-declared	
Lonchura punctulata	Nutmeg mannikin	Non-declared	
Passer domesticus	House sparrow	Non-declared	
Streptopelia chinensis	Spotted turtle-dove	Non-declared	
Sturnus vulgaris	Common starling	Non-declared	
Mammals			
Bos taurus	Domestic cattle	Non-declared	
Canis lupus familiaris	Domestic dog		Class 2, Restricted invasive animal
Capra hircus	Feral goat		Class 2, Restricted invasive animal
Felis catus	Domestic cat	Non-declared	Restricted invasive animal
Cervis sp.	Feral deer		Class 2, Restricted invasive animal
Lepus capensis	Brown hare	Non-declared	
Mus musculus	House mouse	Non-declared	Other invasive animal
Oryctolagus cuniculus	Rabbit	Non-declared	Class 2, Restricted invasive animal
Rattus norvegicus	Brown rat	Non-declared	
Rattus rattus	Black rat	Non-declared	
Sus scrofa	Feral pig	Declared	Class 2
Vulpes vulpes	Red fox	Declared	Class 2, Restricted invasive animal
Frogs			
Rhinella marina	Cane toad	Declared	
Reptiles			
Hemidactylus frenatus	Asian house gecko	Non-declared	Other invasive animal
Ramphotyphlops braminus	Flowerpot or Brahminy blind snake	Non-declared	

Under the Biosecurity Act.

Source: DAWE EPBC Act PMST, August 2020

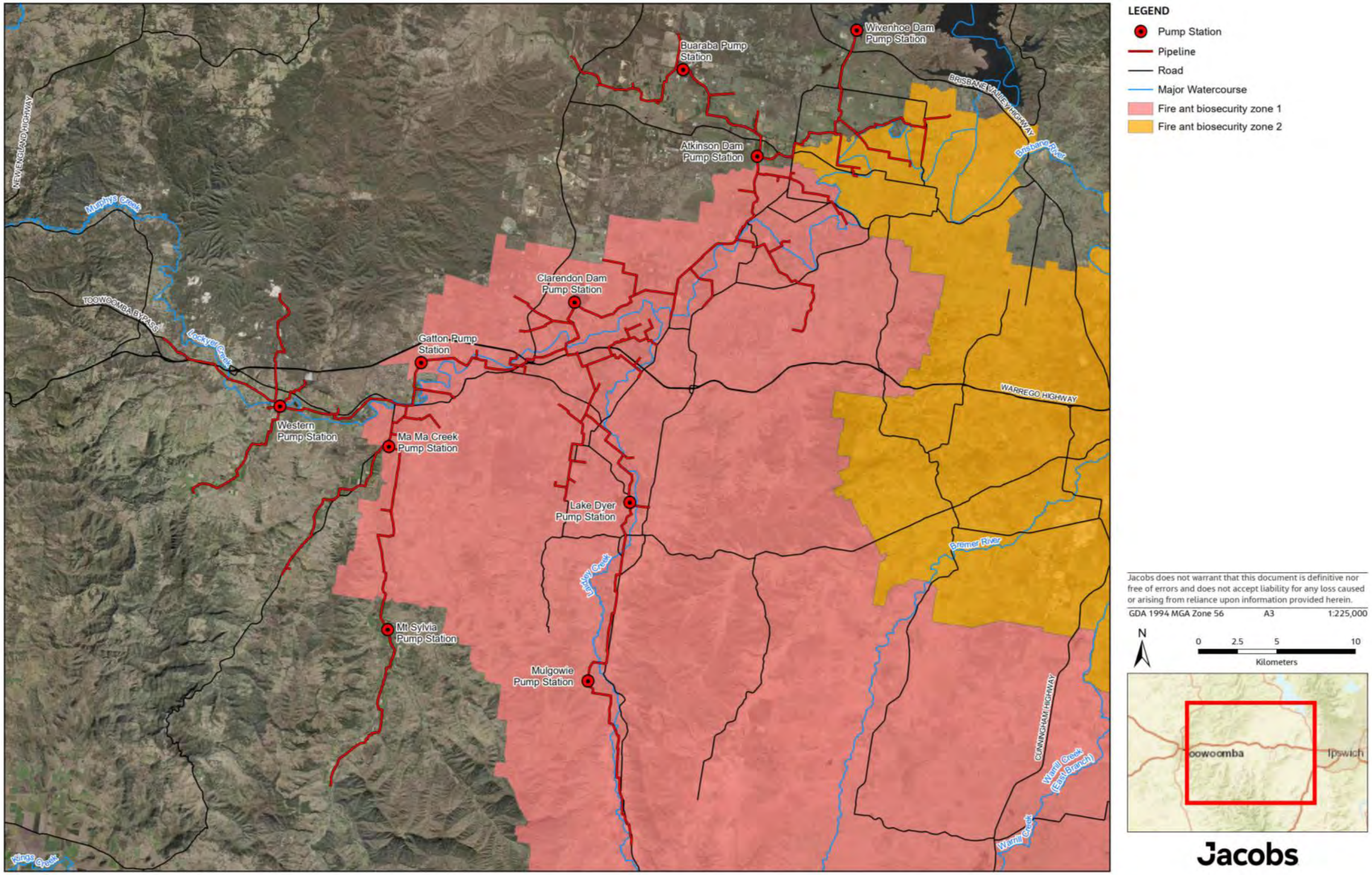
12.11.8.1 Red imported fire ant

Fire ant biosecurity zones are in place in areas of Queensland to restrict the movement of materials that could spread fire ants. Under the *Biosecurity Act 2014*, individuals and organisations whose activities involve the movement or storage of materials that may carry fire ants will have a general biosecurity obligation to take all reasonable steps to ensure they do not spread fire ants. Two fire ant biosecurity zones have been identified in Queensland. Each has procedures that indicate how materials that might carry fire ants must be managed and stored.

Most of the proposed pipeline network is located in fire ant biosecurity zone 1 (Figure 12.52). Additionally, three of the five pumping stations; Lake Dyer pumping station, Clarendon Dam pumping station and Atkinson Dam pumping station, are also located in this zone. A small portion of alignment in the north-east is in fire ant biosecurity zone 2 (Figure 12.52). The remaining alignments and pumping stations are outside of the fire ant zones.

For any construction work required to be undertaken in fire ant biosecurity zone 1, soil can be moved from its original place in zone 1 directly to a waste facility in either zone 1 or zone 2 without a biosecurity instrument permit (BIP). In contrast, for any construction work in fire ant biosecurity zone 2, soil from a place in zone 2 can only be moved within zone 2 without a BIP. Any restricted material moved from site during construction of the pipeline networks within these zones must comply with the fire ant carrier restrictions (including above) or a BIP is required.

Figure 12.52: Fireant biosecurity zones



12.11.9 Potential impacts

12.11.9.1 Avoidance of potential impacts

The pipeline network alignment initially underwent a constraints analysis to refine each of the lines and spurs into their respective designations. In determining the current route alignments various constraints, including ecological values, were included in the process and subsequent alignment refinement. The alignments underwent modification in order to firstly avoid, and secondly minimise impacts to species and communities of conservation significance.

12.11.9.2 Residual ecological impacts

The potential ecological impacts remaining once the preferred pipeline network was finalised for the detailed business case stage were assessed from a desktop review. Key residual impacts include:

- the clearance of up to 990 ha of non-remnant vegetation
- the clearance of up to 37 ha of remnant vegetation
- the clearance of up to 26.56 ha of core koala habitat
- potential to impact seven EVNT TECs listed under the EPBC Act
- potential to impact seven REs listed under regulated vegetation management mapping prepared by DNRME
- potential to impact species or species habitat for 30 flora and 32 fauna EVNT species under the EPBC Act.

The proposed development will require some clearing of vegetation regulated under the VM Act, including potentially essential habitat which is likely to provide habitat for a variety of fauna species including birds, mammals and reptiles. South East Queensland koala protection area and koala habitat are also present within the project area, and some clearance is anticipated based on current siting of the development.

While vegetation clearance will be required in some areas along the proposed pipeline network, it is unlikely to significantly increase the existing fragmentation or reduce habitat connectivity throughout the broader area, given habitat connectivity is already extremely limited due to the heavily cleared nature of the project area and its intensive use for cropping and grazing.

While the proposed alignment has, where possible, minimised disturbance to areas of native vegetation and fauna habitat during construction of the project, minor impacts to the ecological values of the project area are likely to be unavoidable.

In addition, while pumping stations are currently not located in vegetated areas, vegetation clearing may be required at construction stage to allow construction access.

Impacts to ecological values identified within the site are considered to be limited but may include:

- removal of native vegetation
- displacement of resident fauna
- reduction of fauna habitat
- potential injury and death of native fauna associated with construction activities
- potential introduction and spread of exotic weeds and pests.

12.11.9.3 Mitigation and management measures

Implementation of the following recommended additional investigations, management and mitigation strategies will aid in further reducing impacts to the local biodiversity:

- Before construction starts, a field ecological assessment of the preferred pipeline network should be undertaken. The assessment should concentrate on those communities and species of conservation significance identified from the desktop review and mapped adjacent or along the alignments.
- A vegetation management plan should be prepared to identify areas of conservation significance, areas to be protected from/avoided by clearance activities during construction and areas for revegetation.
- Species management plans should be prepared for those species of conservation significance that are identified, from the field assessment, to be present within the pipeline network corridors.
- Vegetation to be retained within and adjacent to the impact area must be suitably demarcated and protected (using barricade fencing, signage, etc.) in accordance with AS 4970-2009 before works start on site.
- Clearing of vegetation should be undertaken by a suitably qualified contractor.
- Stockpiles, storage of materials, dumping of waste and excavation activities should be excluded from demarcated areas, including riparian areas.
- Identified pest flora species (i.e. weeds) should be managed and disposed of appropriately.
- Excavation and removal of soil from designated red fire ant zones must comply with the fire ant carrier restrictions or a BIP will be required.
- A suitably qualified and licensed fauna spotter/catcher should be present during clearing works, including disturbance to any structures that may serve as habitat or refugia for wild animals. It is recommended that the *Queensland code of practice for the welfare of wild animals affected by land-clearing and other habitat impacts and wildlife spotter/ catchers* (Hanger & Nottidge 2009) be used as a guide to inform fauna management strategies.

  For examples, before hollow-bearing trees approved for removal are removed, they should be thoroughly checked for fauna presence prior to felling. If presence is identified, it is recommended that the tree be left overnight to allow for self-dispersal.
- The requirements should be considered that are outlined in relevant koala policy, including the *Nature Conservation and Other Legislation (Koala Protection) Amendment Regulation 2020, Environmental Offsets Regulation 2014, Planning Regulation 2017, Nature Conservation (Koala) Conservation Plan 2017* and *Vegetation Management Regulation 2012* with regard to clearing works and potential impacts to koala individuals and habitat trees.
- Vehicles entering the site should have weed hygiene certifications to avoid the introduction of pest species.
- Revegetation should occur progressively as the pipelines are laid and covered.
- Ongoing monitoring of revegetation works should be undertaken to ensure successful coverage of the cleared ground, and where the vegetation works has not been successful, additional planting should be undertaken.
- Where impact is still to occur then offsets should be considered.

No further impacts are expected during operation, assuming that the revegetation has successfully covered the works area. Should maintenance be required at any stage on the pipeline, then further revegetation work will need to occur to ensure cleared areas are not left on site that may lead to soil erosion or weed dispersal.

12.12 Environmental offsets

Under the *Environmental Offsets Act 2014* (EO Act) an environmental offset is defined as an activity undertaken to counterbalance a significant residual impact of a prescribed activity on a prescribed environmental matter. An environmental offset may be required as a condition of approval where, following consideration of avoidance and mitigation measures, a prescribed activity is likely to result in a significant residual impact on a prescribed environmental matter(s). An environmental offset condition may be imposed under certain Queensland legislation that applies to development assessment where the activity is a prescribed activity under the EO Act.

Schedule 1 of the Environmental Offsets Regulation 2014 (EO Regulation) provides a list of prescribed activities. Schedule 2 of this same regulation lists the prescribed environmental matters for which offsets may likely be calculated.

The EO Act places limits on when a condition may be imposed and provides for the subsequent assessment, delivery and compliance with offset conditions once imposed. The EO Act also seeks to minimise duplication in the imposition of offset conditions where these relate to the 'same, or substantially the same', impact and the 'same, or substantially the same', prescribed environmental matter. Duplication in state and Commonwealth referral and assessment processes may be reduced through a future approval bilateral.

At this early stage of the project, an accurate calculation of the offset area per prescribed environmental matter is not able to be determined, and therefore its associated offset liability cannot be accurately identified. This is because the siting and design of the proposed project is not confirmed and, more importantly, field verification of the nature and extent of flora and fauna communities and species has not yet been conducted. Without a thorough understanding of species and community presence in the field, determination of the extent of overlap of between the relevant environmental matters cannot be made and therefore the offset calculated is likely to be an overestimate.

With this in mind a 'ballpark estimate' of the potentially impacted land in hectares and associated offset liability has been calculated. For the purpose of this assessment the potential offset liability for the project has been calculated as a financial cost as opposed to other forms of offset provision under the EO Act. These calculations have been based on a scenario that:

- has not considered potential offset requirements under the Commonwealth EPBC Act
- assumes the clearance width of for the entire pipeline network to be 35 metres
- has not determined whether prescribed environmental matters are the 'same, or substantially the same' matter under the EO Act framework
- utilises the highest offset ratio of 1:4 for all prescribed environmental matters that currently relate to the project area.

The prescribed environmental matters that may be impacted by the project include:

- regulated vegetation, including prescribed regional ecosystems
- wetlands of high ecological significance
- connectivity areas
- protected areas
- protected wildlife habitat, including koala habitat areas and areas for other protected flora/fauna species.

Table 12.16 provides a breakdown based on each of the prescribed environmental matters and sub matters that relate to the proposed project area. A nominal value based on these hectarage figures can be obtained from the Queensland Government environmental offsets calculator, however for the purpose of this scenario some prescribed environmental matters were unable to be incorporated into the calculation of offsets until field verification or engagement with DES has been undertaken. These matters include protected areas, wetlands of high ecological significance, areas for protected flora/fauna species (excepting the koala) and connectivity areas.

Table 12.16: Indicative areas with potential for offset requirements within the project area

Environmental matter*	Sub matter	Impacted area (ha)
Total impacted area (full corridor length x 35m width)	N/A	1,031.42
Prescribed regional ecosystem	12.3.3	2.93
Prescribed regional ecosystem	12.3.7	12.06
Prescribed regional ecosystem	12.3.8	8.52

Environmental matter*	Sub matter	Impacted area (ha)
Prescribed regional ecosystem	12.9-10.2	5.66
Prescribed regional ecosystem	12.9-10.5	5.48
Prescribed regional ecosystem	12.9-10.7	2.36
Koala habitat	N/A	28.56
Wetlands of high ecological significance*	N/A	8.69
Protected areas*	Lockyer Resources Reserve	5.27

** Potential offset liability for protected species and connectivity were unable to be calculated*

The total potential offset cost for the project, as determined by the Queensland Government offsets calculator, is in the order of $7.393M. As previously discussed, it is expected that more accurate calculations would be determined as part of a detailed offsets strategy once the pipeline network alignments have been finalised and appropriate field studies have been undertaken.

12.13 Noise and vibration

12.13.1 Existing context

Existing land uses within the project area largely comprise land utilised for irrigated agriculture and livestock grazing in less built-up areas, with a range of rural residential, low-density residential and service-based land uses in the vicinity of local villages and townships such as Gatton, Laidley and Helidon.

Given the proximity of the project to these more urbanised areas, there are a significant number of sensitive receptors in the vicinity of the proposed pipeline. These sensitive receptors include aged care facilities, hospitals, childcare services and educational establishments located near the proposed pipeline network and pumping stations. Further, the proposed pipeline network and pumping stations are located close to a number of low-density residential and rural residential areas (Table 12.17).

Table 12.17: Proximity of project works to existing residences in urban areas

Urban area	Local government area	Approximate distance between project works and residential areas (metre)
Coominya	Somerset Regional Council	0
Clarendon	Somerset Regional Council	0
Forest Hill	Lockyer Valley Regional Council	0
Laidley	Lockyer Valley Regional Council	150
Plainland	Lockyer Valley Regional Council	20
Gatton	Lockyer Valley Regional Council	100
Grantham	Lockyer Valley Regional Council	50
Tenthill	Lockyer Valley Regional Council	50
Helidon	Lockyer Valley Regional Council	0

The existing noise and vibration environment in the vicinity of the proposed pipeline network and associated pumping stations would be influenced by noise and vibration generated by:

- local roads and state-controlled roads such as the Warrego Highway
- agricultural activities
- resource activities to the north of the township of Helidon and the associated haulage of resource materials.

12.13.1.1 Potential noise and vibration impacts

Noise and vibration impacts are likely to be experienced during construction activities for the pipeline infrastructure, pumping stations and construction traffic. Given that the project is principally a linear water pipeline, noise and vibration impacts would be transient as the work program (clearing works, trenching, pipelaying, etc.) progresses along the alignment.

In rural areas, climate factors and the predominantly flat topography may propagate noise emissions to travel over a kilometre from construction sites. However, impacts within these areas would be short-term and unlikely to occur outside of typical work hours, being between 7am and 6pm from Monday to Saturday. Further, it is expected that noise emissions associated with the construction of the pipeline and associated pumping station infrastructure in urban areas would be similar to that for rural areas, however the impact would be lesser due to ambient noise levels that are typically present within urban areas.

Potential for noise and vibration impacts on fauna within the project area are expected to be considered as part of a detailed flora and fauna assessment for the project.

During the operation of the proposed irrigation scheme it is expected that impacts on sensitive receptors would be minor in nature and limited to noise produced by the pumping stations and maintenance activities. It is considered that potential noise impacts from the pumping stations could be further mitigated through the incorporation of acoustic design elements into their design.

12.13.1.2 Further noise and vibration investigations

Should the project proceed, a noise and vibration impact assessment would be required as part of a detailed environmental assessment undertaken for an EIS or IAR. The noise and vibration impact assessment would be required to identify:

- sensitive receptors that could potentially be impacted by noise and vibration associated with the project
- sources and characteristics of noise and vibration expected to be generated from the construction and operation of the project
- mitigation measures to avoid, manage or mitigate identified impacts

Appropriate noise and vibration measures should be incorporated into the project's construction environment management plan.

12.14 Natural resources

12.14.1 Water

12.14.1.1 Potential impacts

The proposed project entails construction of an irrigation scheme that will result in the distribution of water across a network of pipelines to facilitate intensive agricultural irrigation. Given this stated aim of the project, this use of water is excluded from consideration here.

The use of water for the project is expected to be limited to the construction of the project and future maintenance works that may be required for the proposed pipeline network and pumping stations. Water use is anticipated to be limited to its use for the suppression of dust generated through construction and maintenance activities.

Water is likely to be sourced from surface or ground water sources near the project.

12.14.1.1.1 Management measures

Where water is required for construction works, the following mitigation and management strategies should be considered:

- Opportunities to incorporate chemical binders for dust suppression should be investigated as an alternative to the use of water for dust suppression.
- The use of recycled water or otherwise non-potable water should be considered by the construction contractor in the first instance.
- Where the use of water is necessary, the water should be taken from a sustainable source.
- Where possible, the construction program should be adjusted to avoid periods of drought and low rainfall to ensure that construction activities have minimal impact on water resources.

Water for the project should be sourced in accordance with legislative requirements, including permitting requirements for taking or interfering with water in accordance with the *Planning Regulation 2017* where necessary.

Should the project proceed, best practice in the sustainable management of water in construction should be considered. These sustainability practices should be incorporated into the project design, construction methodology and operational environmental management plan where appropriate.

12.15 Energy

12.15.1 Potential impacts

During the construction of the project, it is expected that the primary source of energy will be limited to the use of diesel fuel to power construction equipment, machinery, vehicles and generators.

Energy use for the operation of the irrigation scheme is expected to include:

- the use of diesel fuel to power construction plant, staff and haulage vehicles and generators where asset maintenance is required
- the use of renewable energy generated from solar panels attached to pumping stations, with auxiliary connections to the electricity grid as a back-up power supply when required.

12.15.1.1 Management measures

Should the project proceed, mitigation and management measures to be considered are:

- the use of renewable energy during the construction phase of the project, including:
  - solar panels for lighting and signage
  - biofuels that can substitute conventional mineral fuels
- opportunities for the use of alterative construction materials with lower embodied energy to conventional construction materials during the project design phase, such as:
  - the use of alternative bedding materials for the pipeline alignment (e.g. glass instead of sand/aggregate)
  - the use of fly ash in concrete.
- preparation of a procurement strategy that takes into account social, environmental and economic benefits, consistent with the principles of sustainable procurement and the circular economy. This may include:
  - identification of suppliers that have greenhouse gas reduction and sustainability strategies in place for their operations
  - sourcing of materials and equipment from the closest possible locations
  - consideration of additional opportunities for the use of renewable energy for operations
  - reuse of site-won material, and other material, where possible, during construction

- inclusion of energy efficiency clauses and requirements in all equipment, machinery and vehicles tendered for on the project.

12.16 Landscape and visual amenity

12.16.1 Existing context

The landscape within the project area is largely dominated by agricultural land uses, including open pastures utilised for livestock grazing and areas of irrigated agriculture. These agricultural areas are predominantly cleared and disturbed from their natural state; however, some scattered mature vegetation remains in areas utilised for livestock grazing.

Other visually prominent landscape features within the project area include:

- protected areas of high biodiversity value, including Gatton National Park, Tenthill Conservation Park, Mount Beau Brummell Conservation Park, Lockyer National Park, Lockyer State Forest and Lockyer Resource Reserve
- landscape features, including Mount Mulgowie, Mount Stradbroke, Mount Grandchester, Paradise Mountain, Mount Cooper, Mount Beau Brummell, Mount Haldon, Mount Ma Ma and Stringybark Mountain
- watercourses, including Lockyer Creek, Laidley Creek, Tenthill Creek, Ma Ma Creek, Sandy Creek and Deep Gully
- natural and artificial water bodies, including Wivenhoe Dam, Seven Mile Lagoon, One Mile Lagoon, Schlecht Lagoon, Lake Freeman, Lake Clarendon, Atkinsons Lagoon, Lake Dyer and Lake Apex.

These prominent natural features are identified in Figure 12.53 to Figure 12.56.

Figure 12.53: Prominent landscape features 1 of 4

Figure 12.54: Prominent landscape features 2 of 4

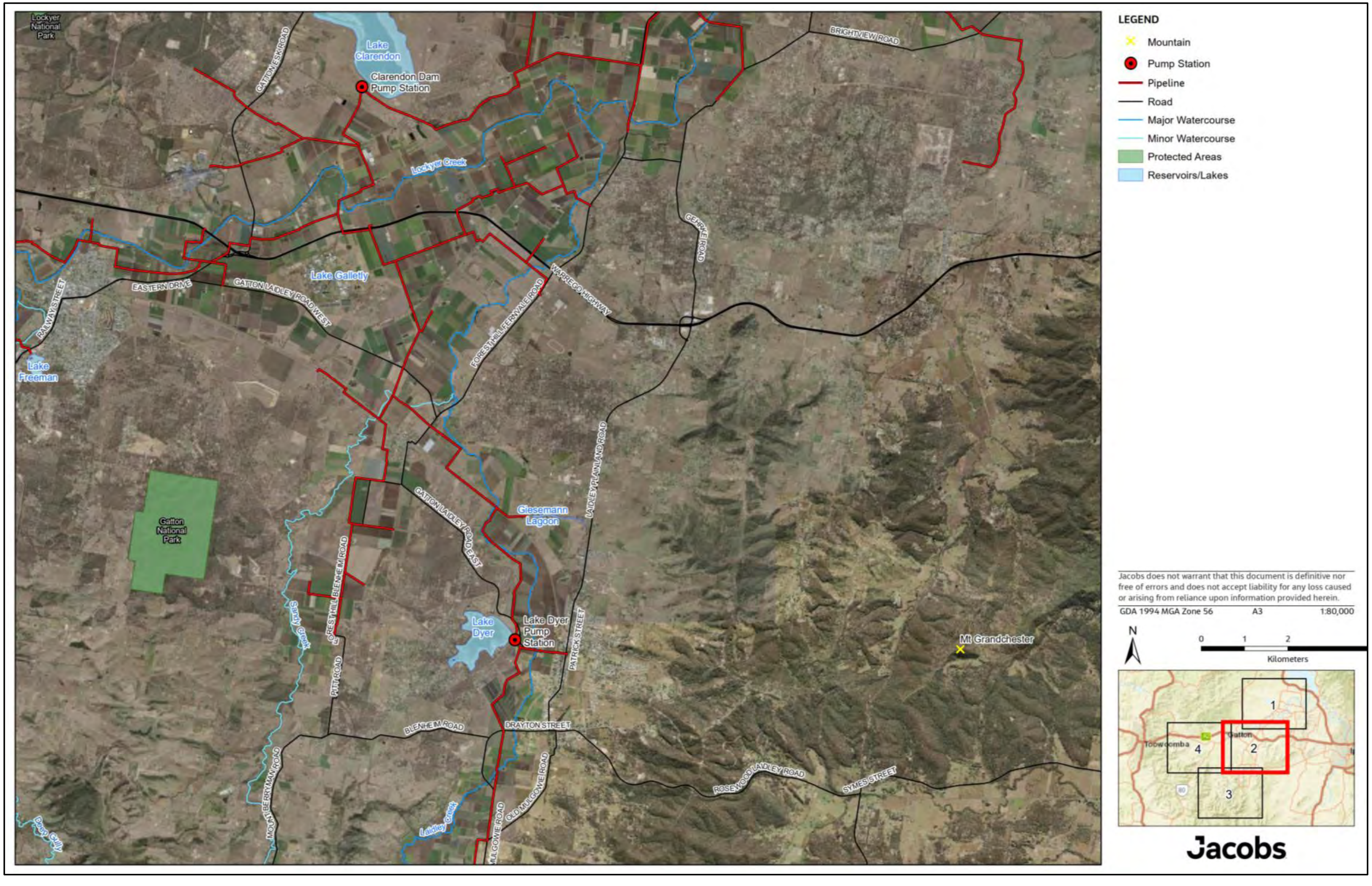


Figure 12.55: Prominent landscape features 3 of 4

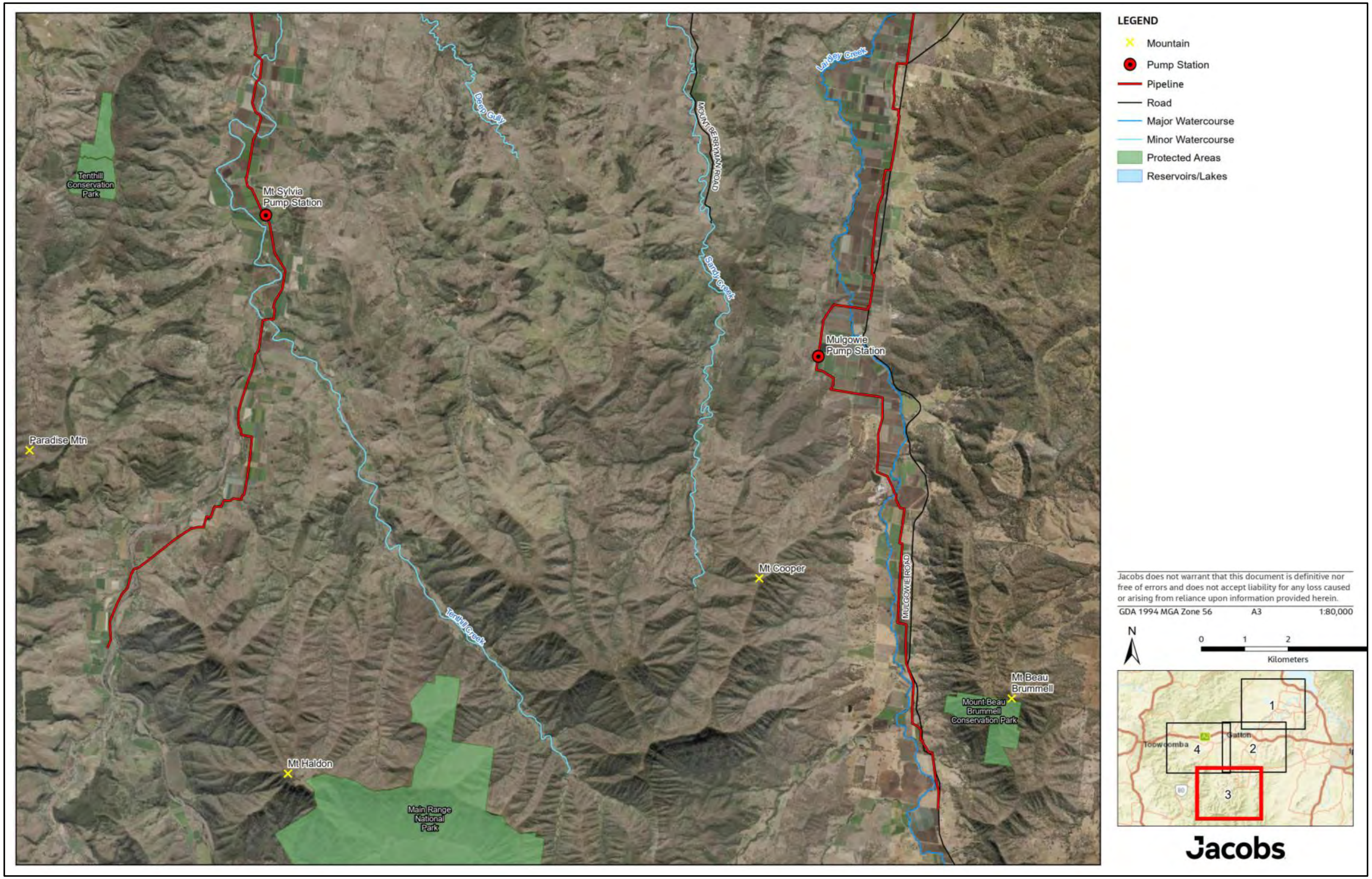
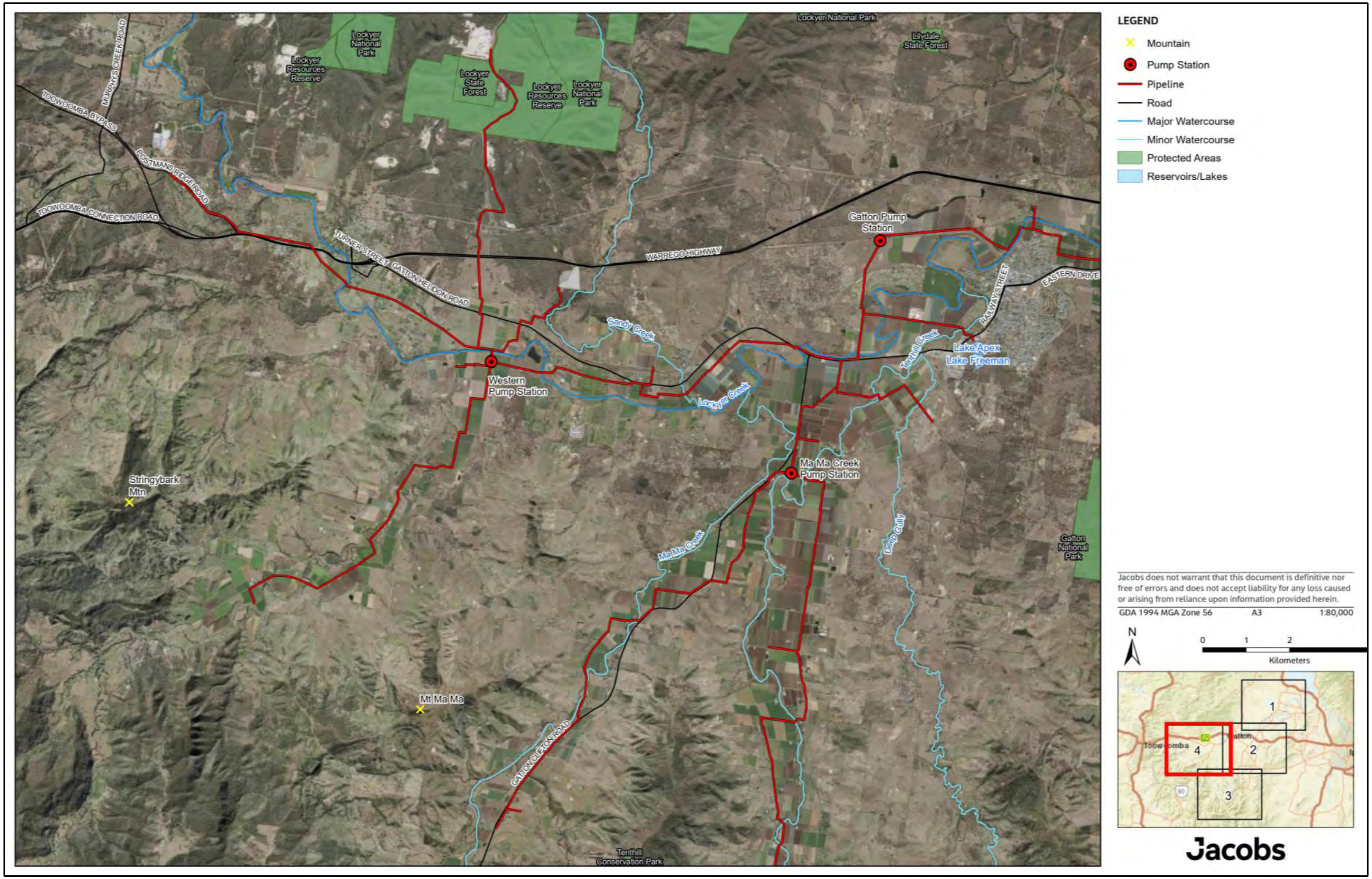


Figure 12.56: Prominent landscape features 4 of 4



Further, the proposed pipeline network and pumping station infrastructure is located close to a range of built-up urban areas including Gatton and Laidley, and smaller townships including Clarendon, Forest Hill, Grantham, Helidon and Tenthill. All of these urban areas feature rural residential and low-density residential areas that offer a high level of scenic amenity.

12.16.1.1 Potential impacts to landscape and visual amenity

Changes to the landscape and visual amenity would be most prominent during the construction phase of the project and therefore would be temporal in nature. Construction-related impacts would be expected to predominantly relate to:

- clearing and grubbing to enable excavation works
- the presence of machinery, project equipment and construction personnel
- preparation of laydown areas for storage of topsoil and excavated materials
- excavation works to install the pipeline infrastructure
- night-time lighting, if required, at work areas, site compounds or laydown areas
- increased local traffic movements associated with construction workforce and delivery of equipment.

Once operational, the visual impacts of the project would be negligible, due to the proposed pipeline being located underground. Any areas that are subject to disturbance to facilitate construction activities would be reinstated on completion of construction where possible; however, access tracks to facilitate maintenance works may be required in some locations.

Above-ground infrastructure such as pumping stations would be new built structures in the landscape and would be visible from nearby areas and elevated locations. However, given that the proposed pumping stations are expected to be generally small structures co-located with other utility infrastructure where possible, it is considered that they are unlikely to detract from the visual amenity of the surrounding area.

12.16.1.2 Further landscape and visual amenity investigations

Should the project proceed, a landscape and visual assessment of the project should be undertaken as part of a detailed environmental assessment through an EIS or IAR. It is expected that a detailed landscape and visual assessment would be prepared that would:

- evaluate the existing landscape and visual environment
- assess potential impacts of the landscape and visual amenity of the project area.
- identify cumulative and residual impacts
- propose mitigation strategies to be incorporated into project design and relevant construction documentation.

12.17 Cultural heritage

12.17.1 Aboriginal cultural heritage

A desktop review of the following legislation, guidelines and databases informed the findings related to Aboriginal cultural heritage:

- the *Aboriginal Cultural Heritage Act 2003* (the ACH Act)
- the ACH Act Duty of Care Guidelines (the Duty of Care Guidelines)
- the Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP) Aboriginal and Torres Strait Islander Cultural Heritage Database and Register (ACH Register) (accessed on 11 August 2020) to determine previously identified Aboriginal cultural heritage values that may be impacted by the project.

The ACH Register was searched by creating broad polygons around the proposed pipeline network and buffering these polygons by 1 km. The spatial extent of the database search is attached as an **Appendix.**

12.17.2 Registered Aboriginal parties

There are currently three cultural heritage parties within the project area (established from the DATSIP ACH Register) (see Table 12.18).

Table 12.18: Cultural heritage parties within the project area

Cultural heritage party	QC reference number	QUD reference number
Jagera People #2	QC2003/015 PRC	QUD6014/03
Yuggera Ugarapul People	QC2017/005	QUD213/2017
Jinibara People	QCD2012/011 DET	QUD6128/1998

12.17.3 Aboriginal Heritage Register search results

The search of the DATSIP ACH Register determined that there are 239 previously identified Aboriginal cultural heritage features within the extent of the search area. All previously identified Aboriginal cultural heritage features, including the relevant party, are documented in Table 12.19, with their location relative to the proposed pipeline network mapped in Figure 12.57 to Figure 12.60.

Table 12.19: Identified Aboriginal cultural heritage features within the project area

Identified feature	Cultural heritage party		Total
	Jagera People #2	Yuggera Ugarapul People	
Aboriginal historical place		4	4
Aboriginal intangible place		7	7
Artefact scatter		135	135
Burial	1	1	2
Cultural site		4	4
Earth feature		4	4
Earthen arrangement(s)		9	9
Grinding groove(s)		4	4
Hearth/oven(s)		1	1
Isolated find	1	28	29
Landscape feature	1	7	8
Pathway(s)		2	2
Quarry		7	7
Resource area	1	3	4
Scarred/carved tree	4	12	16
Stone feature		3	3
Total	**8**	**231**	**239**

Figure 12.57: Cultural heritage sites 1 of 4

Figure 12.58: Cultural heritage sites 2 of 4

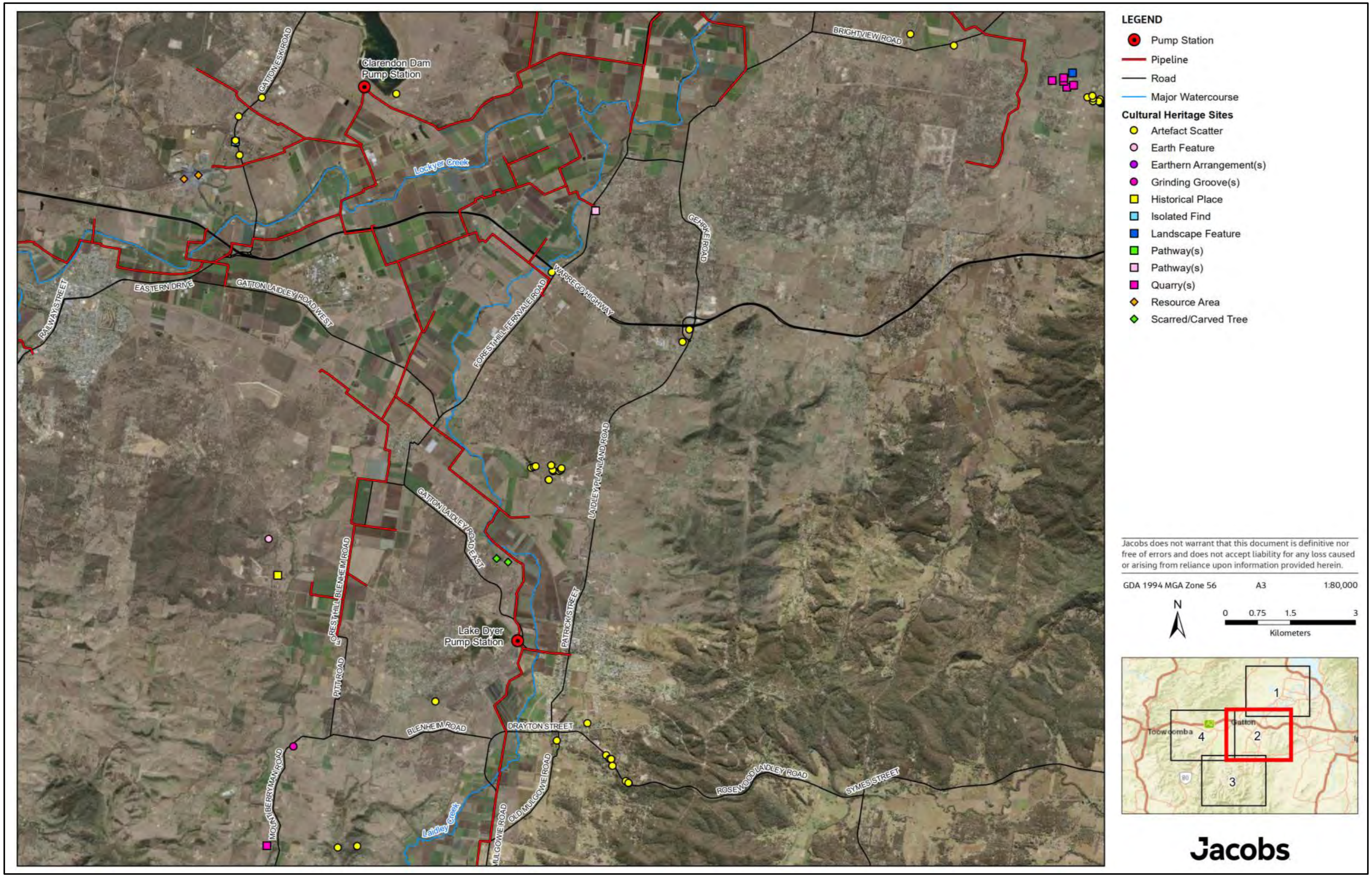


Figure 12.59: Cultural heritage sites 3 of 4

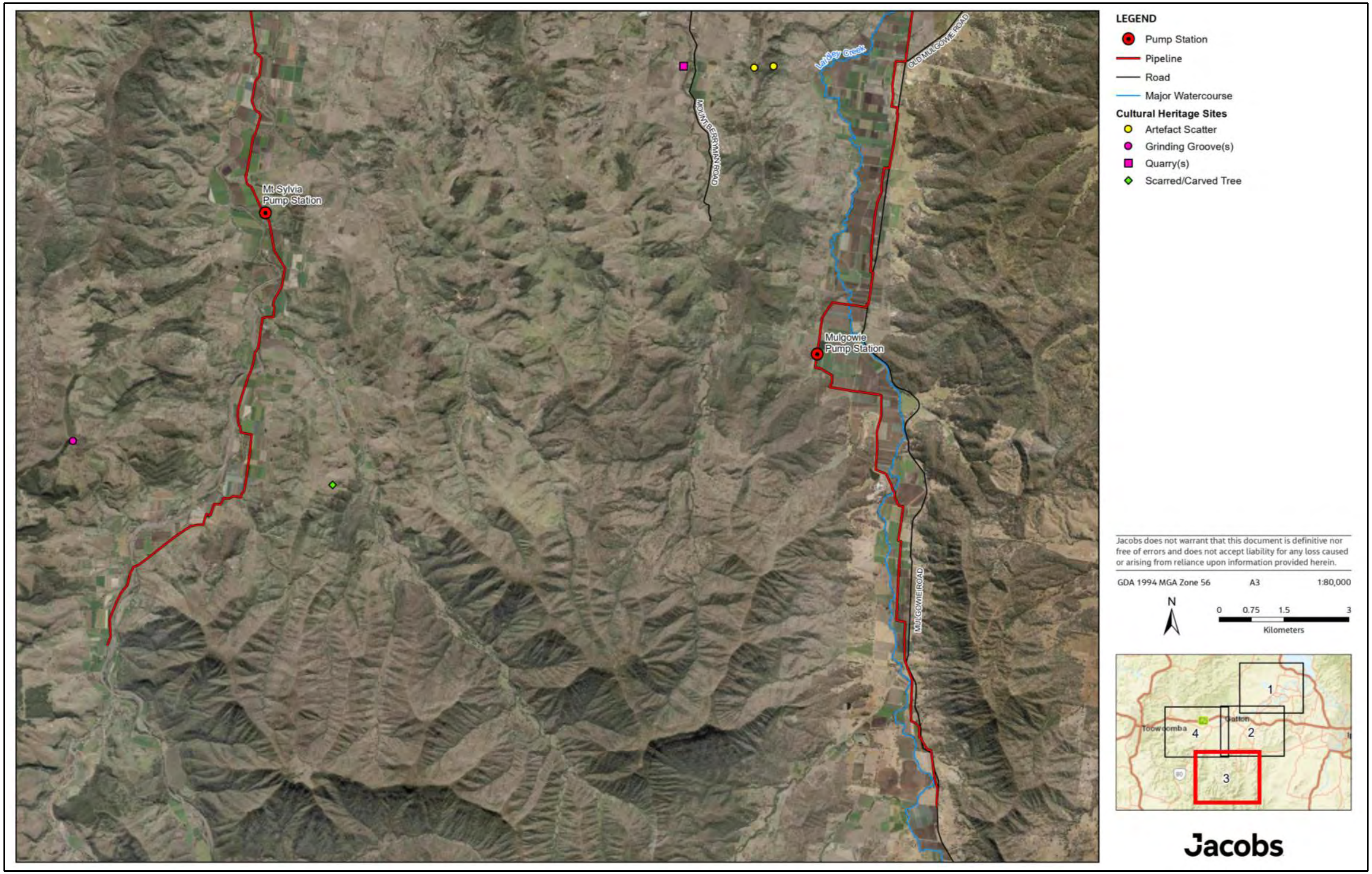
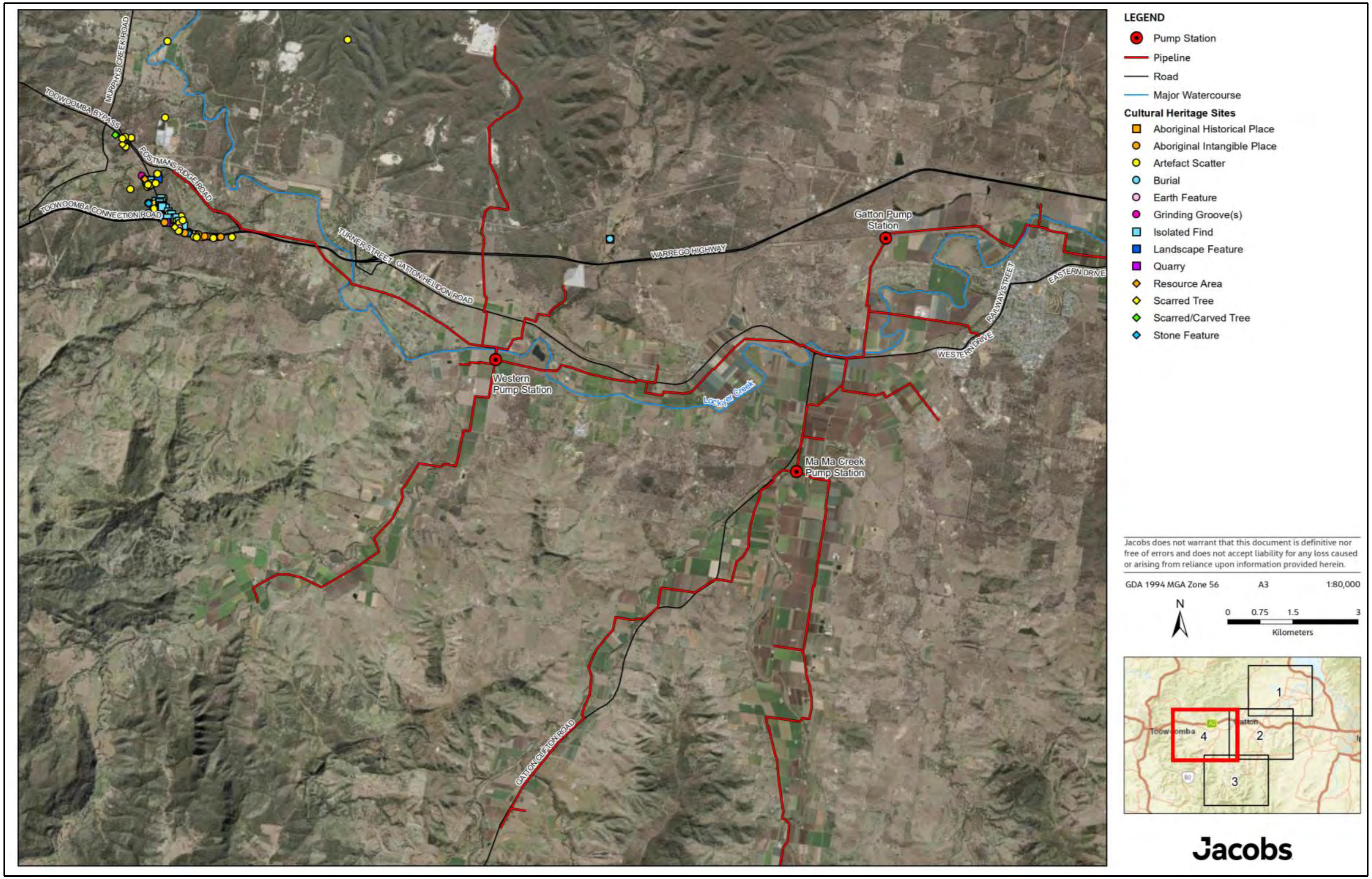


Figure 12.60: Cultural heritage sites 4 of 4



In addition to the Aboriginal heritage values identified, there could be potential for previously unidentified Aboriginal cultural heritage values to be present within the project area. This is largely due to:

- portions of the proposed pipeline network being located within areas with limited previous ground disturbance
- the close proximity of the pipeline to landscape features such as watercourses and rock outcrops, which are landscape features known to have been utilised as a resource by Aboriginal people in the past and therefore potentially contain cultural heritage value.

There is also potential for intangible Aboriginal cultural heritage to be present within the project area. The presence of intangible cultural heritage can only be ascertained through consultation with the relevant Aboriginal party. Aboriginal parties/Traditional Owners are the primary knowledge keepers of all matters relating to their cultural heritage.

12.17.3.1 Potential Impacts to Aboriginal Cultural Heritage

The proposed pipeline network has been designed to mitigate direct impacts to the previously identified Aboriginal cultural heritage values listed in Table 12.19, with all of the identified cultural heritage values being located between 69 m and 4,853 m from the centre point of the proposed pipeline alignment.

While previously identified Aboriginal cultural heritage values have been considered in the design of the proposed pipeline network, it is considered that there is a risk of impact to unidentified tangible and intangible cultural heritage values as part of the proposed project. All significant Aboriginal cultural heritage in Queensland is protected under the ACH Act, and penalty provisions apply for any unauthorised harm. Under the ACH Act, a person carrying out an activity must take all reasonable and practicable measures to ensure the activity does not harm Aboriginal cultural heritage (the cultural heritage duty of care). This applies, whether or not such places are recorded in an official register, and whether or not they are located in, on or under private land. Further, the presence of intangible cultural heritage can only be ascertained through consultation with the relevant Aboriginal party. Aboriginal Parties/Traditional Owners are the primary knowledge keepers of all matters relating to their cultural heritage and should be consulted with where there are proposed impacts to any potential cultural heritage material.

Section 2.2 of the *Aboriginal Cultural Heritage Act 2003* Duty of Care Guidelines (the Duty of Care Guidelines):

> 'recognise that it is unlikely that Aboriginal cultural heritage will be harmed where':
>
> - the current or proposed activity is on an area previously subject to significant ground disturbance and the activity will impact only on the area subject to the previous disturbance; or
> - the impact of the current or proposed activity is unlikely to cause any additional harm to Aboriginal cultural heritage than that which has already occurred.
>
> This is not to say that a particular area may not continue to have importance under Aboriginal tradition or history even though it has been subject to 'significant ground disturbance.'

A person who carries out an activity is taken to have complied with the cultural heritage duty of care in relation to Aboriginal cultural heritage if the person is acting in compliance with the Duty of Care Guidelines.

12.17.3.2 Further Aboriginal cultural heritage investigations

A full Aboriginal cultural heritage due diligence assessment should be undertaken in accordance with the ACH Act along the extent of the proposed pipeline alignment to determine the likelihood of project-related impacts to previously unidentified Aboriginal cultural heritage values.

The outcome of this cultural heritage due diligence assessment will inform the subsequent approval pathways and potential mitigation measures required for the project in relation to Aboriginal cultural heritage. Such pathways and measures may include a site survey/inspection, engagement with Aboriginal parties, preparation of procedures for managing any unexpected discoveries of Aboriginal cultural heritage material during project works, or the necessity for a Cultural Heritage Agreement or cultural heritage management plan.

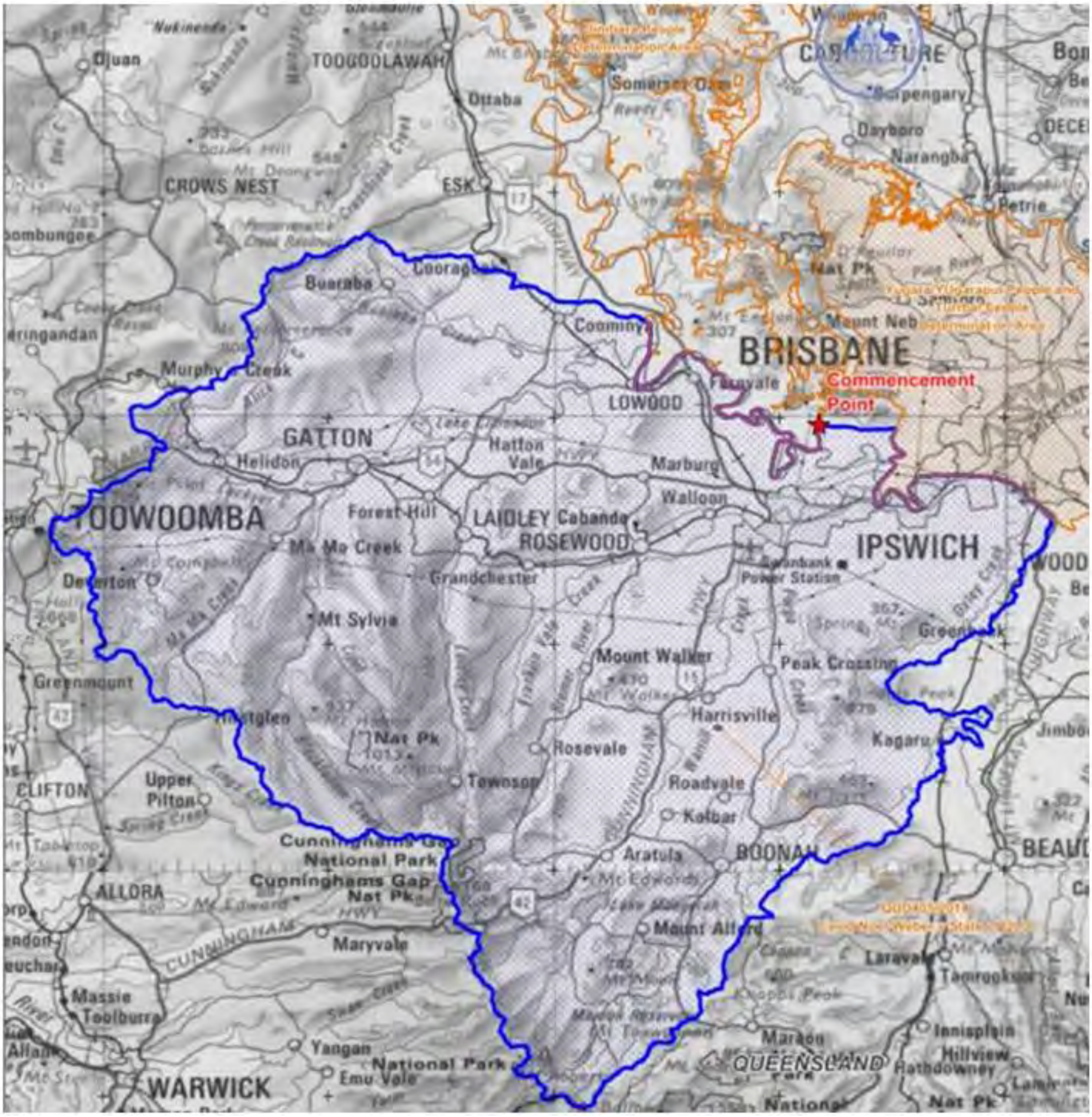
12.18 Native title

12.18.1 Claim of the Yuggera Ugarapul People

The project is within the area of the active native title claim of the Yuggera Ugarapul People, National Native Title Tribunal number QC2017/005.

As this claim has not yet been determined, the final area has not been decided. The claim area covers all of the Lockyer Valley Region, as shown in Figure 1.1 below with the claim area within the dark-blue marked boundary. This claim is currently before the Federal Court of Australia, case number QUD213/2017.

Figure 12.61: Claim area of the National Native Title Tribunal number QC2017/005



12.18.2 Claim of the Jagera Yagara Gurrangham People

The project is within the area of the active Native Title claim of the Jagera Yagara Gurrangham People, National Native Title Tribunal number QC2019/002.

As this claim has not yet been determined, the final area has not been decided. The claim area covers a large part of the Lockyer Valley Region, as shown in Figure 1.2 below with the claim area within the light-blue marked boundary. The area of this claim includes part of Lake Wivenhoe.

This claim is currently before the Federal Court of Australia, case number QUD675/2019.

Figure 12.62: Claim area of the National Native Title Tribunal number QC2019/002

While it is possible that changes to the project, such as the pipeline route, could impact on other native title claims or determination areas, at this stage it appears that only these two claim areas will be impacted by the project. The Queensland Native Title Determination Area Schedule is attached, which shows a map of the active claims and determination areas.

12.19 Historic heritage

A review of relevant local, state and Commonwealth historic heritage legislation, databases, registers and mapping was undertaken in August 2020 to understand the potential for historic cultural heritage matters to be impacted by the project. These sources included:

- the Commonwealth Department of Agriculture, Water and the Environment (DAWE) Australian Heritage Database, including the National Heritage List, World Heritage List, Commonwealth Heritage List and Register of the National Estate; historic heritage identified on the lists, excepting the Register of the National Estate, are protected as Matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- the Queensland Heritage Register, which identifies non-Indigenous historic cultural heritage places and precincts protected under the *Queensland Heritage Act 1992* (QH Act); the register was accessed through the August 2020 Queensland Heritage Register dataset on the Queensland Government Open Data Portal, with heritage places mapped on a project-specific Esri interactive mapping system
- local heritage places listed in the Gatton Shire Planning Scheme (Version 2) Register of Heritage Places and Precincts and mapped on the Cultural Heritage Places and Precincts Overlay
- local heritages places mapped on the Somerset Region Planning Scheme (version 3) Local Heritage Register Overlay.

A review of other planning schemes relevant to the project area including the Laidley Shire Council Planning Scheme (version 3) and the Development Scheme for the Grantham Reconstruction Area was also undertaken. This review determined that the proposed pipeline network will not impact on local heritage values identified under these planning instruments.

12.19.1 Historic Heritage Register search results

There were no Commonwealth-listed historic heritage places within 6 km of the project area.

There were several state-listed and locally listed historic cultural heritage places and precincts identified within 100 m of the proposed project area. These historic heritage places, their location and the relevant heritage register are detailed in Table 12.20.

Table 12.20: Listed historic cultural heritage values within 100m of the project area

Heritage place/precinct	Location	Heritage Register
University of Queensland Gatton Campus (Queensland University)	5391 Warrego Highway, Lawes (Lot 184 CC3374)	Queensland Heritage Register (ID 601672)
Corduroy Road Remains, Laidley	Adjoining 9–11 Mulgowie Road, Laidley Heights (Lot 1 RP25614)	Queensland Heritage Register (ID 600657)
Mount Sylvia State School	6 Left Hand Branch Road, Mount Sylvia (Lot 1 CC1373 & Lot 1 RP32682)	Queensland Heritage Register (ID 650247)
Museum	Freemans Road, Gatton (Lot 2 RP802604)	Gatton Shire Planning Scheme Heritage Register
School	Gatton Clifton Road, Mount Whitestone (Lot 2 RP50065)	Gatton Shire Planning Scheme Heritage Register
Church	Gatton Clifton Road, Mount Whitestone (Lot 1 RP123274)	Gatton Shire Planning Scheme Heritage Register
School	Gatton Clifton Road, Ma Ma Creek (Lot 3 CH312323)	Gatton Shire Planning Scheme Heritage Register

Heritage place/precinct	Location	Heritage Register
Cricket Club Pavilion	Ropehill Rd, Upper Tenthill beside Bert and Lil Peach Memorial Oval No 2 (Lot 3 RP119038)	Gatton Shire Planning Scheme Heritage Register
Cemetery	977 Mount Sylvia Rd, Caffey (Lot 227 CC466)	Gatton Shire Planning Scheme Heritage Register
Quarry	445 Seventeen Mile Rd, Helidon (Lot 150 CA311265 & Lot 151 CA311336)	Gatton Shire Planning Scheme Heritage Register
Lockyer Creek Railway Bridge (Clarendon)	Mahons Road, Coominya (Lot 35 SP122398)	Somerset Region Planning Scheme

In addition to the historic heritage values identified in Table 12.20, there is potential for previously unidentified archaeological cultural heritage values to be present within the project area which are related to the early European settlement of the area and historical land uses such as mining and agriculture.

12.19.2 Potential impacts to historic heritage

Given that the project involves the construction of an underground water pipeline, it is considered that potential impacts to historic cultural heritage values will generally be limited to the construction phase of the project, rather than during the operation of the irrigation scheme. Accordingly, mitigation and management measures have been adopted into the design of the pipeline network to minimise the risk of construction-related impacts on listed cultural heritage values in close proximity to the project.

Where possible, the pipeline corridor has been sited a minimum of 20 m away from the values (Table 12.20) to ensure that impacts from construction are minimal to these historic heritage values. The exception to this is the University of Queensland Gatton Campus (Queensland University), which will be directly impacted by the construction of the proposed pipeline network. Impacts to identified historic heritage values on the University of Queensland Gatton Campus (Queensland University) are proposed to be mitigated by siting the pipeline in areas that are of low heritage value, such as areas that have been subject to previous significant ground disturbance, where possible – for example, established internal pathways and roads.

However, under Part 6 of the QH Act, approval is required from the Department of Environment and Science (DES) for any proposed work or changes within the boundary of a place entered on the Queensland Heritage Register. Approval from DES may be granted by one of the following:

- **General exemption certificate:** No application is required. Most minor work and maintenance needed to keep a place in operation condition is approved under the General Exemption Certificate which applies to all places entered on the QHR.
- **Exemption certificate:** Application direct to DES. Exemption Certificates are mostly used to approve simple projects or work that does not have a detrimental impact on the cultural heritage significance of a Queensland heritage place not covered by general exemption.
- **Development application:** For proposed work not covered by a General Exemption Certificate or able to be covered by an Exemption Certificate, a development application must be made in accordance with the Development Assessment Rules, lodged with local government and referred to DES for assessment.

Further, the project has potential to impact on previously unidentified historic heritage places and artefacts associated with the early European development of the region, including both built heritage and archaeological material. Under Part 9 of the QH Act, a person must report to DES if they discover an archaeological artefact that is an important source of information about an aspect of Queensland's history. Archaeological artefacts include any relic or other remains located above, on or below the present land surface, or found in state waters, that relate to past human behaviour. This should be included in the construction environment management plan for the project.

Potential risks for unidentified heritage values would generally be associated with the siting or construction of the proposed pipeline network, any excavation works for construction materials, and haulage routes.

12.19.3 Further historic heritage investigations

Should the project proceed, a historical cultural heritage due diligence assessment should be undertaken to determine the likelihood of direct or indirect impacts on identified and previously unidentified historical cultural heritage sites and archaeological material within or surrounding the project area. The outcome of this historical cultural heritage due diligence assessment will inform the subsequent approval pathways and potential mitigation measures required for the project in relation to historical cultural heritage. Such pathways and measures may include a site survey/inspection, preparation of heritage impact assessment to support approval applications, and preparation of mitigation and management measures including procedures for managing any unexpected discoveries of historic heritage material during project works.

Further consultation with DES is required to understand the specific approval pathway and potential mitigation and management measures that may be required for the University of Queensland Gatton Campus (Queensland University) site.

12.19.4 Waste management

This desktop assessment of waste management for the project involved a review of relevant Queensland Government waste management legislation and policies, including:

- the *Environmental Protection Act 1994*, *Waste Reduction and Recycling Act 2011* and *Waste Reduction and Recycling Regulation 2011*
- the Department of Environment and Science (DES) *Waste Management and Resource Recovery Strategy (2019).*

This review sought to identify waste likely to be generated by the proposed project during both the construction and operational phases. Information was also gathered from discussions with the pipeline network design team, and geotechnical advisors, and from previous experience on similar pipeline projects.

12.19.4.1 Existing context

The *Waste Management and Resource Recovery Strategy (2019)* guides the management of waste generated in Queensland by establishing a waste hierarchy and promoting a circular economy approach to waste management.

Generally, the Queensland framework for waste management promotes:

- the avoidance of waste generation
- the reuse of waste generated by activities where avoidance is not possible
- waste disposal where avoidance and reuse are not possible.

12.19.4.2 Potential waste management impacts

Waste generated through the construction of the project is anticipated to include:

- residual excavated materials (predominantly topsoil and subsoil) that cannot be reused on site comprising:
  - soils generally improved for agriculture
  - soils associated with the road reserve
  - potentially isolated pockets of soil derived from land where prior or current activities may have resulted in contamination
- cleared vegetation

- waste oil
- construction wastes such as plastics and metals
- wastewater derived from plant and vehicle washdown
- typical consumable wastes generated by on-site staff (construction and operation phases).

Excavated site-won material generated during construction is anticipated to predominantly be agricultural or semi-improved soils. It is expected that the majority of site-won material from excavation will be reused on site; however, any spoil that is surplus to requirements may need to be managed off-site or disposed of at a licenced disposal facility.

Soil taken from a site that is listed on the Environmental Management Register (EMR) or Contaminated Land Register (CLR) may require specialist investigation, remediation and a soil disposal permit if the soil must be removed from the site. Waste soil from a site not on the EMR/CLR that cannot be reused on-site will be defined as a waste under the *Environmental Protection Act 1994*.

Waste that is likely to be generated through the operational phase of the project is expected to include waste generated through operational and maintenance activities, including:

- residual excavated materials (predominantly topsoil and subsoil) that cannot be reused on-site
- cleared vegetation
- waste oil
- wastewater derived from plant and vehicle washdown
- construction wastes such as plastics and metals
- typical consumable wastes generated by on-site staff.

It is expected that the appointed construction and maintenance contractor would be responsible for managing waste arisings generated through construction and operational activities in accordance with legislative requirements and a construction environment management plan.

12.19.4.3 Mitigation and management measures

In accordance with Queensland's waste management framework, potential waste arising from the construction and operational phases of the project should be avoided where possible. As a general principle, waste should be managed in a manner that avoids or mitigates risks to human health, the environment and other environmental values.

Where the avoidance of waste generation through project activities is not possible, the following management and mitigation measures are considered appropriate for the project:

- Site-won material should be incorporated into pipeline design where possible to minimise the volume of material for off-site storage, recycling or disposal.
- Soil and rock meeting the definition of clean earth should be incorporated into the construction of another amenity facility or offered locally where fill material is required. Approval for this may be necessary from the Department of Environment and Science under the *Waste Reduction & Recycling Act 2011*.
- Typical commercial and construction/demolition wastes (e.g. paper and card, packaging and timber) should be reused where practicable. Recyclable material should be placed in designated recycling bins. Other waste arisings must be disposed of as general waste.
- All waste arisings should be placed and compacted in areas designated within a project-specific waste management plan.

If waste cannot be reused or sent to an appropriately licensed facility for treatment or recycling, then waste disposal to a licensed disposal facility may be required.

12.19.4.4 Further waste management investigations

A waste management plan should be developed for the project that sets out:

- waste stream characterisation
- waste stream separation protocols and storage areas
- the identification and assessment of avoidance, reuse or recycling opportunities for potential waste
- waste management pathways for all waste types expected to be generated.

12.20 Conclusion

This assessment provides a high-level environmental assessment of the Water for the Lockyer project, including a review of potential environmental impacts associated with the construction and operation of the project. Should the project proceed, a detailed EIS or IAR would need to be completed to identify and assess relevant environmental, social and economic impacts of the project within and adjoining the project area, to the extent relevant.

That would require further technical environment assessments for environmental factors relevant to the project as well as extensive consultation with local, state and Commonwealth regulatory bodies. Consultation with affected stakeholders, including Traditional Owners, property owners and adjoining communities would also be required.

The construction of the project is likely to have some impact on environmental values within and adjoining the project area, particularly in relation to flora and fauna and Aboriginal cultural heritage. Residual planning and environmental impacts associated with the project that are unable to be avoided, mitigated or offset and the applicable evaluation approach are identified in Table 12.21. Given that the project is still conceptual, the full extent of the project's environmental impacts would be further examined and verified during the detailed design stage and as part of the technical investigations for key project approvals such as an EIS or IAR.

It is expected that environmental offsets would be consistent with the requirements as set out in applicable Australian and Queensland policies, should the project proceed.

Table 12.21: Potential residual environmental impacts

Potential impact	Description	Evaluation approach
Loss of residential amenity	Permanent impacts expected through establishment of pipeline infrastructure and easements over private property	Social impact evaluation
Aboriginal cultural heritage	Loss of intangible Aboriginal cultural heritage values as a result of construction activities	Qualitative assessment
Emissions production	Greenhouse gas emissions produced during construction, maintenance activities (use of vehicles) and through the use of electricity to power the pumping stations	Quantitative assessment

13. Demand assessment

13.1 Key points

Jacobs was engaged to undertake a detailed business case (DBC) for the Water for the Lockyer Project. A key part of a strong DBC is demand assessment that assesses whether a scheme has customers and private sector investors. There are three parts to a comprehensive real-world demand assessment:

1) Round 1: Expression of Interest (EOI) (non-binding), which was the topic of a previous report
2) Round 2: Letter of Intent (LOI) (non-binding), which is the topic of this report
3) Round 3: Water sales (legally binding), which would occur post-DBC assuming this project proceeds.

Round 1 Results Recap

By March 2020, the Round 1 demand assessment was complete with customer statistics as follows.

Table 13.1: Customer statistics for Round 1 demand assessment

Participants	No. of people / entities
Attended Round 1 meeting and provided contact details	247
Contacted the project after Round 1 meetings (may not have attended)	59
Total participants in Round 1	**306**
Round 1 Customers at $1,000/ML upfront	184
Round 1 Customers at $2,000/ML upfront	178

Volumes of minimum, likely and maximum demand at all five prices points were collated. To express demand for water, potential customers were required to complete a four-page EOI. The prices that were presented were as follows.

Table 13.2: Round 1 estimated water prices (subject to change)

Cost to Customer ($/ML)	Very Low	Low	Medium	High (SBC)	Very high
Upfront capital costs (one-off)	1,000	2,000	3,000	4,000	5,000
Fixed annual charge	280	330	400	450	520
Variable annual charge	30	50	70	100	120
Indicative total charge	**310**	**380**	**470**	**550**	**640**

Demand in Round 1 – based on the annual charges presented above and the five up-front customer capital contribution scenarios of $1,000 to $5,000 per ML were as follows.

Table 13.3: Likely demand from Round 1

Scenario	Actual Likely Demand - Round 1 or Round 2 (ML)
Priced at $1,000/ML upfront	49,500
Priced at $2,000/ML upfront	26,700

Engineering Design and Costs based on Round 1 Results

Using the data from Round 1, Jacobs prepared an engineering design and P90 cost estimate of **$160 million**. In the strategic business case, the concept level cost estimated had been about $200 million (plus or minus 30%).

Based on the Round 1, it can be seen that demand drops about 50% between $1,000/ML and $2,000/ML. Furthermore, at capital contributions above $2,000 per ML, demand declines steeply, approaching zero at $5,000/ML.

Accordingly, for Round 2 and assumption was made that 50% government capital grant funding should be sought. There are strong precedents for this in Tasmania, Western Australian and in Queensland for the Granite Belt Irrigation Project. In many cases the Australian Government will provide 50% grant funding and the State Government will provide additional funding. However, for Round 2 government funding was capped at 50% to test a customer willingness to pay.

Based on government grants of 50%, the customers contribution in Round 2 would be **$1,600/ML** up front. The annual charges for Round 2 were $260/ML fixed plus variable charges based on a zone's pumping costs, but averaging $55/ML.

Water Product

Badu Advisory and Jacobs worked with Seqwater to perform hydrologically modelling to describe product characteristics. Over thirty years the average modelled reliability is about 75%. However, due to changing demand from water customers in south east Queensland and allowing for changing climatic conditions, this reliability changes over time. Other aspects of the water product include:

- This is not a water allocation. Rather, it is a 25- or 30-year supply contract with an option to extend.
- The water product will be tradeable.
- The minimum guaranteed pressure is 5 meters of head or 50kpa (7psi) at the outlet.
- The design assumed 50,000 ML delivered over 11 months or 330 days, so flow rates are relatively low.

Round 2 Results

In July and August 2020, a Covid-safe format for Round 2 was conducted, with the following customer statistics.

Table 13.4: Customer statistics for Round 2 demand assessment

Round 2 Participants	No. of people / entities	Portion of Round 2 meeting attendees
Attended Round 2 meetings (in groups of 15-20)	190	100%
Round 2 customer forms received and entered into GIS	152	80%
Net no. withdrawals in Round 2	32	17%
New customers in Round 2 (i.e. no Round 1 demand)	14	7%

In summary, about 190 people participated in Round 2 and 152 submitted non-binding letters of intent. The volumes of demanded – based on the product characteristics and prices provided above – were as follows.

Table 13.5: Round 2 demand

Scenario	Result (ML)
Minimum	25,000
Likely	34,000
Maximum	42,000

In summary, between Round 1 and Round 2 the number of customers fell from 184 to 152. The likely demand fell from 49,000 ML to 34,000 ML – a 31% decline. The qualitative insights that follow provide an explanation.

1) **Capital charge higher than expected –** The 49,000 ML of likely demand in Round 1 was predicated on an upfront capital contribution of $1,000/ML. Round 2's price of $1,600/ML contributed to reducing demand to 34,000 ML. In many cases the farmer had a fixed budget. The increase capital costs led to a reduction in the volume of demand. However, this was not the only reason. We know this because the decrease in demand was more than a linear forecast between Round 1 price points suggested. Additional decreases were due to three other factors below.

2) **Fixed annual charges higher than expected –** Many irrigators realised during Round 2 that the fixed $260/ML component of the annual charges meant that they would pay this whether or not water was delivered. This fact discouraged customers of all sizes. Fixed charges were often identified as a reason for lower demand than Round 1.

3) **Water not available during drought –** There was a perception among some irrigators that the Water Grid would be in drought at precisely the same time that the Lockyer Valley was in drought. Analysis completed by us since Round 2 refutes this, for example, the Water Grid recovers its levels one to two years more quickly than traditional ground water sources in the Lockyer Valley. Water supply from the new pipeline recommences whilst the Lockyer Valley is still in drought recovery / ground water levels are still low.

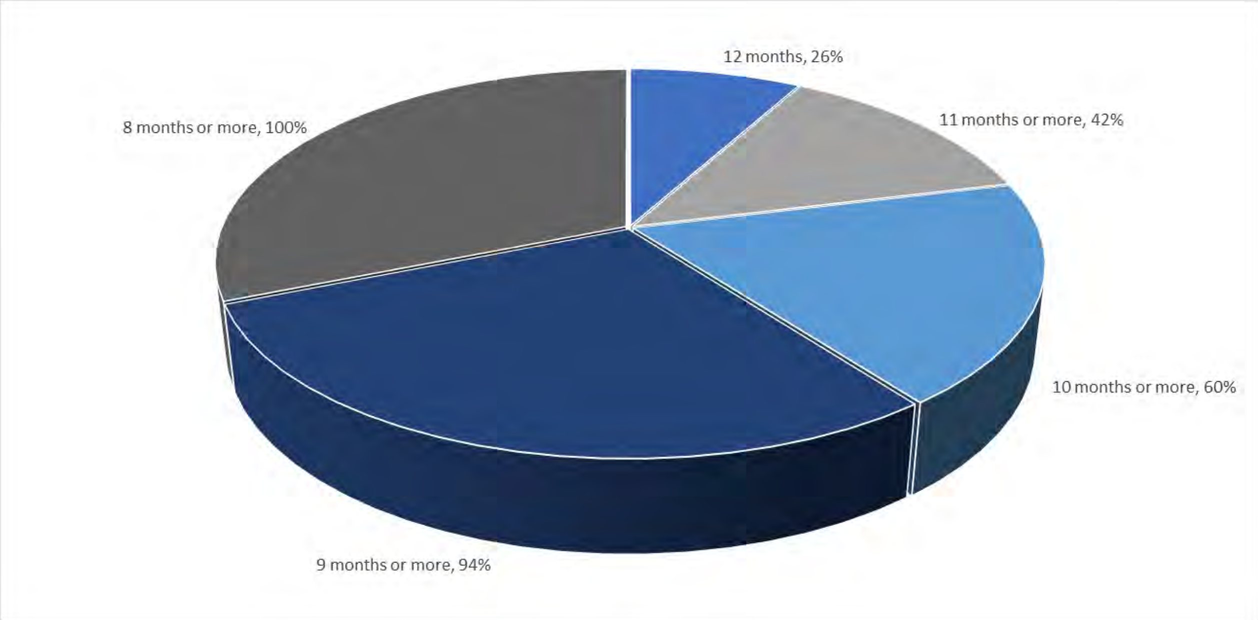
4) **Low flow rates –** The scheme was designed so that its nominal volume could only be delivered over 11 months or 330 days per annum. This minimised capital costs (e.g. pump sizes and pipe diameters are smaller than would be needed to deliver water over a shorter period). Flow rates were lower than expected by some farmers, who reduced their demand due to concerns about the cost of additional on-farm storages. Most customers did not change their demand for this reason and have adequate on farm storage. However, it raised further questions.

Post Round 2 questions on irrigation delivery period / flow rates

After Round 2, an email was sent to prospective customers to explore delivery periods and flow rates. Responses were received from 82% of likely demand. The weighted average irrigation period for the valley is 10 months, ranging from 7 to 12 months. The observations and figure below revealed the best delivery period to match the needs of the valley.

- In summary, an 11-month (330 day) delivery period would meet the irrigation needs of 42% of likely demand.
- The weighted average active irrigation period for the valley of 10 months (300 days) – if this became the basis of scheme design – would meet the needs of 60% of likely demand.
- If irrigators could access their full entitlement over 9 months (270 days) at any point during the 11 months of scheme operation (whole year net of maintenance shutdowns), it would meet the needs of 94% of likely demand.

Figure 13.1: Volumes associated with various active irrigation / delivery periods



The preferred 270-day delivery period has been reflected in the DBC preliminary design (phase two). This version of the reference project will help to ensure future flexibility and tradability exists within the scheme.

Specifically, a 270-day scheme will address the following concerns raised by about one third of customers: Proposed 330-day delivery period should be shorter to reduce risk of not getting total allocation of water when unable to take water for two or more months (e.g. during flood or rainy season December to February); and Proposed low flow rates should be higher to increase operational flexibility for those not able to water 24 hours per day (smaller farms).

Impact on demand of higher flow rates

Some irrigators expressed the view that a shorter delivery period would materially increase demand. While this may ultimately prove to be the case at water sales, the data collected post-Round 2 does not strongly support the claim.

Rather, with a delivery period better aligned to active irrigation the data suggests a modest (3%) increase in demand may be elicited by higher flow rates, as long as the water is available 11 months of the year.

Table 6: Change in demand if delivery period was shorter to match active irrigation

Item	Result
Portion of respondent likely demand that increased if delivery period shortened (%)	3.2%
Extrapolated increase in 'likely demand' if delivery period shortened (ML) - Forecast	1,064
Extrapolated 'likely demand' if delivery period shortened - Rounded (ML)	35,000

Round 3 forecast – Potential further reductions in demand

Experience in other jurisdictions in the past ten years has shown that at binding water sales, demand may fall (relative to non-binding demand). A rule of thumb is:

- Up to 10% reduction in likely demand if confidence is high
- Up to 20% reduction in likely demand if confidence is moderate
- Up to 30% reduction in likely demand if confidence is low.

Jacobs considers confidence in the Lockyer Valley to be moderate. The level of commercial 'belief' in a scheme changes over time. It is a function of the quality of the project delivery team, communications and macro-conditions (including weather and economic activity).

However, heuristically this observation suggests that with a 3% increase in likely demand to 35,000 ML (and assuming $1,600/ML and similar annual charges), Round 3 demand may fall to 28,000-31,000ML. This is an uncertain forecast.

The potential reduction highlights the need for clarity around drought performance of the scheme and a professionally managed process that provides customers confidence that the project will be delivered as agreed.

To mitigate the risk of demand falling, government may consider increased funding to enable the capital charge to be $1,500/ML (rather than $1,600/ML) and increase the investment in solar, resulting in lower annual charges. Such considerations are a matter for discussion between the Collaborative and the relevant levels of government.

13.2 Introduction

13.2.1 Demand assessment process

Jacobs was engaged to undertake a detailed business case (DBC) for the Water for the Lockyer Project. A key part of a strong DBC is demand assessment that assesses whether a scheme has customers and private sector investors. There are three parts to a comprehensive real-world demand assessment:

1) Round 1: Expression of Interest (EOI) (non-binding), which was the topic of a previous report

2) Round 2: Letter of Intent (LOI) (non-binding), which is the topic of this report

3) Round 3: Water sales (legally binding), which would occur post-DBC assuming this project proceeds.

This is consistent with DNRME's demand assessment guidelines, which appear to align with our long-demonstrated practices. That is, our demand assessment is comprehensive and drives engineering design (not the reverse).

13.2.2 Summary of our process for Round 2

13.2.2.1 Stakeholder engagement

The Round 2 process featured the following:

- Working group held seven half-day workshops to prepare during Covid-stay-at-home period from April to June 2020
- Prepared materials and set dates in May and June 2020 and advertised Covid-safe meetings in mid-June 2020
- Invited 300 people directly via emails gathered in Round 1 and registered about 200 attendees
- Over 2 weeks, held about 14 meetings from 22 to 30 June 2020
- Due to the need to hold these meetings in accordance with a Covid safe delivery plan, no more than twenty people attended each meeting.
- Jacobs presented detailed product and price information during those presentations and showed the scheme layout on massive hard copy A1 maps and on the GIS- engineering interactive webmap on a large screen
- Over 300 emailed copies of the information document and non-binding letter of intent form were sent at the end of week 1 of meetings on 26 June 2020
- Jacobs and the working group facilitated many positive and some challenging discussions

- Provided hard copies and electronic copies of product and price information and non-binding letter of intent form to all 300 emails on data base, to the 200 registered attendees and anyone else who approached the project team
- The documents were also made available on the Collaborative website late in June 2020
- Minimum demand was 20ML (otherwise the cost of connection can exceed a customer's capital contribution).

13.2.3 Post Round 2 data management

- The project team allowed a month for responses (the model was locked it off at COB Monday 3 August). All individual data was and remains confidential. Only aggregated information is reported. Final EOIs (including several late responses) were entered into a comprehensive data base by 31 August 2020, which took approximately 300 hours.
- Jacobs contacted at least 70 people individually via phone or email who had participated in Round 1 but had not as yet responded to Round 2. There were also 32 other participants that withdrew from the project. Of these, there were 25 that either actively reached out or were contacted by Jacobs who no longer believed that the project was feasible for them at it had, in many cases, become too expensive at the Round 2 prices.
- Since that time there have been about five additional prospective customers approach, with a total volume of approximately 500ML, which does not change the rounded 34,000 ML result. Overall, there was very strong support for the process and project.

13.3 Round 1 Results Recap

In February and March 2020, the Round 1 demand assessment was conducted.

13.3.1 Participation

After advertising in local media, the project attracted strong participation at six community meeting spread geographically from the lower to the upper Lockyer Valley.

Over 300 people attended these meetings, providing email and mobile contact details, which were later used to send out Round 1 Expression of Interest forms and supporting product and price scenarios. The customer statistics for Round 1 were as follows.

Table 13.7: Customer statistics for Round 1 demand assessment

Participants	No. of people / entities
Attended Round 1 meeting and provided contact details	247
Contacted the project after Round 1 meetings (may not have attended)	59
Total participants in Round 1	**306**
Round 1 Customers at $1,000/ML upfront	184
Round 1 Customers at $2,000/ML upfront	178

13.3.2 Demand

Volumes of minimum, likely and maximum demand at all five prices points were collated. To express demand for water, potential customers were required to complete a four-page EOI. The prices that were presented were as follows.

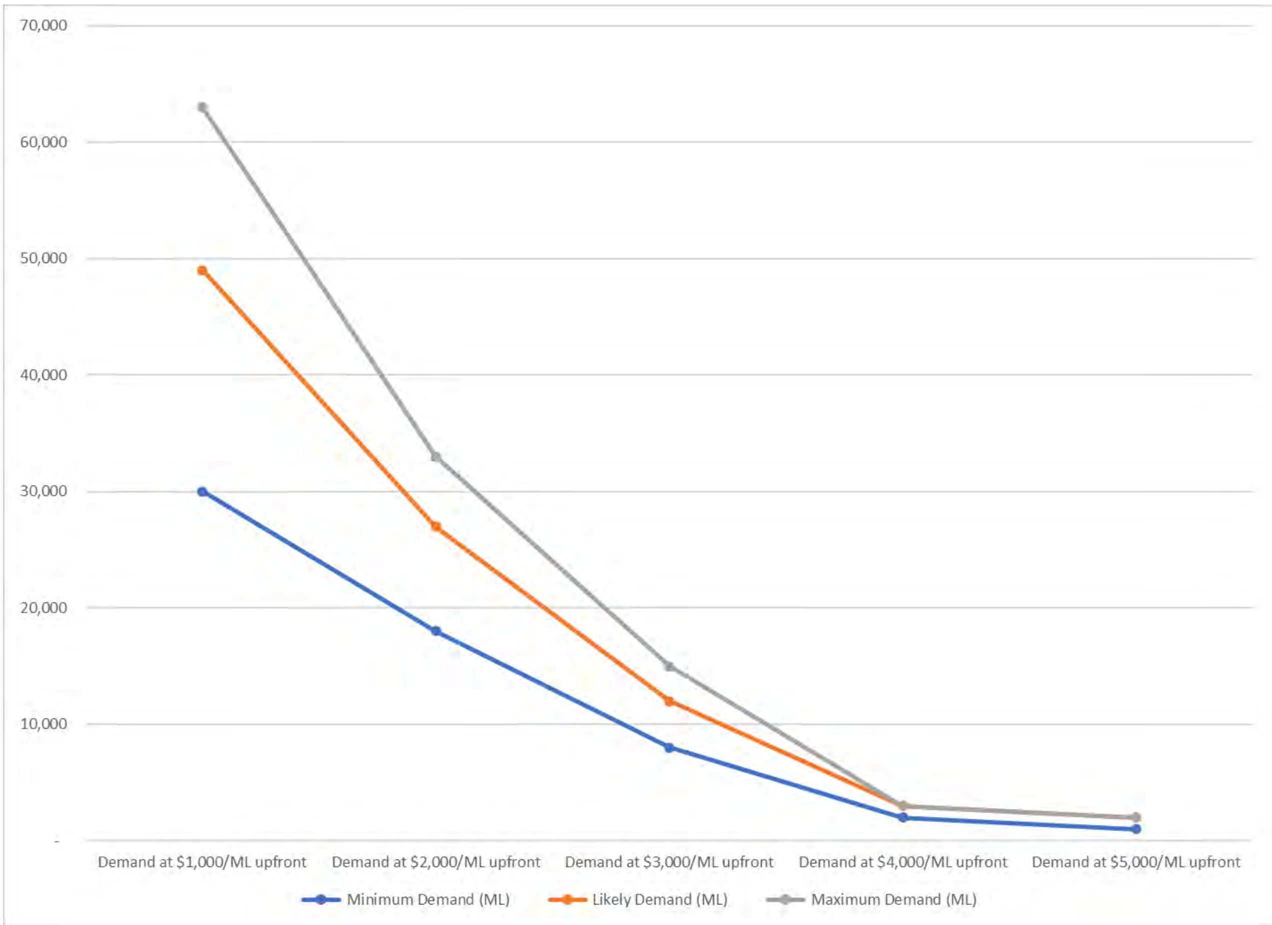
Table 13.8: Round 1 estimated water prices (subject to change)

Cost to Customer ($/ML)	Very Low	Low	Medium	High (SBC)	Very high
Upfront capital costs (one-off)	1,000	2,000	3,000	4,000	5,000

Fixed annual charge	280	330	400	450	520
Variable annual charge	30	50	70	100	120
Indicative total charge	**310**	**380**	**470**	**550**	**640**

Demand in Round 1 – based on the annual charges presented above and the five up-front customer capital contribution scenarios of $1,000 to $5,000 per ML were as follows.

Figure 13.2: Round 1 demand



13.4 Engineering Design and Costs and Prices

13.4.1 Connections

Using the data from Round 1, Jacobs prepared a detailed web-based map that plotted demand locations and volumes for all 184 potential customers of the scheme. The engineers were asked to connect as many properties as possible.

Only eight properties could not be connected due to cost (i.e. were 4km or more from the nearest pipeline as designed). The owners of all eight blocks enjoyed one-on-one discussions to resolve their connection and most participated in Round 2 in a manner informed by those discussions. Solutions included increased demand at the outlier block to make it viable to connect or focus their demand on a block within the viable scheme design area.

13.4.2 Customer capital contribution for Round 2

This resulted in a Post Round 1 engineering design and P90 cost estimate of **$160 million**. In the strategic business case, the concept level cost estimated had been about $200 million (plus or minus 30%), so this P90 estimate is consistent.

Based on the Round 1, it can be seen that demand drops about 50% between $1,000/ML and $2,000/ML. Furthermore, at capital contributions above $2,000 per ML, demand declines steeply, approaching zero at $5,000/ML.

Accordingly, for Round 2 and assumption was made that 50% government capital grant funding should be sought. There are strong precedents for this in Tasmania, Western Australian and in Queensland for the Granite Belt Irrigation Project. In many cases the Australian Government will provide 50% grant funding and the State Government will provide additional funding. However, for Round 2 government funding was capped at 50% to test a customer willingness to pay.

Based on government grants of 50%, the customers contribution in Round 2 would be **$1,600/ML**.

13.4.2.1 Timing of upfront charge communicated to customers

$1,600 per ML one-off to own the water right comprised of:

1) 2% ($32/ML) deposit when you sign a water sales contract (say early to mid-2021)

2) 8% ($128/ML) deposit when government green light (say late 2021)

3) 90% ($1,440/ML) upon practical completion of scheme (say 2024).

13.4.3 Annual charges for Round 2

The annual charges for Round 2 were $260/ML fixed plus variable charges based on a zone's pumping costs.

Table 13.9: Annual charges for Round 2 demand assessment (net of solar revenue)

Tariff No.	Name of Tariff and Areas in Zone	Fixed – Part A, B & C ($/ML pa)	Variable – Part D ($/ML)	Total - Annual charge ($/ML)
1	Wivenhoe, Lockyer Creek and Patrick Estate	260	11	271
2	Atkinson, Buaraba, Brightview, Glenore Grove, Crowley Vale, Morton Vale Pipeline	260	25	285
3	Gatton, Lawes, Forest Hill, Redbank Creek and Lake Dyer	260	39	299
4	South Gatton, Grantham, Lower Tenthill and Winwill	260	50	310
5	Lake Dyer, Laidley South to Mulgowie	260	53	313
6	Mulgowie to Thornton	260	68	328
7	Upper Tenthill, Caffey to Mt Sylvia	260	67	327
8	Mt Sylvia to Woodbine	260	82	342
9	Ma Ma Creek to Mount Whitestone	260	61	321
10	Carpendale, Lilydale, Flagstone Creek, Helidon and Withcott	260	64	324

13.5 Water Product

Badu Advisory and Jacobs worked with Seqwater to perform hydrologically modelling to describe product characteristics.

13.5.1 Reliability

Over thirty years the average modelled reliability is about 75%. However, due to changing demand from water customers in south east Queensland and allowing for changing climatic conditions, this reliability changes over time. For Round 2 discussions it was assumed that the scheme takes 50GL per annum and customers use 90% of water:

- Reliability at the start of the scheme is 94% (e.g. 2023)
- Reliability falls to about 52% twenty years later (e.g. by 2043)
- If Seqwater builds another source of water for SEQ, reliability is forecast to quickly rise to 78% (e.g. around 2044), after which reliability declines prior to future augmentations of Seqwater's bulk supplies.

13.5.2 Other water product attributes

- Other aspects of the water product include:
- This is not a water allocation. Rather, it is a long-term supply contract. The length of the water supply contract will be 25 or 30 years with an expected option to extend for same period (i.e. another 25 or 30 years).
- At the end of the first term, irrigators will have the option to extend the supply contract for the same period. The State Government would decide. Seqwater and the scheme operator will be key parties to the discussion.
- The water product will be tradeable. Customers will be able to do temporary or permanent trades.
- The minimum guaranteed pressure is 5 meters of head or 50kpa (7psi) at the outlet. This will be a function of the outlet's position on the pipeline. Some properties may receive up to 50 meters head or 500 kpa (70psi).
- The design assumes 50,000 ML delivered over 11 months or 330 days (averaging 152 ML per day capacity). So, flow rates are relatively low. They are equivalent to a customer's nominal volume divided by 330 days (24 hours/day).

13.6 Round 2 Results

13.6.1 Participation

In mid-2020, during the Covid-19 pandemic, the Water for the Lockyer Working Group and Jacobs conducted seven half-day teleconferences to prepare for Round 2. A Covid-safe format and dates were decided, and advertisements placed in local media calling all farmers in the Lockyer – regardless of their participation – to attend a detailed briefing on the water product, costs and prices that had been developed on the basis of the Round 1 results.

The following are the customer statistics for participation in Round 2.

Table 10: Customer statistics for Round 2 demand assessment

Round 2 Participants	No. of people / entities	Portion of Round 2 meeting attendees
Sent invitation to Round 2 meetings	314	
Attended Round 2 meetings (in groups of 15-20)	190	100%
Round 2 customer forms received and entered into GIS	152	80%
Jacobs contacted one-on-one via phone and email towards end of Round 2 (participated in Round 1 but had not responded Round 2)	70	37%
Net no. withdrawals in Round 2	32	17%
Customers who actively communicated their Round 2 withdrawal	25	13%
New customers in Round 2 (i.e. no Round 1 demand)	14	7%

In summary, about 190 people participated in Round 2 and 152 submitted non-binding letters of intent.

13.6.2 Demand

The volumes of demanded – based on the product characteristics and prices provided above – were as follows.

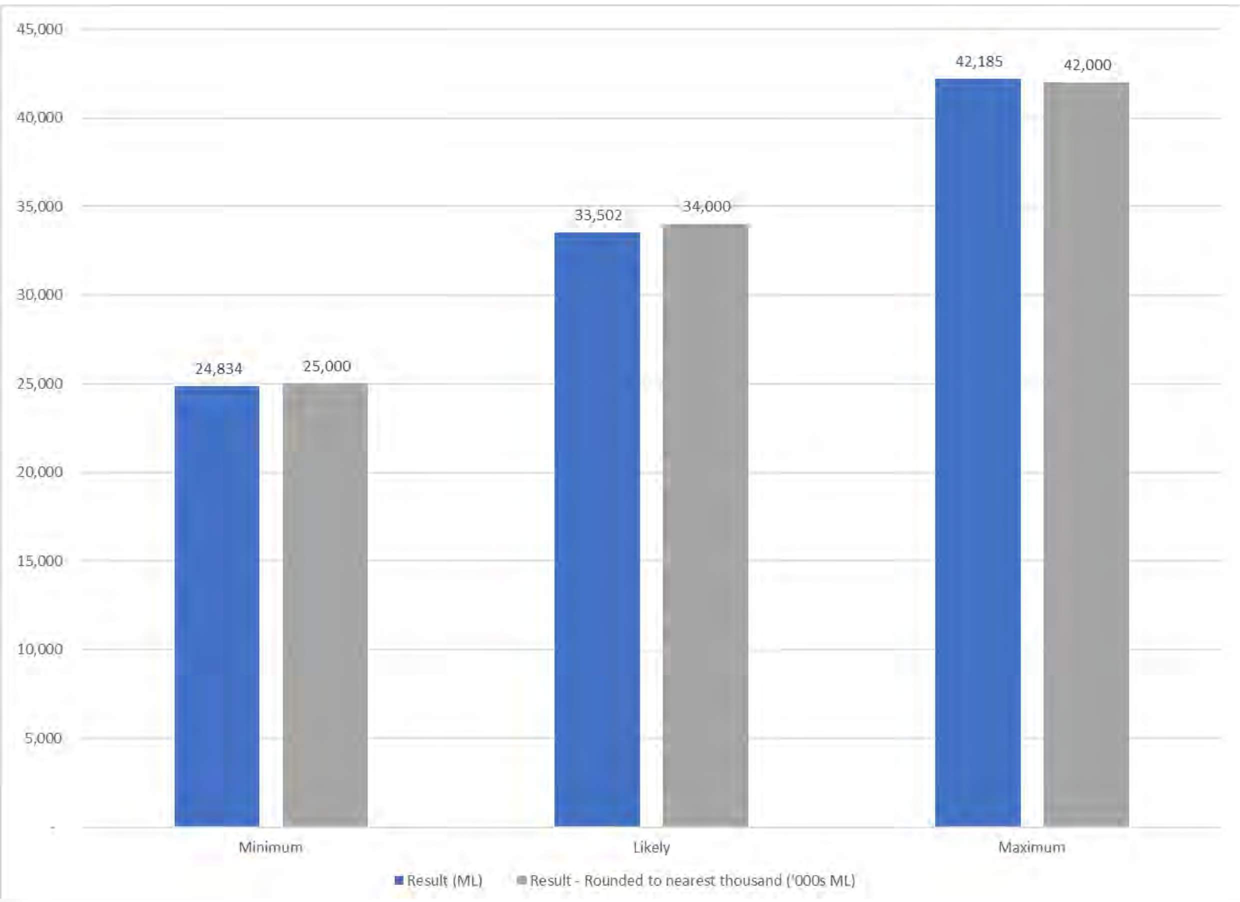
Figure 3: Round 2 demand

Round 2 Demand	Result (ML)
Minimum	25,000
Likely	34,000
Maximum	42,000

In summary, between Round 1 and Round 2 the number of customers fell from 184 to 152. The likely demand fell from 49,000 ML to 34,000 ML – a 31% decline.

The following figure shows actual and rounded demand from Round 2. Rounded data was used to inform the final engineering design and costs. This decision was considered sensible because, for example, about 500ML of likely demand materialised from five prospective customers after the demand model was locked down on 3 August 2020.

Figure 13.4: Round 2 demand



13.6.3 Customer size

The follow table provides an understanding of the concentration of demand.

Table 13.11: Concentration of demand

Top No. of Customers	Cumulative Likely Demand (ML)	Portion of Likely Demand
Top 5 customers	7,800	23%
Top 10 customers	11,815	35%
Top 20 customers	17,325	52%
Top 25 customers	19,415	58%
Top 50 customers	25,640	77%
Top 100 customers	31,687	95%
Top 125 customers	32,852	98%
Total 152 customers	33,492	100%

The customer base is not top heavy, but there is a tail of small customers. Observations include:

1) The Top 25 customers account for 58% of likely demand

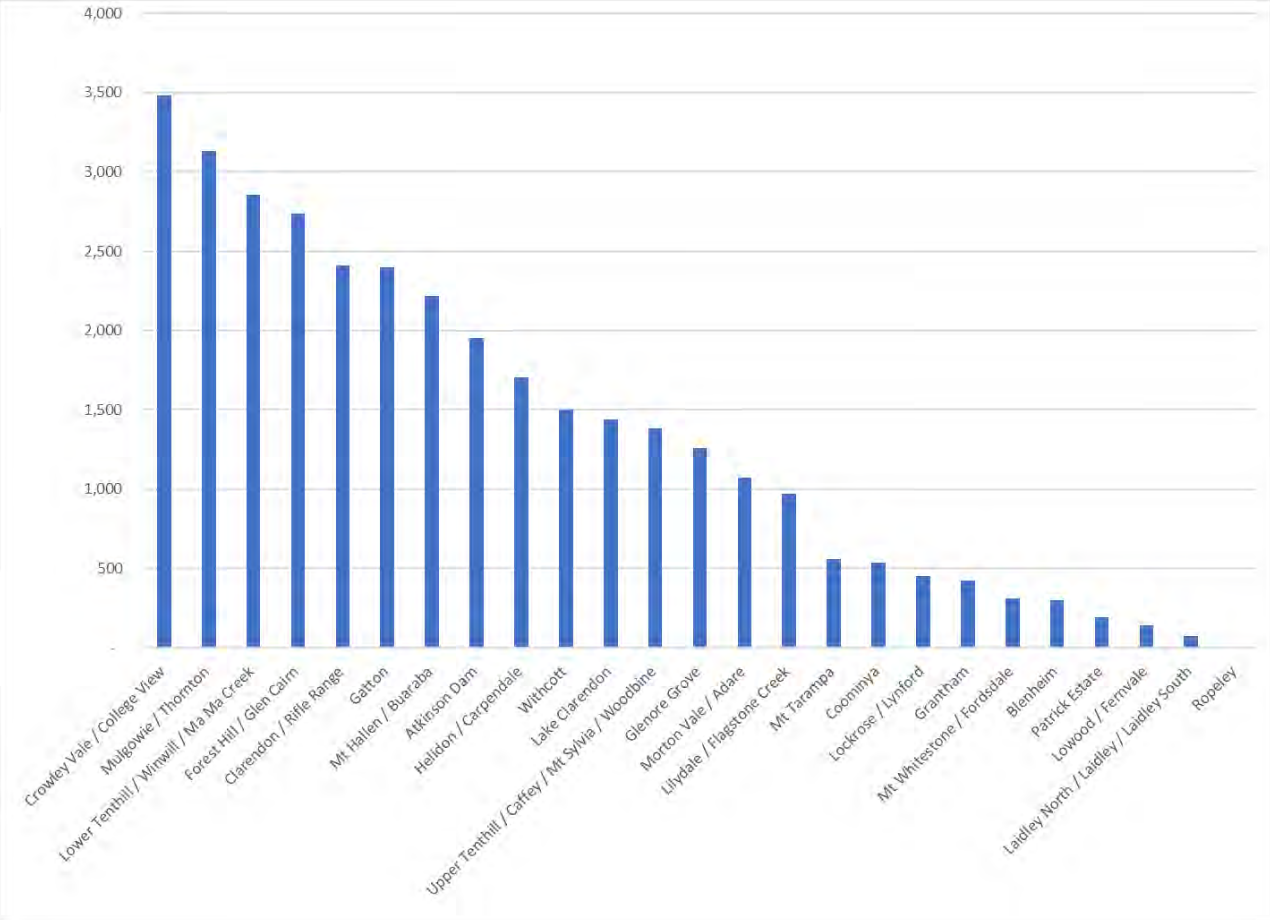
2) The Top 50 customers account for 77% of likely demand

3) The Top 100 customers account for 95% of demand. So clearly the final 52 customers only account for 5% of demand.

13.7 Location of demand

Demand is distributed from lower to upper Lockyer. This figure valley areas from high to low likely demand volumes.

Figure 13.5: Likely Round 2 demand by indicative area of the Lockyer Valley



The share of demand by area is presented in this table.

Table 13.12: Likely demand by area of the valley and share of total likely demand

Demand by zone	Likely demand at $1,600/ML upfront (ML)	Share of likely demand
Crowley Vale / College View	3,480	10%
Mulgowie / Thornton	3,130	9%
Lower Tenthill / Winwill / Ma Ma Creek	2,857	9%
Forest Hill / Glen Cairn	2,740	8%
Clarendon / Rifle Range	2,410	7%
Gatton	2,400	7%
Mt Hallen / Buaraba	2,220	7%
Atkinson Dam	1,955	6%
Helidon / Carpendale	1,705	5%
Withcott	1,500	4%
Lake Clarendon	1,440	4%
Upper Tenthill / Caffey / Mt Sylvia / Woodbine	1,380	4%
Glenore Grove	1,260	4%
Morton Vale / Adare	1,070	3%
Lilydale / Flagstone Creek	970	3%
Mt Tarampa	560	2%

Coominya	535	2%
Lockrose / Lynford	450	1%
Grantham	425	1%
Mt Whitestone / Fordsdale	310	1%
Blenheim	300	1%
Patrick Estate	190	1%
Lowood / Fernvale	140	0.4%
Laidley North / Laidley / Laidley South	75	0.2%
Ropeley	-	0.0%
Total	**33,502**	**100%**

13.8 Insights from Round 2

The qualitative insights that follow provide a summary of the explanations provided by many of the participants on their written Letter of Intent forms and in over 70 conversations held in person or via telephone during Round 1.

13.8.1 Small customer numbers reduced

Most customers who withdrew from participation (46 customers = 32 net of the 14 new customers) were small demand customers who sought 20-50ML in Round 1. They generally commented that the water was too expensive. Many of these small customers who withdrew were nearing retirement and/or not farming commercially. This means that their farm revenue may not have justified an investment in water, especially given the relatively high annual fixed charges.

The reduction in small customers, however, offers the project two savings: operating cost saving due to a reduced billing and meter reading for 152 customers; and a potential capex saving as outlet/meter costs are material.

Other customers who continued to participate in Round 2, reduced the volume of their demand for the reasons below.

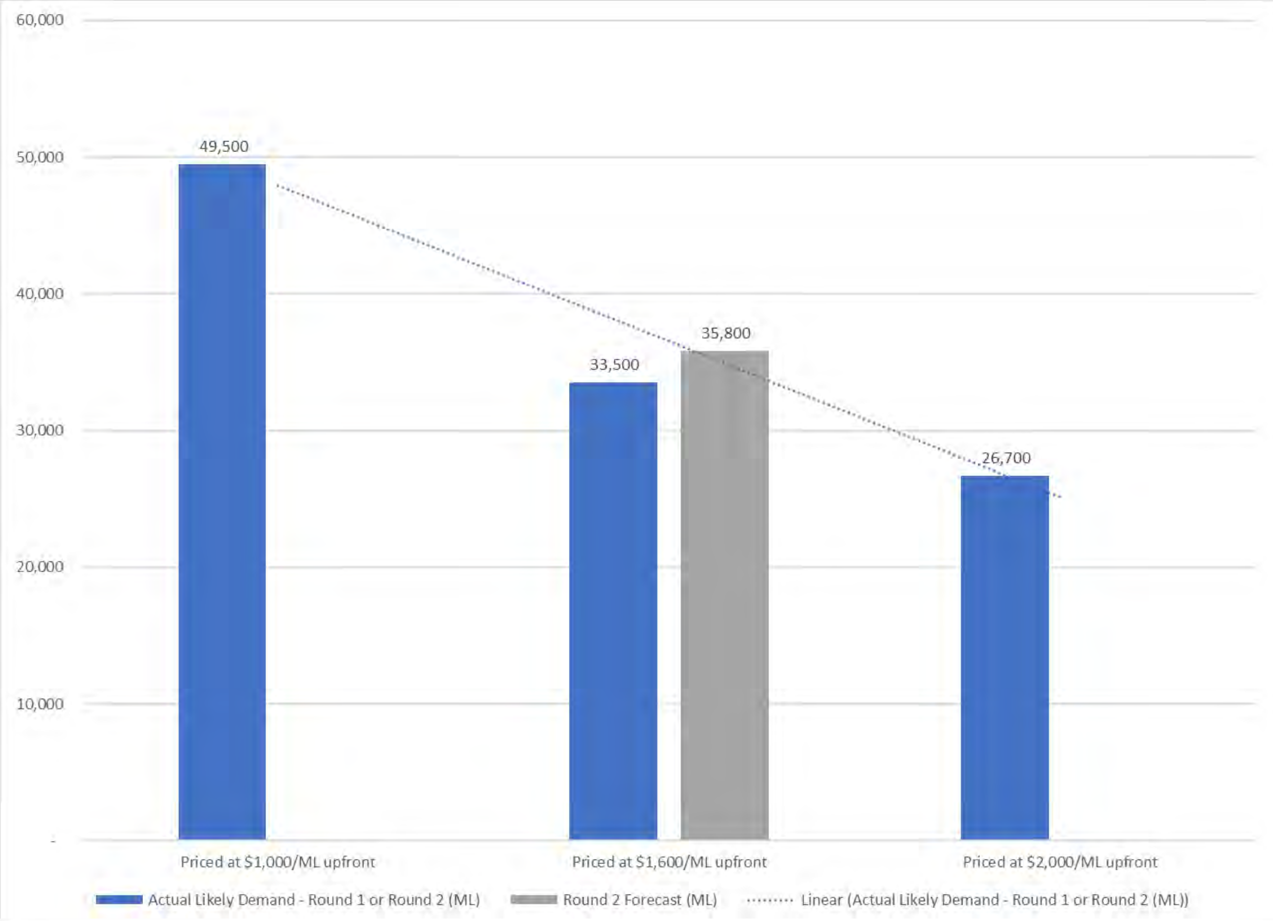
13.8.2 Why did Round 2 demand decline?

Round 2 results can be explained by the following key / qualitative observations:

1) **Capital charge higher than expected –** The 49,000 ML of likely demand in Round 1 was predicated on an upfront capital contribution of $1,000/ML. Round 2's price of $1,600/ML contributed to reducing demand to 34,000 ML. In many cases the farmer had the same fixed dollar budget in mind for Round 1 and 2. The increase capital costs led to a reduction in the volume of demand.

   However, this was not the only reason. We know this because the decrease in demand was more than a linear forecast between Round 1 price points suggested (see figure below).

Figure 13.6: Forecast and actual Round 2 demand in context of Round 1 results



Additional reductions (or the non-linear) decrease in demand may be attributable to the three other factors below.

2) **Fixed annual charges higher than expected –** Many irrigators realised during Round 2 that the fixed $260/ML component of the annual charges meant that they would pay this whether or not water was delivered. This fact discouraged customers of all sizes. Fixed charges were often identified as a reason for lower demand than Round 1.

3) **Water not available during drought –** There was a perception among some irrigators that the Water Grid would be in drought at precisely the same time that the Lockyer Valley was in drought. It was considered that when farmers in the Lockyer needed water most, no water would be available from the new pipeline.

   Analysis completed by us since Round 2 – documented in the DBC – refutes this to a material degree. For example, the Water Grid (e.g. Wivenhoe Dam) recovers its levels one to two years more quickly than traditional ground water sources in the Lockyer Valley. This means that the water supply from the new pipeline recommences whilst the Lockyer Valley is still in drought or drought recovery (i.e. while ground water levels are still low).

   In hindsight, this and other water security benefits will need to be communicated effectively during binding water sales, to assist in clarifying this product characteristic.

4) **Low flow rates –** The scheme was designed so that its nominal volume could only be delivered over 11 months or 330 days per annum (i.e. at relatively low flow rates). This approach was adopted in the concept and preliminary design (phase one) to minimise capital costs (e.g. keep pump sizes and pipe diameters smaller than would be needed deliver water a shorter period). By contrast, many schemes in Australia – with

only a summer growing season – are designed to delivery water over a six month or 180-day period, resulting in higher flow rates.

Flow rates were lower than expected by some farmers and when, during Round 2, this was made explicit a minority of customers reduced their demand due to concerns about the cost that they would need to incur to develop additional on-farm storages.

The majority of customers had understood this implicitly during Round 1 and did not change their demand for this reason, noting that they had adequate on farm storage. Nevertheless, this issue was a focus for the working group and subsequent questions were asked of participants in Round 2.

13.9 Post Round 2 questions on irrigation delivery period / flow rates

13.9.1 Questions

Dear Customer

Thanks for participating in Round 2 Demand Assessment. Although we were aiming for 45,000 ML, the likely demand is currently 34,000 ML (Maximum 42,000 ML). This is a strong result, and the project is likely to proceed.

However, we have these four follow-up questions for you:

1. How many months of the year will you actively irrigate (incl. with water from this project) (e.g. 6, 7, 8, 9, 10 or 11 months)?
2. In which months of the year do you irrigate very little or zero (e.g. June, July and August)?

If we reduced delivery period to say (210 days, 240 days or 270 days). Assume upfront charge = $1,600 per ML.

3. How many ML did you ask for in Round 2 (middle number / likely demand)?
4. How many ML would you ask for if the flow rates were higher, that is, the delivery period matched your answer to Question

Please let us know quickly by responding to this email.

13.9.2 Participation

Subsequent to Round 2, an email was sent to about 160 participants in Round 1, including 152 customers and eight additional prospective customers who has indicated withdrawal for reasons that may have including flow rates. The response rate to this structured email survey was statistically significant and yielded the following results.

Table 13: Response level to follow up questions

Respondents to extra questions	Result
What portion of likely demand responded to survey in volumetric terms	82%
How many customers responded	90
How many likely ML provided this response (out of 34,000 ML)	27,395

With 82% of likely demand represented the following results were noteworthy.

13.9.3 Lockyer valley active irrigation

Firstly, that the weighted average irrigation period for the valley is 10 months, but this ranged from 7 months to 12 months depending on the business.

Table 13.14: No. of enterprises with different delivery period requirements

No. of respondents who actively irrigate for:	No. of respondents / enterprises
12 months	19
11 months	16
10 months	22
9 months	19
8 months	12
7 months or less	2
Total	90

13.9.4 Lockyer valley delivery period to match irrigation activity

The observations and figure below provided insights into the best delivery period to match the needs of the valley.

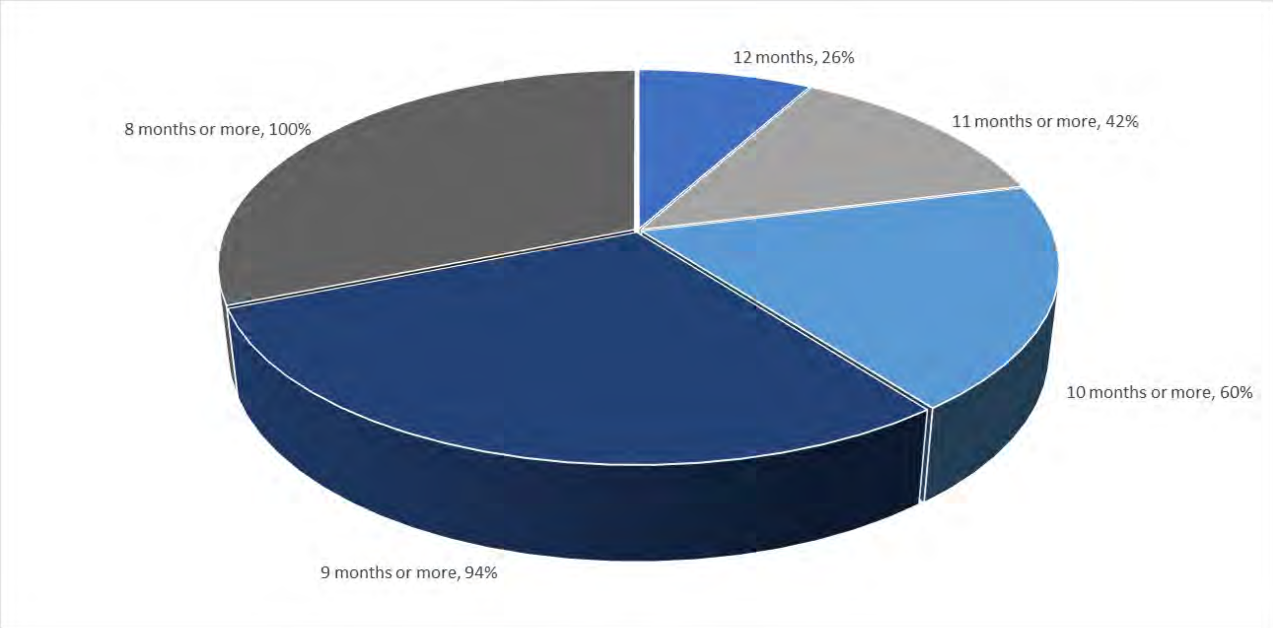
- In summary, an 11-month (330 day) delivery period would meet the irrigation needs of 42% of likely demand.
- The weighted average active irrigation period for the valley of 10 months (300 days) – if this became the basis of scheme design – would meet the needs of 60% of likely demand.
- If irrigators could access their full entitlement over 9 months (270 days) – but at any point during the 11 months of scheme operation (i.e. whole year net of maintenance shutdowns) – this meet the irrigation needs of 94% of likely demand.

The preferred 270-day delivery period has been reflected in the DBC preliminary design (phase two). This version of the reference project will help to ensure future flexibility and tradability exists within the scheme.

Specifically, a 270-day scheme will address the following concerns raised by about one third of customers:

- Proposed 330-day delivery period should be shorter to reduce risk of not getting total allocation of water when unable to take water for two or more months (this can occur during flood or rainy season December to February)
- Proposed low flow rates should be higher to increase operational flexibility for those seeking to directly irrigate from the pipeline (which is possible in certain locations) or for those not able to water 24 hours per day (smaller farms).

Figure 13.7: Volumes associated with various active irrigation / delivery periods



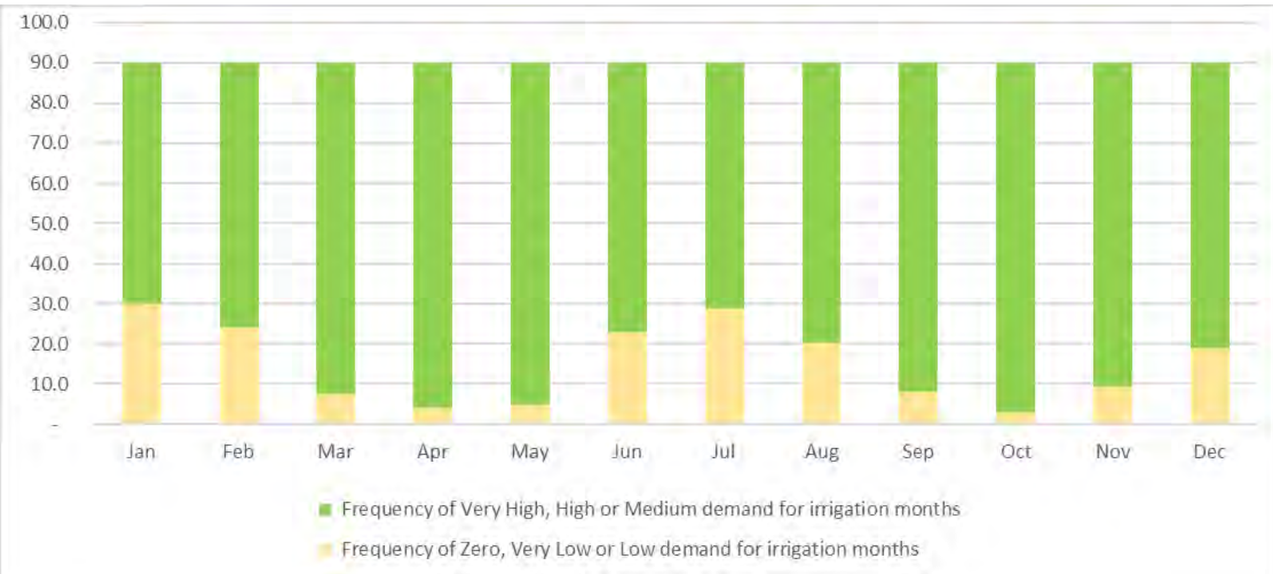
13.9.4.1 Active irrigation and low irrigation months

Another interesting set of observations emerged from this post Round 2 survey. There are two periods (not one) of relatively lower irrigation activity in the valley:

- Winter (as expected) from June to August
- Summer (during higher rainfall, the holidays and/or farms that do not summer crop) from December to February.

The following figure shows the active and inactive irrigation months forecast by 82% of likely demand.

Figure 13.8: Active and inactive irrigation months in the Lockyer Valley



Given this moderate seasonality of water use in the Lockyer Valley, another opportunity identified in the qualitative responses provide by customers was that some, who have traditionally not double cropped, will use the new water to introduce irrigated summer cropping (a second crop per year for the first time. This has been conservatively captured in the economic benefits assessment.

13.9.5 Impact on demand of higher flow rates

A minority of vocal irrigators expressed the view that a shorter delivery period would materially increase demand. While this may ultimately prove to be the case during Round 3 binding water sales, the data collected post-Round 2 does not strongly support the claim.

Rather, with a delivery period better aligned to active irrigation the data suggests a modest (3%) increase in demand may be elicited by higher flow rates, as long as the water is available (albeit it at a faster rate) for any 11 months of the year.

Table 13.15: Change in demand if delivery period was shorter to match active irrigation

Item	Result
Respondent's stated increase in likely demand if delivery period shortened (ML) – Actual responses to survey	870
Portion of respondent likely demand that increased if delivery period shortened (%)	3.2%
Extrapolated increase in 'likely demand' if delivery period shortened (ML) - Forecast	1,064
Extrapolated 'likely demand' if delivery period shortened (ML)	34,566
Extrapolated 'likely demand' if delivery period shortened - Rounded (ML)	35,000

13.9.6 Round 3 forecast – Potential further reductions in demand

Experience in other jurisdictions in the past ten years has shown that at binding water sales, demand may fall (relative to non-binding demand). A rule of thumb is:

- Up to 10% reduction in likely demand if confidence is high
- Up to 20% reduction in likely demand if confidence is moderate
- Up to 30% reduction in likely demand if confidence is low.

Jacobs considers confidence in the Lockyer Valley to be moderate. The level of commercial 'belief' in a scheme changes over time. It is a function of the quality of the project delivery team, communications and macro-conditions (including weather and economic activity).

However, heuristically this observation suggests that with a 3% increase in likely demand to 35,000 ML (and assuming $1,600/ML and similar annual charges), Round 3 demand may fall to 28,000-31,000ML. This is an uncertain forecast.

The potential reduction highlights the need for clarity around drought performance of the scheme and a professionally managed process that provides customers confidence that the project will be delivered as agreed.

To mitigate the risk of demand falling, government may consider increased funding to enable the capital charge to be $1,500/ML (rather than $1,600/ML) and increase the investment in solar, resulting in lower annual charges. Such considerations are a matter for discussion between the Collaborative and the relevant levels of government.

14. Economic analysis

14.1 Key points

- A cost-benefit analysis was undertaken on the scheme in comparison to the base case, capturing the economic impacts for a detailed business case level assessment.
- Key benefits for the scheme include increased water availability and reliability that increases irrigated agricultural and other primary production.
- Benefit-cost ratios (BCRs) and net present values (NPVs) were generated.
- The results of the economic analysis as an NPV and BCR using P50 and P90 risk-adjusted costs at a 7% discount rate are shown in **Table 14.1**.

Table 14.1: Economic NPV ($ million) and BCR – P50 and P90 risk adjusted costs

Item	P50	P90
Total benefits ($ millions)	304.5	304.5
Total costs ($ millions)	231.7	244.5
Net benefits NPV ($ millions) @ 7% real discount rate	**72.8**	**60.1**
BCR @ 7% real discount rate	**1.31**	**1.25**

- The BCR of the scheme using P50 and P90 risk-adjusted costs are above 1 which indicates that the economic benefits of the scheme outweigh the costs.
- The sensitivity analysis suggests that the BCR is robustly above one as there is no sensitivity analysis where the BCR is below one. The lowest BCR of 1.07 is with net margins that are 80% of the expected value while the higher BCR is 1.56 due to net margins being 120% of calculated net margin.
- The scheme will produce an additional annual agricultural production of $209.8 million, 373 jobs during construction and 1,923 permanent jobs in agriculture and supporting industries.

14.2 Approach

The economic analysis develops a coherent socio-economic narrative of the qualitative and quantitative costs and benefits of the proposal. It is supported by a robust and transparent cost benefit analysis (CBA) and social impact evaluation (SIE).

The goal of economic analysis that is aligned with the Building Queensland's Detailed Business Case framework is to document the economic merit of the option.

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

- identify all cash flows to be considered for the scheme
- 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, in terms of both the benefit-cost ratio (BCR) and net present value (NPV) of the scheme relative to the base case.

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

The general parameters and assumptions include model start year, assessment period and discount rates. The starting year and assessment period are shown in Table 20.1.

Table 14.2: Starting year and assessment period

Parameter	Unit	Value
Starting year	Year (period)	2021
Assessment period	Number of years	30

Discount rate scenarios, with the medium scenario (7% real) being the central scenario, are shown in Table 14.3.

Table 14.3: Discount rate scenarios

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

14.3 Base case

The base case for the scheme is outlined in the Base Case and Service Need chapters. In addition, the economic analysis integrates the likely substitution of some existing rainfed agriculture to irrigated agriculture as customers move to higher value production facilitated by the commissioning of the scheme. The opportunity cost analysis is shown in Section 14.5.1.5.

14.4 Economic benefits

The economic benefits of the pipeline are calculated based on key inputs:

- Demand assessment – how much water is demanded by customers
- Reliability of the water product – how much water will customers likely receive per year
- Likely water use – how water will be used for which crop
- Net margin of water use – how much economic value will be generated by each ML of water used by customers.

The three inputs are detailed in the following sections.

14.4.1.1 Demand assessment

A detailed – two round demand assessment has been undertaken to determine the demand from potential irrigators. This has been undertaken in accordance with DNRME's Assessing Demand for Water: Guidance for Project Proponents. The full demand assessment is detailed in Chapter 13.

Two demand assessments have been undertaken as part of this DBC:

4) Round 1: Expression of Interest (non-binding)
5) Round 2: Letter of Intent (non-binding)

The volumes of demand from the Round 2 assessment is shown below.

Table 14.4: Round 2 demand

Round 2 Demand	Result (ML per annum)
Minimum	25,000
Likely	**34,000**
Maximum	42,000

The likely demand of 34,000ML per annum is, therefore, used for the purpose of estimating economic costs and benefits. A scenario analysis is also undertaken for a 42,000ML scheme.

14.4.1.2 Water reliability

Jacobs worked with Seqwater to perform hydrological modelling to describe product characteristics. The scenarios tested, relevant to 34,000 ML of demand are shown in the following table.

Table 14.5 : Hydrology assumptions

Modelling year	Annual Demand (ML)	Climate Year	Urban Demands for Year
2025	34,000	2030	2025
2043	34,000	2050	2043
2044	34,000	2050	2025
2061	34,000	2050	2043

Seqwater advised that 2044 urban demand would be like 2025 demand as Seqwater plans to augment its water supply sources so that the demand and supply relationship in 2044 is like 2025. Further information is available in Appendix E.

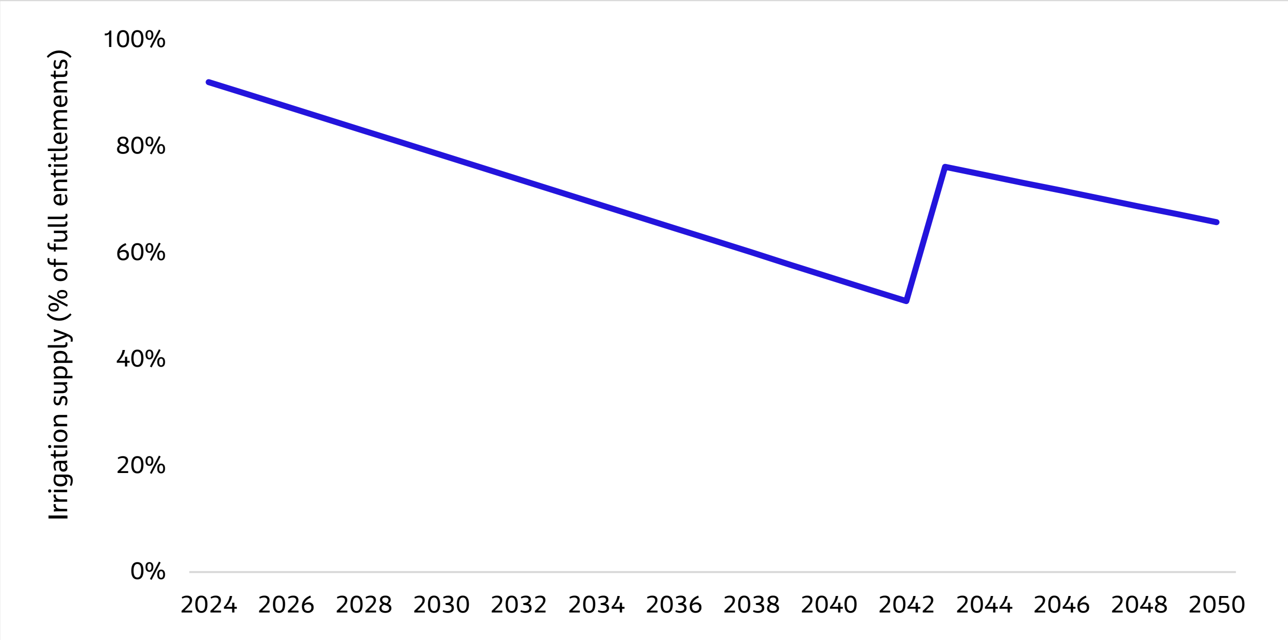
Seqwater then provided a set of hydrological scenarios for the likely access to water by the pipeline for 4 years (2025, 2043, 2044 and 2061). The mean annual irrigation supply is the average reliability for the modelled year so, for instance, in 2043, customers are likely to receive 52% of their 34,000ML allocation with a shortfall of 16,691ML. However, Seqwater intends to cease supply to irrigators during drought conditions, so water supply to irrigators will be different to the average.

Table 14.6 : Irrigation water reliability

Modelling year	Mean Annual Pipeline Supply (ML)	Mean Annual Pipeline Supply/Reliability (%)	Mean Annual Shortfall (ML)
2025	31,296	92%	2,705
2043	17,309	52%	16,691
2044	25,879	77%	8,121
2061	17,309	52%	16,691

The reliability modelling provided by Seqwater was then interpolated to create a reliability profile as shown in **Figure 14.1**.

Figure 14.1 : Interpolation of water reliability



This reliability profile was used to calculate the amount of water that is likely to be provided to customers over the 30-year assessment period.

14.4.1.3 Crop suitability analysis

The likely use of the water was based on the Round 2 demand assessment in conjunction with the analysis undertaken on the crop suitability of each crop (i.e. whether there is sufficient room in domestic and export markets for additional production. This is outlined in Appendix M.

14.4.1.4 Scheme water usage

The water use mix by enterprise for 34,000ML scheme is shown in **Table 14.7**. The mix is highly diverse, so the economic benefits of the pipeline do not rely on a small number of enterprises.

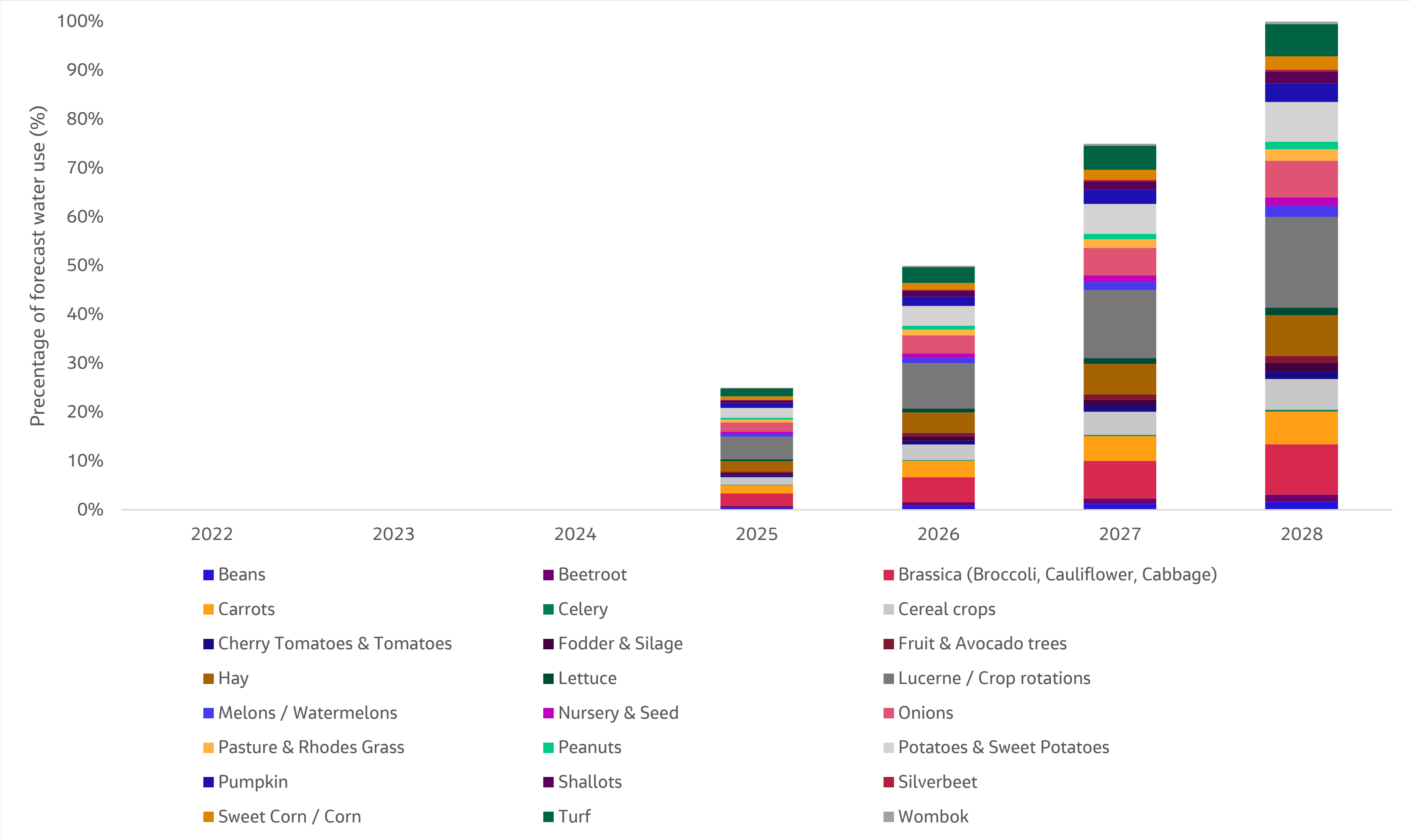
Table 14.7: Water use mix by enterprise for 34,000ML scheme

Enterprise (e.g. crop)	Volume (ML)	Share
Lucerne / Crop rotations	6,132	18.6%
Brassica (Broccoli, Cauliflower, Cabbage)	3,383	10.3%
Hay	2,748	8.3%
Potatoes & Sweet Potatoes	2,690	8.2%
Onions	2,464	7.5%
Carrots	2,241	6.8%
Turf	2,174	6.6%
Cereal crops	2,095	6.3%
Pumpkin	1,269	3.8%
Sweet Corn / Corn	905	2.7%
Shallots	787	2.4%
Pasture & Rhodes Grass	775	2.3%
Melons / Watermelons	729	2.2%
Nursery & Seed	605	1.8%
Fodder & Silage	569	1.7%
Beans	541	1.6%
Cherry Tomatoes & Tomatoes	520	1.6%
Lettuce	520	1.6%
Peanuts	502	1.5%
Beetroot	487	1.5%
Fruit & Avocado trees	467	1.4%
Wombok	168	0.5%
Silver beet	130	0.4%
Celery	99	0.3%
Crop totals	**33,000**	**100.0%**
Non crop demand		
Quarries	800	
Chickens	200	
Total (all users)	**34,000**	

Most of the water is for crop irrigation (33,000ML) with a small amount to be provided to non-crop enterprises of quarries and chicken production.

It is unlikely that the uptake of the water for irrigated crops will be 100% from the commissioning of the scheme (in year 2025) so a usage profile has be included that ramps the likely use of water up over time as shown in **Table 14.8**.

Table 14.8: Modelled uptake of water for irrigated crop use (% of total demand)



There are also likely to be losses associated with on-farm storage as irrigators store the water for a period, before using it. This will affect the final amount of water applied to crops. The range of water loss and retained water is shown in **Table 14.9**.

Table 14.9: Water losses

Water loss	Low	Medium	High
Total demand (ML)	30,000	34,000	42,000
Quarries (ML)	240	800	950
Chickens (ML)	200	200	200
Crops (ML)	29,560	33,000	40,850
Water losses and retained water for crops (%)	5%	10%	15%

The expected water use by the pipeline is the amount identified in the Round 2 demand assessment, modified based on the crop suitability assessment, and then reduced to reflect the uptake profile and expected losses.

14.4.1.5 Net margins

Net margins (irrigation profit after fixed and variable costs) is a key component of the economic benefits for the scheme. The scheme generates economic benefits for:

- irrigated crops
- quarries
- chicken production.

14.4.1.6 Irrigated crop net margins

The primary economic benefit of the scheme is increased irrigated agricultural output. To calculate the benefits, we have:

- determined the amount of water to be used for each crop type and crop area (crop mix) in the previous section
- determined the net margin of each crop (per megalitre) through a detailed, consultation-driven process. Each crop has a different net margin, depending on the yield, costs, and commodity prices
- 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.

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 including:

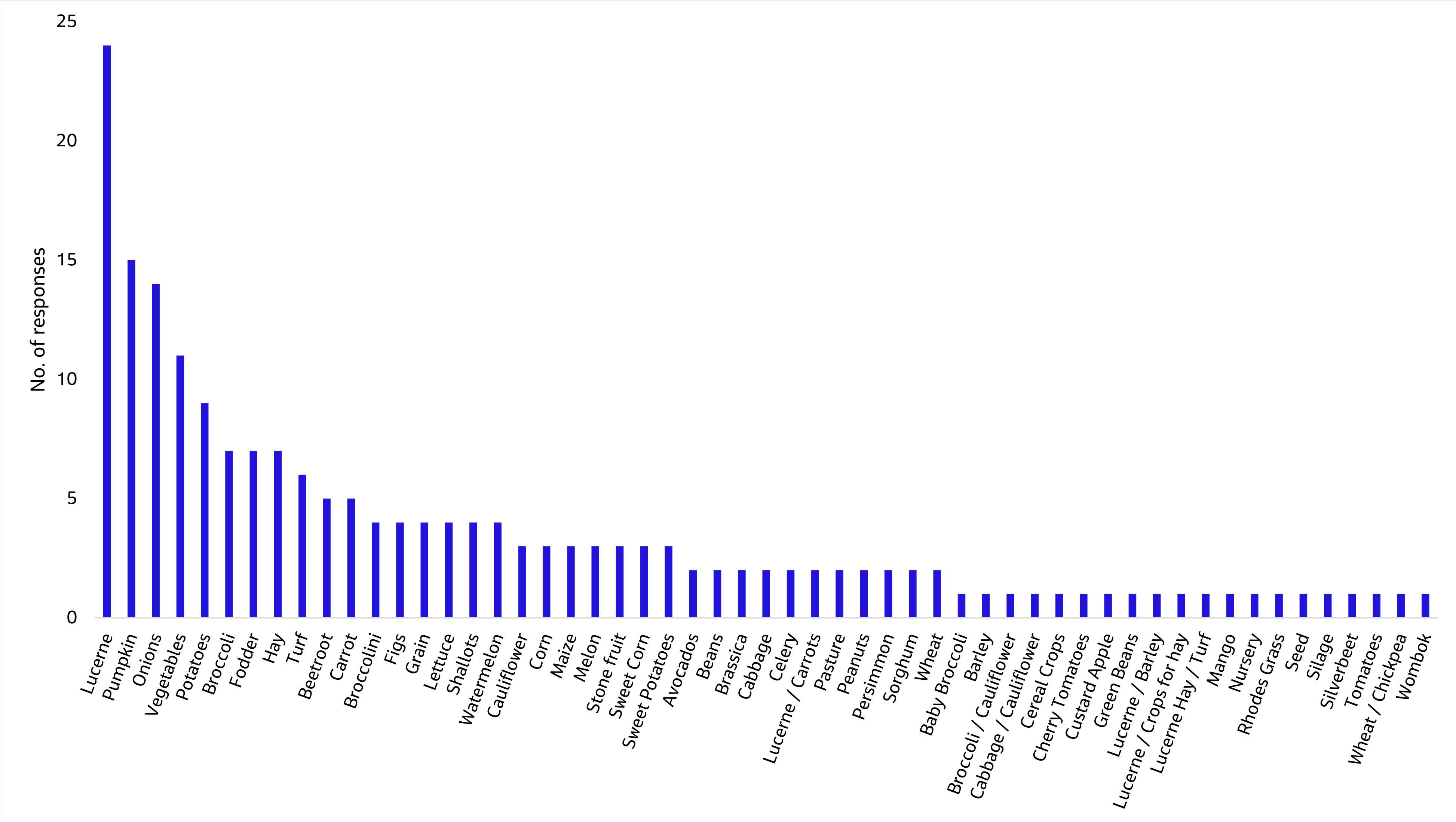
- Round 1 demand assessment and further consultation with potential customers in the Lockyer Valley
- Previous literature provided by client and state government
- Agbiz farm budgeting tools – Queensland Government
- AgMargins Gross Margin Calculator - Queensland Government.

The net margins generated for the scheme were primarily based on the results of the Round 1 demand assessment where prospective customers were asked:

- Proposed crop type
- Volume applied to crop (ML)
- Water use (ML/ha)
- Area (ha)
- Farmgate Revenue ($/ha)
- Fixed and variable costs ($/ha)

The Round 1 assessment generated 197 responses from potential customers with a range of enterprises to these questions as shown in Figure 14.2.

Figure 14.2: Round 1 assessment – responses by enterprise



A weighted average was then generated based on the responses for each of the crop types. The weighted net margins for each crop is shown in the table below.

Table 14.10: Crop volumes and weighted net margin – 34,000ML scheme

Crop	Volume (ML)	Weighted net margin ($/ML)
Lucerne / Crop rotations	6,132	510
Brassica (Broccoli, Cauliflower, Cabbage)	3,383	1,140
Hay	2,748	580
Potatoes & Sweet Potatoes	2,690	1,570
Onions	2,464	2,160
Carrots	2,241	1,370
Turf	2,174	4,490
Cereal crops	2,095	280
Pumpkin	1,269	1,550
Sweet Corn / Corn	905	640
Shallots	787	2,790
Pasture & Rhodes Grass	775	320
Melons / Watermelons	729	1,360
Nursery & Seed	605	4,120
Fodder & Silage	569	330
Beans	541	400
Cherry Tomatoes & Tomatoes	520	6,410
Lettuce	520	5,510
Peanuts	502	750
Beetroot	487	880
Fruit & Avocado trees	467	3,830
Wombok	168	1,570
Silver beet	130	3,550
Celery	99	1,670
Weighted net margin		**1,520**

The weighted margins for each of the irrigated crops are used in the analysis as the economic value of each ML applied to the crop demand.

14.4.1.7 Quarries

Quarry operators located in the Lockyer Valley also provided Letters of Intent for water from the pipeline as part of the Round 2 demand assessment. The economic value of new water provided by the quarry should be the amount of additional profit generated by additional water, not the entire profit of the operation, as quarry activities can be undertaken with lower water but higher chemical use.

Consultation with a prospective quarry customer revealed that profits per annum for different water use for a representative quarry as shown in **Table 14.11**.

Table 14.11: Profit and water use scenarios for a representative quarry

Profit and water use scenarios	Profit ($ pa)	ML per day
Very low	1,000,000	0.60
Low	1,500,000	0.70
Medium	2,000,000	0.80
High	2,500,000	0.90
Very high	3,000,000	1.00

it is assumed that quarries can move from a lower water use to a higher water use with increase in profits. The incremental economic value of increased water use for the representative quarry is shown in **Table 14.12**.

Table 14.12: Additional profit per ML (net margin) for a representative quarry of new scheme water

Scenario	Additional profit ($ pa)	ML per day	Total water use - all sources (ML pa)	Portion of total water use that is from new water	ML used from new scheme (ML)	Additional profit (net margin) - new source ($/ML)
Low	500,000	1.00	400	75%	300	1,667
Medium	1,000,000	1.00	400	75%	300	3,333
High	2,000,000	1.00	400	75%	300	6,667

The expected demand from the quarries is 800ML per annum so the medium net margin used of $3,333/ML is applied to this demand.

14.4.1.8 Chicken production

Chicken producers in the Lockyer Valley has also provided a Letter of Intent for 200ML per annum. The Queensland Government provides an Agbiz tool for poultry production in the Moreton region where the Lockyer Valley is located, which includes depreciation and interest. The tool was used to calculate the net margin per ML as shown in **Table 14.13**

Table 14.13 : Economic benefits for chickens

Economic benefits	Low	Medium	High
Revenue per operation ($)	220,500	249,800	280,060
Net margin per operation ($)	138,961	164,119	190,236
Water use (ML)	100	100	50
Revenue per ML ($/ML)	**2,205**	**2,498**	**5,601**
Net margin per ML ($/ML)	**1,390**	**1,641**	**3,805**

Source: Agbiz tools - Animals and Grazing- Poultry

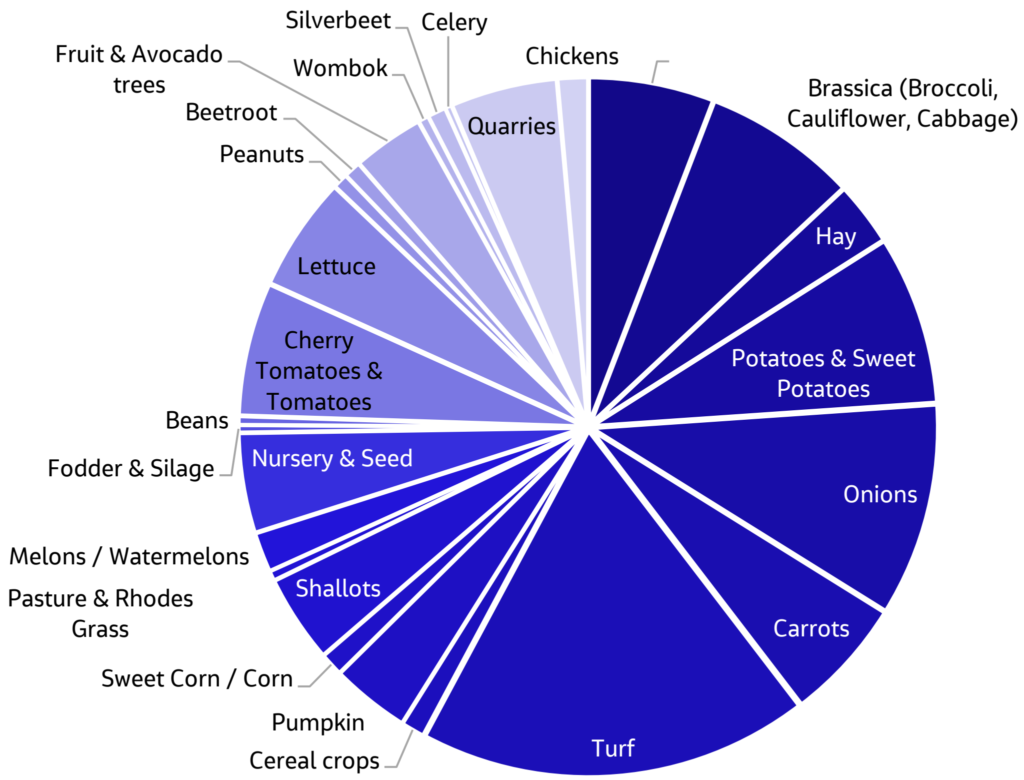
A net margin of $1,641/ML has been applied to the 200ML of water demand for chick production.

14.4.1.9 Summary of economic benefits

Most economic benefits arise from the application of additional water and the increase in agricultural production.

A break-down of the contribution of each crop / commodity to the total economic benefit is shown in **Figure 14.3**. This analysis shows that the economic benefits do not rely on a single, or small number, of crops. This broad diversity means that the scheme is not subject to a specific crop or industry.

Figure 14.3: Contribution of each commodity to total economic benefits



14.5 Economic costs

The economic costs associated with the scheme include:

- Risk adjusted capital and operating costs
- Opportunity costs associated with base case.

14.5.1.1 Risk adjusted capital and operating costs

Forecasting costs includes some uncertainty. A DBC 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).

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.

- Intrinsic risk: 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 schemes. 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 Chapter 15). 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.

- Contingent risks: Contingent risks are generated for the scheme. 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.

P50 costs have also been used

14.5.1.2 Risk-adjusted capital costs

The risk-adjusted capital costs for the P50 and P90 are shown in Chapter 15 and summarised in **Table 14.14**.

Table 14.14: Risk-adjusted capital costs for P50 and P90 (real, 2021 dollars, $ million)

Probability level	P50	P90
Base cost	136.30	136.30
Intrinsic risk	2.89	9.73
Contingent risk	19.00	27.05
Total	**158.18**	**173.08**

P50 and P90 costs are used in the economic analysis. These costs do not include escalation or interest during construction which are financial costs but not included in economic assessment.

14.5.1.3 Risk-adjusted operating costs

The risk-adjusted operating costs are comprised of:

- Fixed operating costs
- Variable electricity costs by pump station.

Table 14.15: Annual fixed costs (real, 2021 dollars, $millions)

Probability level	P50	P90
Base cost	1.37	1.37
Intrinsic risk	0.03	0.14
Contingent risk	-	-
Total	1.40	1.52

Table 14.16: Risk-adjusted variable costs of electricity by pump station (real, 2021 dollars, $/ML)

Probability level	P50	P90
Base cost ($/ML)	39	39
Intrinsic risk ($/ML)		-
Contingent risk ($/ML)		21
Total ($/ML)	**39**	**61**

14.5.1.4 Cost of water

The pipeline will access water in Wivenhoe Dam, but the cost of this water is the alternative supply for filling Wivenhoe Dam to a level where urban water security is unaffected by the withdrawals by the pipeline. During periods of low rainfall during droughts, the surface water storages begin to empty, and restrictions on urban water use are introduced to ensure water supply can continue.

Seqwater's manufactured water assets, including the Western Corridor Recycled Water Scheme and the Gold Coast Desalination Plant, reduce the impact of a drought restrictions on urban water users. Seqwater's current plan is to commence production of desalination water and recommission of the recycled water assets when the combined volume in Seqwater's 12 largest storages (Grid 12) reaches 60%, the manufactured water trigger.

The scheme will use water directly from Wivenhoe Dam and additional manufactured water will be produced to ensure there is no impact on urban water users. This involves raising the manufactured water trigger to 66% so the probability of Grid 12 reaching the original trigger level stays the same. These trigger levels change over the life of the scheme.

Table 14.17 : Manufactured water triggers

Modelling year	Probability of reaching manufactured water trigger for urban users	Manufactured water trigger for urban users	Manufactured water trigger after the scheme
2025	7%	60%	66%
2043	55%	70%	76%
2044	23%	60%	68%
2061	55%	70%	76%

Raising the manufactured water trigger will increase the production of manufactured water. Hydrological modelling has estimated the expected increase in manufactured water over the life of the scheme. The expected amount is the average over 10,000 simulations of future rainfall, so actual amounts produced will be different.

Table 14.18 : Manufactured water before and after the scheme

Modelling year	Mean annual manufactured water production before the scheme (ML)	Mean annual manufactured water production after the scheme (ML)	Mean annual additional manufactured water production (ML)
2025	4,137	8,491	4,354
2043	41,302	53,218	11,916
2044	14,779	21,629	6,850
2061	41,302	53,218	11,916

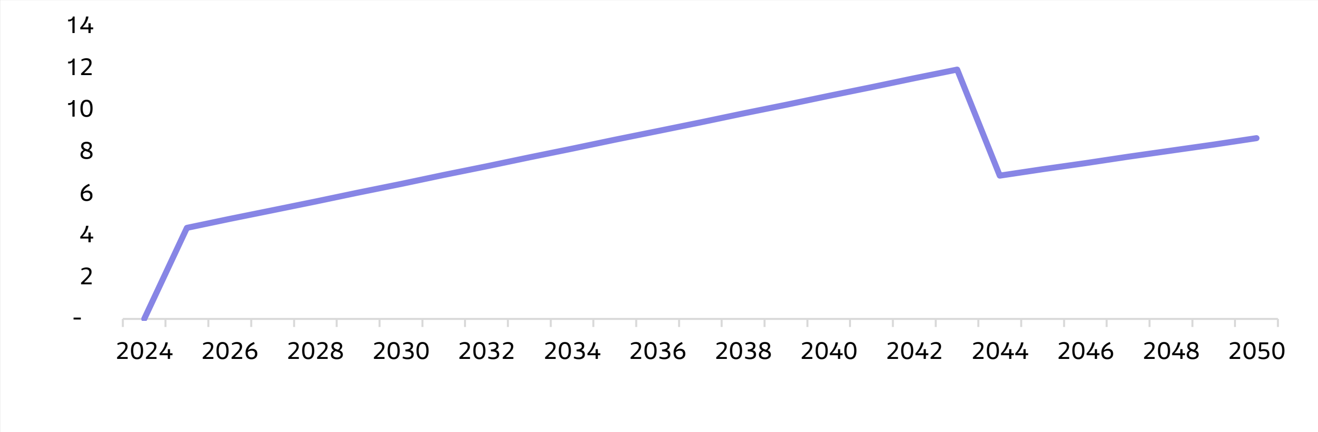
Seqwater has estimated the costs of producing additional manufactured water. This includes additional variable costs, for items such as electricity and chemicals, and fixed costs, for items such as membranes.

Table 14.19 : Costs of manufactured water

Category	Cost ($/ML)
Variable cost ($/ML)	600
Fixed cost ($/ML)	400
Total cost ($/ML)	**1,000**

The expected cost of manufactured water over the life of the scheme is shown in Figure 14.4.

Figure 14.4 : Costs of additional manufactured water



14.5.1.5 Opportunity costs of base case

The Lockyer Valley has several rainfed crops and part of these dryland crops are likely to be converted to irrigation cropping following the commissioning of the pipeline. The loss of the net margins of these crops represents an opportunity costs to the scheme. This is a conservative approach, as some of the water will be applied to existing irrigation areas to increase yields and will not reduce the amount of land available for other uses.

Table 14.20: Dryland cropping net margins

Crop	Net margin ($/ha)
Barley	50
Chickpea	156
Cotton	162
Faba beans	289
Lentils	281
Maize	83
Mungbeans	70
Navy beans	178
Sorghum	89
Soybean	271
Sunflower	454
Wheat	83
Average	**140**

Based on the average of $140 per hectare and an average water use per hectare for the area irrigated by the scheme of 5.96ML, the average opportunity cost per ML of new, scheme water is $23/ML.   The total opportunity cost is $782,000 per year and has been included in the modelled economic costs of the project.

14.5.1.6 Summary of economic costs

The economic costs of the project are summarised in Table 14.21.

Table 14.21: Economic cost summary

Category	Upfront cost ($ million)	Ongoing fixed costs ($million pa)	Ongoing variable costs ($/ML)
Capex (P90)	173.08		
Fixed operating costs		1.52	
Variable operating costs			69
Manufactured water costs			287
Opportunity cost			23
Total	**173.08**	**1.52**	**380**

14.6 Residual values

The scheme life is 50 years while the assessment period is 30 years, so a residual value has been calculated to account for ongoing net benefits. Recent consultation with Building Queensland confirmed that residual values can be appropriate, particularly for long-lived assets such as pipelines.

The residual value included in the analysis is shown in **Table 14.22**.

Table 14.22: Residual value

Asset life	Construction Duration (years)	Model Period	Remaining life	Remaining asset value in Year 30 ($ million)
50	3	30	23	70.1

14.7 Cost benefit analysis results

The results of the economic analysis as an NPV and BCR for P50 and P90 costs are shown **Table 14.23**

Table 14.23: Economic NPV ($ million) and BCR – P50 and P90 risk adjusted costs

Item	P50	P90
Total benefits ($ millions)	304.5	304.5
Total costs ($ millions)	231.7	244.5
Net benefits NPV ($ millions) @ 7% real discount rate	**72.8**	**60.1**
BCR @ 7% real discount rate	**1.31**	**1.25**

Discount rate sensitivity analysis for P50 is shown in **Table 14.24**

Table 14.24: Economic net present value ($ million) and benefit–cost ratio for P50 risk adjusted costs

Item	Low economic discount rate (real 4%)	Medium economic discount rate (real 7%)	High economic discount rate (real 10%)
Total benefits ($ million)	454.8	304.5	214.1
Total costs ($ million)	289.3	231.7	194.6
Net benefits NPV ($ million)	**165.5**	**72.8**	**19.5**
BCR	**1.57**	**1.31**	**1.10**

The BCR of the scheme is above 1 at a high discount rate (10% real).

14.7.1.1 Sensitivity analysis

Sensitivity analysis has been undertaken for key inputs as shown in **Table 14.26**.

Table 14.25: Summary of sensitivity tests conducted

Test	Sensitivity Test	Low	Medium	High
1	Change in capital expenditure	90% of base estimate	100% of base estimate	110% of base estimate
2	Change in operating expenditure	90% of base estimate	100% of base estimate	110% of base estimate
3	Change in net margins	80% of base estimate	100% of base estimate	120% of base estimate
4	Reliability of water	90% of base estimate	100% of base estimate	100% of base estimate
5	Seqwater charges	80% of base estimate	100% of base estimate	120% of base estimate
6	Losses and retained water	5% losses	10% losses	20% losses

The NPV results are provided in **Table 14.26** below.

Table 14.26: Sensitivity results – Economic NPV ($ million) for P50

Test	Sensitivity Test	Low	Medium	High
1	Change in capital expenditure	86.8	72.8	58.7
2	Change in operating expenditure	81.9	72.8	63.7
3	Change in net margins	15.3	72.8	130.3
4	Reliability of water	43.1	72.8	72.8
5	Seqwater charges	86.8	72.8	58.8
6	Losses and retained water	88.1	72.8	42.2

The BCR results are provided in **Table 14.27** below.

Table 14.27: Sensitivity results – BCR for P50

Test	Sensitivity Test	Low	Medium	High
1	Change in capital expenditure	1.40	1.31	1.24
2	Change in operating expenditure	1.37	1.31	1.26
3	Change in net margins	1.07	1.31	1.56
4	Reliability of water	1.19	1.31	1.31
5	Seqwater charges	1.40	1.31	1.24
6	Losses and retained water	1.38	1.31	1.18

The sensitivity analysis suggests that the BCR is robustly above one as there is no sensitivity analysis where the BCR is below one. The lowest BCR of 1.07 is with net margins that are 80% of expected margins while the highest BCR is 1.56 due to net margins being 120% of calculated net margin.

14.7.1.2 Scenario analysis

Two scenarios have been analysed as part of the scenario analysis:

- Larger scheme
- Maximum solar generation for a P90 of $200m.

14.7.1.2.1 Larger scheme scenario

Scenario analysis has also been undertaken on two scenarios to the explore the net economic benefits of a larger scheme supplying 42,000ML. It is noted that there was insufficient demand to support a 42,000ML scheme at this time so these scenarios are purely indicative. The two scenarios are:

- Larger scheme with same crop mix

- Larger scheme with an export-focused crop mix

The capital costs associated with a 42,000ML scheme have been developed based on previous estimates and approximation. The capital cost for the 42,000ML scheme is a medium cost (not risk adjusted) of $168,050,416 which should be compared to the P50 cost of the 34,000ML scheme of $153,645,210. Operating costs of the pipeline are assumed to be roughly the same based on advice from the engineers for the indicative scenario.

The crop mix for the 'same crop mix' see the additional water demand under the 42,000ML larger scheme allocated in the same proportions as **Table 14.7**. The export-oriented increase sees the large scheme provide the additional water to crops with the greatest export potential as identified in Section 14.4.1.3. The allocation across the export-oriented crops is shown in **Table 14.28**.

Table 14.28: 42,000ML scheme – allocation to export-oriented crops

Crops	Export oriented extra demand for high scenario (ML)
Brassica (Broccoli, Cauliflower, Cabbage)	1,000
Carrots	1,500
Fodder & Silage	500
Hay	500
Lucerne / Crop rotations	500
Melons / Watermelons	500
Nursery & Seed	1,500
Potatoes & Sweet Potatoes	1,750
Pumpkin	250
Total	**8,000**

The results of the scenario analysis compared to the 34,000ML scheme using P50 costs is shown in the following table.

Table 14.29: Scenario analysis results (7% real discount rate)

Scenarios	NPV ($ million)	BCR
34 GL scheme	72.8	1.31
42 GL scheme - same crop mix as 34 GL scheme	121.4	1.52
42 GL scheme - export oriented crop mix	151.4	1.65

The larger schemes have higher BCRs, in part due to the fact that the scenarios are not modelled on risk adjusted costs (P90), but the weighted net margin of the export-oriented crop mix is $1,560/ML compared to $1,517/ML for the 34,000ML scheme suggesting that export-oriented production may further improve the BCR of the scheme.

14.7.1.2.2 Maximum solar scenario

The core capital schedule includes provision for 7MW of solar generation to be installed. A scenario was developed to maximise the amount of solar installed under a $200M P90 capital cost cap. Additional solar generation will generate revenue for the scheme to offset operating costs. The total solar and P50/P90 is shown in **Table 14.30**.

Table 14.30: Total solar installed under the maximum solar scenario

Item	Value
Solar size (MW)	14.1

P50 ($ millions)	182.4
P90 ($ millions)	198.8

The BCR and NPV for the scenario are shown in **Table 14.31**

Table 14.31: BCR and NPVs for maximum solar scenario (7% real discount rate)

Item	P50	P90
Total benefits ($ millions)	304.5	304.5
Total costs ($ millions)	244.3	257.5
Net benefits NPV ($ millions)	**60.2**	**47.0**
BCR	**1.25**	**1.18**

The BCRs for the scenarios are less than the BCRs of the core scenario but still above one. The impact of additional solar generation on the operating costs, and therefore the tariffs paid by customers, is shown in Section 15.10.1.2.

14.8 Economic impact assessment

The preceding economic assessment has been prepared in accordance with Building Queensland's business case guidelines and its's cost benefit analysis (CBA) guidelines. These guidelines specify the types of economic benefits and costs that are suitable to include in a CBA, which have been adhered to in the section above in arriving at the NPVs and BCRs for this scheme.

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, which is 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.

14.8.1.1 Wider economic benefits

The following table outlines the full-time equivalent positions supported by delivery of the scheme, including agricultural jobs from cropping and chicken raising.

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 supported full-time jobs have been created by examining the input-output tables produced by the ABS. The average over the life of the scheme is shown in Table 14.32. This has 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.

The options assessed will also support additional economic activity in the local economy through the gross agricultural production.

Table 14.32 presents the direct and indirect activity every year supported by the scheme. In addition, Table 14.32 outlines the total construction jobs created to build each infrastructure option.

Table 14.32: Wider economic benefits

	Direct	Indirect	Total
Agricultural jobs (FTE)	584	1,339	**1,923**
Industry value add ($ million)	119.1	77.7	**196.8**
Additional agricultural production ($ million)	209.8	n.a.	**209.8**
Construction jobs (FTE)	109	264	**373**

Additionally, a new quarry development proposed by Zanow Quarries will be significantly boosted if the Water for the Lockyer scheme proceeds in a timely manner (i.e. over the next couple of years). Zanow Quarries produces natural rock and sand quarry products – avoiding the use of chemicals as part of on-site processing.

The Water for the Lockyer scheme will not only enable a new quarry development to proceed, it will lower the input machinery requirement / lower capital costs and will allow Zanow to develop a suite of natural quarry products on its new site. The water requested in Round 2 will be enable cleaner processes that require less capital-intensive machinery to produce all-natural sand, rock and road base products.

In the absence of the scheme, Zanow's proposed quarry will have limited water and therefore require more machinery / greater capital intensity and increased on-site water reuse of limited ground water that will also require re-use water to be treated with chemical flocculants. While such re-use practices are consistent with regulations and accepted by the industry, Zanow's would rather develop the water-based natural processing model, spend less on machinery and de-risk the scheme. In turn, new water will increase economic returns and create up to 40 FTE jobs on this new site.

Across the whole quarry sector in the valley similar benefits are expected at other quarries and up to 110 FTE jobs would be supported by the new water demanded by quarries.

14.8.1.2 Recreation

Using the irrigation dams to store water will increase the opportunity for additional recreational activities (camping, fishing, boating, BBQ areas). The monetary value of amenity and recreation benefits have been calculated based on an estimate of number of visitors to the area and willingness to pay per visit.

Visitors to Seqwater's dams have been used to estimate the visitors to the irrigation dams. The overall visitor behaviour to South East Queensland Dams should be reflected to visits to dams in the Lockyer Valley.

Seqwater estimates 2.7 million people visited its lakes and surrounding catchments in 2018/19[60], over a management area of 60,000 ha. We have estimated the visitors to the irrigation dams based on their relative sizes, assuming they are full.

Table 14.33 : Annual dam visitors

Dam	Atkinson Dam	Clarendon Dam	Lake Dyer
Average dam capacity (%)	35.64	24.88	28.93
Potential increase (%)	15.77	11.52	5.77
Average dam capacity with project (%)	**51.41**	**36.40**	**34.70**
Overnight visitors	6,705	-	1,208

We have used the average capacity of each dam before and after the project to estimate the potential recreational impact. We have used the average dam capacity with the project assuming 10% of water is kept for security.

60 https://www.parliament.qld.gov.au/documents/tableOffice/TabledPapers/2019/5619T1705.pdf

Table 14.34 : Potential increase to dam capacities assuming 10% security water

Dam	Atkinson Dam	Clarendon Dam	Lake Dyer
Average dam capacity (%)	35.64	24.88	28.93
Potential increase (%)	15.77	11.52	5.77
Average dam capacity with project (%)	**51.41**	**36.40**	**34.70**

We have used the potential increase in capacity to estimate the increase to dam visits.

Table 14.35 : Increased dam recreational visitors

Dam	Atkinson Dam	Clarendon Dam	Lake Dyer	**Total**
Increase in day visitors	2,880	1,293	191	**4,364**
Overnight visitors	1,057	-	70	**1,127**
Potential increase in visitors	**3,937**	**1,293**	**261**	**5,491**

We have used visitor expenditure published in the Tourism Research Australia Local Government Area Profiles for the value of each visit. Values are published for both day visits and overnight visits in each council area.

Table 14.36 : Value for each visit to the dams

Council Area	Somerset	Lockyer
Value of day visit ($/visit)	61	56
Value of overnight visit ($/visit)	208	291

These are then applied to the estimated increase in visitors to estimate the annual increase in value from recreation.

Table 14.37 : Annual value of increased visits

Dam	Atkinson Dam	Clarendon Dam	Lake Dyer
Value of day visit ($)	176,613	72,709	10,737
Value of overnight visit ($)	219,806	-	20,269
Total value ($)	**396,419**	**72,709**	**31,006**

These benefits can continue over the next 30 years to give the long-term present value of the increase to recreation.

Table 14.38 : Present value of increased visits

Dam	Atkinson Dam	Clarendon Dam	Lake Dyer
Value of day visit ($)	2,191,596	902,255	133,233
Value of overnight visit ($)	2,727,580	-	251,519
Total value ($)	**4,919,176**	**902,255**	**384,752**

14.8.1.3 Onsite investment

Some irrigators will construct additional onsite storages, to store the water before using it. In some cases, this water will only need to be storage for a day or two, as the water is delivered constantly and then applied over a shorter period. These storages would be small. Larger storages would be needed for those irrigators who want to irrigate over a shorter period (for example, six months) but have water delivered over 11 months. They could store a buffer to allow for this irrigation pattern.

Many irrigators already have substantial on farm storages, which will also be used for this purpose. However, it is anticipated that some additional storages may be needed. If this is the case, then we expect that approximately 3,400 ML of capacity could be needed, representing 10 per cent of total maximum supply. The cost of a storage is approximately $3,000 per ML. The construction of these storages would create an additional $10.2 million of additional economic activity during construction.

15. Financial analysis

15.1 Key points

- The financial assessment generated risk-adjusted capital and operating costs, interest during construction, financial NPVs and likely customer charges to consider the financial viability of the scheme.
- The risk-adjusted capital costs are shown in **Table 15.1**.

Table 15.1: Risk-adjusted capital costs ($ million)

Probability level	P50	P90
Base cost	136.30	136.30
Intrinsic risk	2.89	9.73
Contingent risk	19.00	27.05
Total	**158.18**	**173.08**
Escalation	9.40	10.28
Total escalated costs	**167.58**	**183.36**
Interest during construction	2.59	2.59
Total including escalation and interest during construction	**170.18**	**185.96**

- Risk-adjusted operating costs for the scheme has also been developed using a bottom-up approach and risk modelling.
- Financial assessment provides an indication of the cost recovery prices (fixed and variable) based on the risk-adjusted P50 and P90 capital and operating costs.
- A set of scenarios for government funding have also been calculated for the scheme for discussion in the Affordability chapter.

15.2 Approach

The financial assessment of the scheme focuses on three key questions:

1) What is the likely total cost (capital and operating costs) associated with the scheme including intrinsic and contingent risks?
2) If there is insufficient ability for customers to pay for the upfront capital costs of the scheme, what funding might fill this gap?
3) What are the implications of different types of funding options on the scheme's upfront and ongoing charges?

To answer these questions, a financial model and risk workshop generated risk-adjusted capital and operating costs as well as likely cashflows of the scheme under several funding assumptions. The financial outputs are net cash flow and net debt balances in each year over the evaluation period and discounted at an appropriate rate to calculate net cash flows as well as cost-reflective annual customer charges.

This financial analysis was then compared to the results of the demand assessment and customer willingness-to-pay in the Affordability chapter to determine the likely viability of the scheme. The financial assumptions and scenario analysis are consistent with the parameters outlined in the Building Queensland framework.

15.3 Inputs and assumptions

The key inputs and assumptions for the financial assessment include:

- Scheme 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, concessional loans.

15.3.1.1 Timing assumptions

Table 15.2 outlines assumptions about the timing of cash flows.

Table 15.2: Timing assumptions

Component	Assumptions/inputs
Model start date	1 July 2021
Model evaluation period	30 years in total 4 years for design and construction: starting 1 July 2021 and finishing 30 June 2024 25 years for commissioning and operations: starting 1 July 2025 and finishing 30 June 2051
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
Upfront customer contributions	10 per cent is paid when agreeing to purchase (assumed to be 1 July 2022) 90 per cent is paid when the scheme is commissioned (1 July 2024)
Ongoing customer charges	Charges will be collected mid-year (on average), commencing in 2024-25
Discount rate (real, pre-tax)	Assumed cost of debt for a water infrastructure developer, owner and operator of 3.94 per cent based on BBB credit rating
Discount date—base date applied to discount cash flows to determine the NPV	30 June 2021
Renewal interest rate	1.99% (10-year average annual increase ABS PPI other heavy and civil engineering construction 2010-2020)

15.3.1.2 Financial assumptions

The financial assumptions include escalation and discount rates that have been applied in the financial model.

Table 15.3: Financial assumptions

Component	Assumptions/inputs
Assessment	▪ All references to real dollars in this report refer to FY21 dollars. ▪ An evaluation period of 30 years has been adopted for the financial analysis, to align with Building Queensland guidance
Escalations	▪ Where nominal costs are provided: – capital and implementation costs are escalated by 3.00 per cent, the 10-year average annual increase of the ABS Producer Price Index for other heavy and civil engineering construction from FY08 to FY20 – 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
Demand	▪ Irrigation demand is assumed to be 34,000MLML per year ▪ 100 per cent of water allocations are pre-sold in all scenarios. This reflects that the scheme will not be built unless the water is pre-sold

Component	Assumptions/inputs
	▪ A 10 per cent deposit is paid when agreeing to purchase; and the final 90 per cent is paid when the scheme is commissioned. This payment schedule requires the business to obtain a construction loan, and to pay interest during construction
Pricing	▪ The annual fixed charge will comprise of: – fixed operating costs – a renewal annuity – interest and debt repayments ▪ The variable charge will comprise of variable operating costs, such as electricity for pumping ▪ Cost-reflective prices will be calculated to match the escalation rates for costs

15.4 Raw capital and operating costs

15.4.1.1 Raw capital cost

The raw capital costs developed for the scheme (low, medium and high) are shown in **Table 15.4**

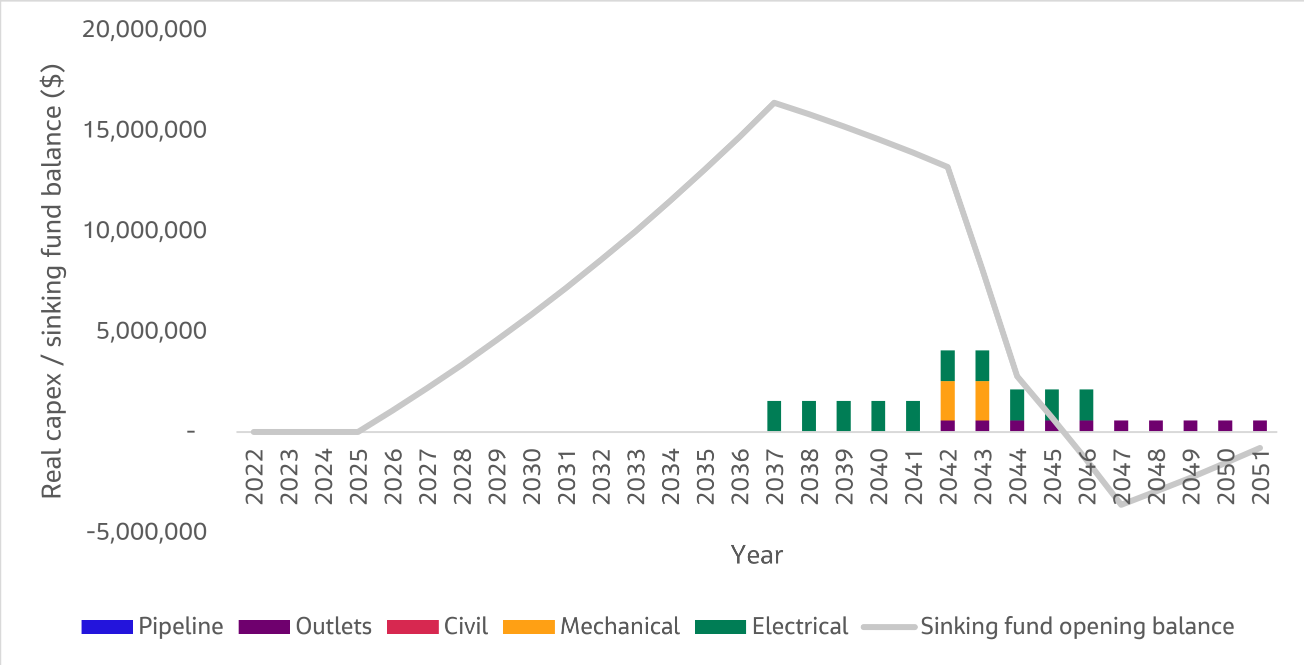
Table 15.4: Raw capital costs (real, 2021 dollars)

Category	Low ($)	Medium ($)	High ($)
Pipeline			
Pipeline	73.0	81.7	93.1
Outlets	5.7	5.7	5.9
Total pipeline	**78.6**	**87.4**	**98.9**
Pump stations			
Civil	3.9	4.3	5.2
Mechanical	3.5	3.9	4.7
Electrical (including solar)	13.9	15.4	29.0
Total pump stations	**21.3**	**23.7**	**38.9**
Preliminaries	**20.3**	**25.2**	**32.9**
Total	**120.2**	**136.3**	**170.7**

15.4.1.2 Renewals

We expect $24 per ML per year will be needed to renew assets which reach the end of their useful lives. This consists of mechanical and electrical pump components, solar assets and outlets. A sinking fund will be used to fund these ongoing capital costs. Part of the annual charges will be contributions towards the sinking fund.

Figure 15.1 : Ongoing capital costs and sinking fund



15.4.1.3 Interest during construction

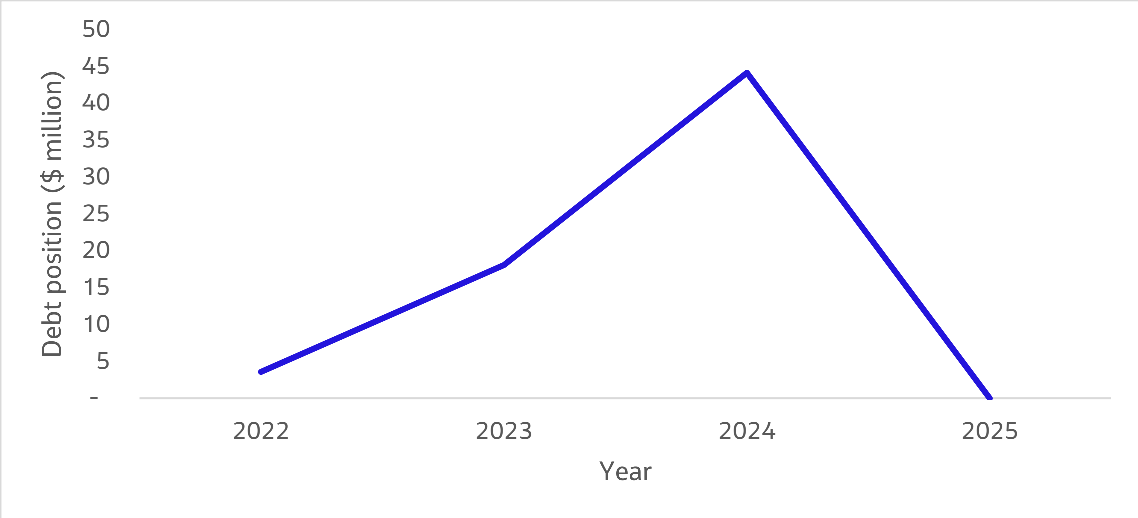
The provision of funding for the scheme is heavily weighted to the end of the construction period as 90% of the customer contributions and likely government funding will provided once the scheme is completed. Therefore, the construction entity will require financing to fund the construction of the scheme. The interest during construction is shown in **Table 15.5**.

Table 15.5: Interest during construction

Year	1	2	3	4
Capex profile	13%	31%	55%	0%
Debt opening position ($m)	-	3.6	18.1	44.2
Interest ($m)	-	0.1	0.7	1.7

This interest is then capitalised in the capital cost of the scheme. During construction, debt will peak at around $44 million, as shown in Figure 15.2.

Figure 15.2 : Debt during construction



15.4.1.4 Environmental offsets

The raw cost of environmental offsets for the scheme are shown in **Table 15.6**.

Table 15.6: Environmental offsets – raw costs ($million)

Category	Low	Medium	High
Environmental offsets	1.3	3.9	7.4

15.4.1.5 Post-DBC activities costs

The raw capital costs include several cost items for the post-DBC activities. The post-DBC activities are shown in **Table 15.7**.

Table 15.7: Post-DBC activities ($)

Category	Low ($)	Medium ($)	High ($)
Owners Engineer	750,000	1,000,000	1,250,000
EIS and other approvals	1,000,000	1,500,000	2,000,000
Proponent costs (governance, prospectus, community engagement)	250,000	300,000	350,000
Post-DBC lead consultant (tendering, coordinate and drive EIS & approvals, delivery of project to start construction)	500,000	750,000	1,000,000
Round 3 - Binding Water Sales (lead consultant and local Input)	350,000	475,000	700,000
Governance and statutory obligations	4,150,000	3,975,000	3,700,000
Total	**7,000,000**	**8,000,000**	**9,000,000**

15.4.1.6 Raw operating costs

The raw fixed operating costs for the scheme is shown in **Table 15.8** and raw variable costs are shown in Solar reductions of operating costs are associated with revenues generated from exporting solar into the grid.

Table 15.9.

Table 15.8: Raw fixed operating costs (2021 dollars, $ million)

Fixed costs	Low	Medium	High
Operations	0.29	0.45	0.67
Fixed electricity	0.61	0.61	0.61
Scheduled maintenance	0.17	0.21	0.37
Unscheduled maintenance	0.07	0.10	0.17
Total operations and maintenance	**1.14**	**1.37**	**1.81**
Asset renewals	0.95	0.95	0.95
Total costs	**2.09**	**2.32**	**2.76**

Solar reductions of operating costs are associated with revenues generated from exporting solar into the grid.

Table 15.9: Annual variable costs of electricity by pump station (2021 dollars, $ million)

Pump station	Total cost
Wivenhoe PSTN	0.03
Atkinson Dam PSTN	0.19
Clarendon Dam PSTN	0.29
Gatton PSTN	0.15
Buaraba PSTN	0.02
Lake Dyer PSTN	0.06
Mulgowie PSTN	0.14
Ma Ma Creek PSTN	0.22
Mt Sylvia PSTN	0.02
Western Scheme PSTN	0.16
Scotbar PSTN	0.05
Total	**1.34**

15.5 Risk adjusted capital and operating costs

Forecasting costs includes some uncertainty. A DBC 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).

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 that may affect the cost (Appendix B).

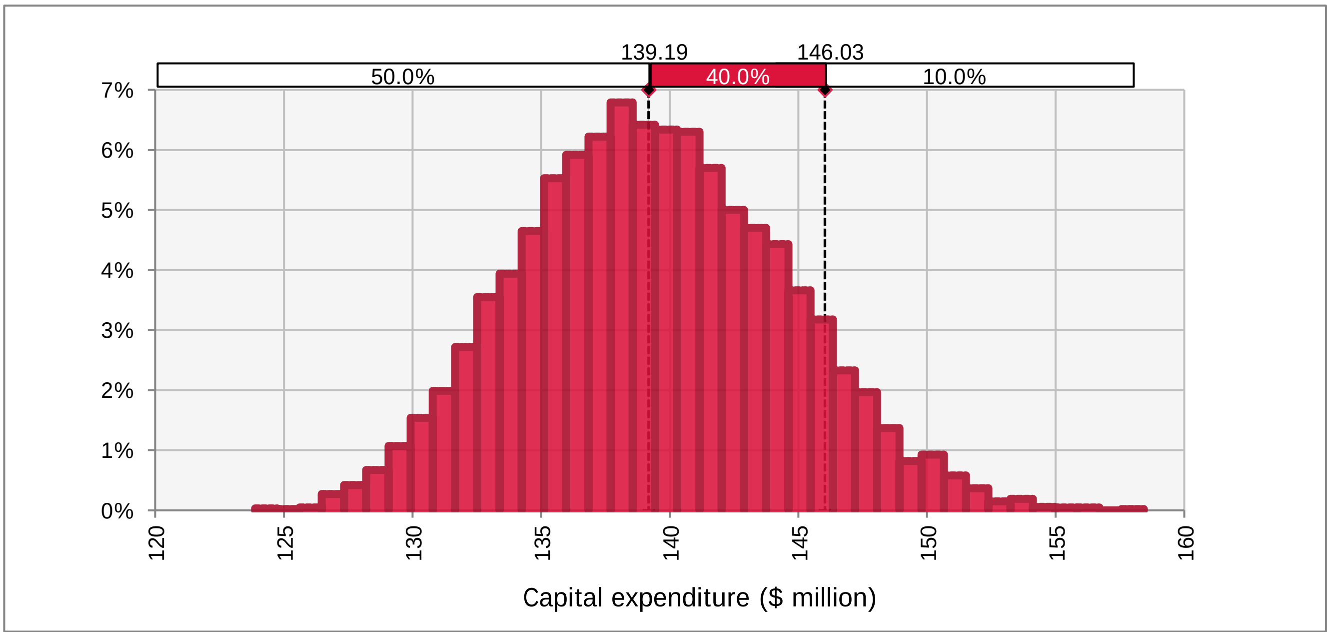
These risk adjustments are shown below. Both risks are modelled using Monte Carlo runs of 10,000 simulations.

15.5.1.1 Capital costs – intrinsic risk adjustment

We used the low, medium and high raw capital costs Table 15.4 to generate probability distributions for capital cost line items. We have calculated the intrinsic risk contingency using capital cost profile drawn from these distributions. The intrinsic risk adjustment is:

- $2.9 million above the medium cost for the P50
- $9.7 million above the medium cost for the P90

Figure 15.3: Capital expenditure intrinsic risk

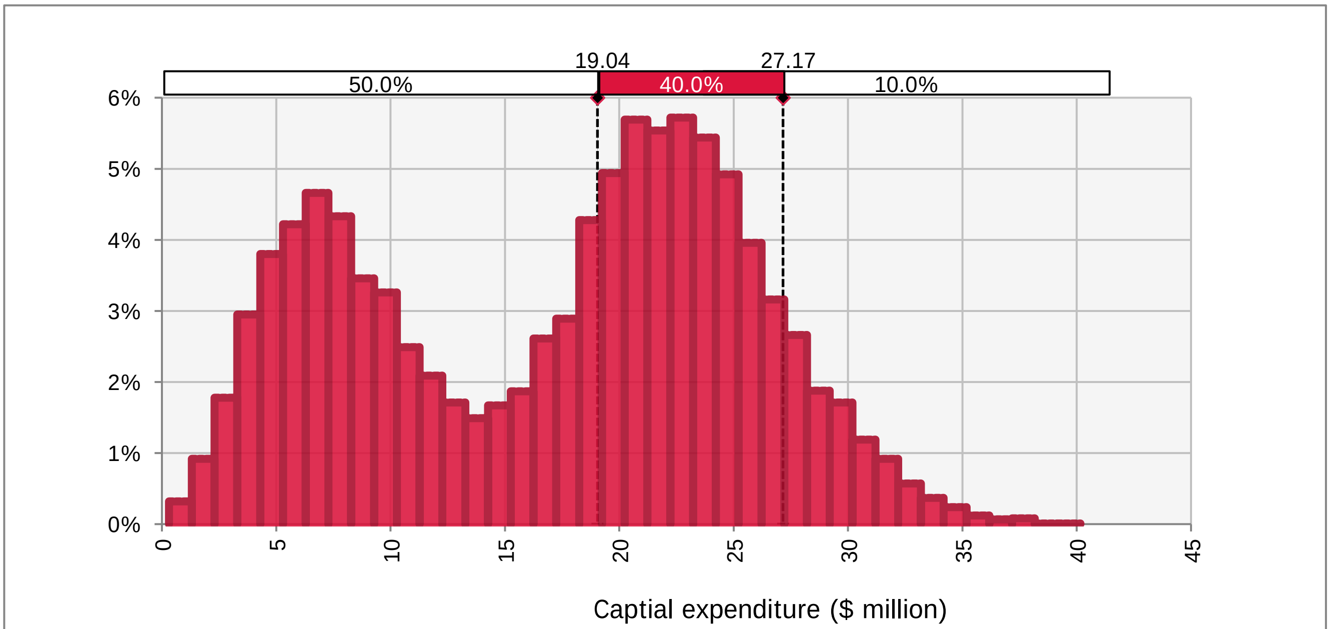


15.5.1.2 Capital costs - contingent risk adjustment

We used the probability and consequence to generate probability distributions for risks in the risk register. We have calculated the contingent risk contingency using risk cost profile drawn from these distributions. The contingent risk adjustment is:

- $19.0 million for the P50
- $27.2 million for the P90

Figure 15.4: Capital expenditure contingent risk



15.5.1.3 P50 and P90 capital costs

The risk-adjusted capital costs are shown in **Table 15.10**. The total capital costs include escalation and interest during construction.

Table 15.10: Risk-adjusted capital costs ($ million)

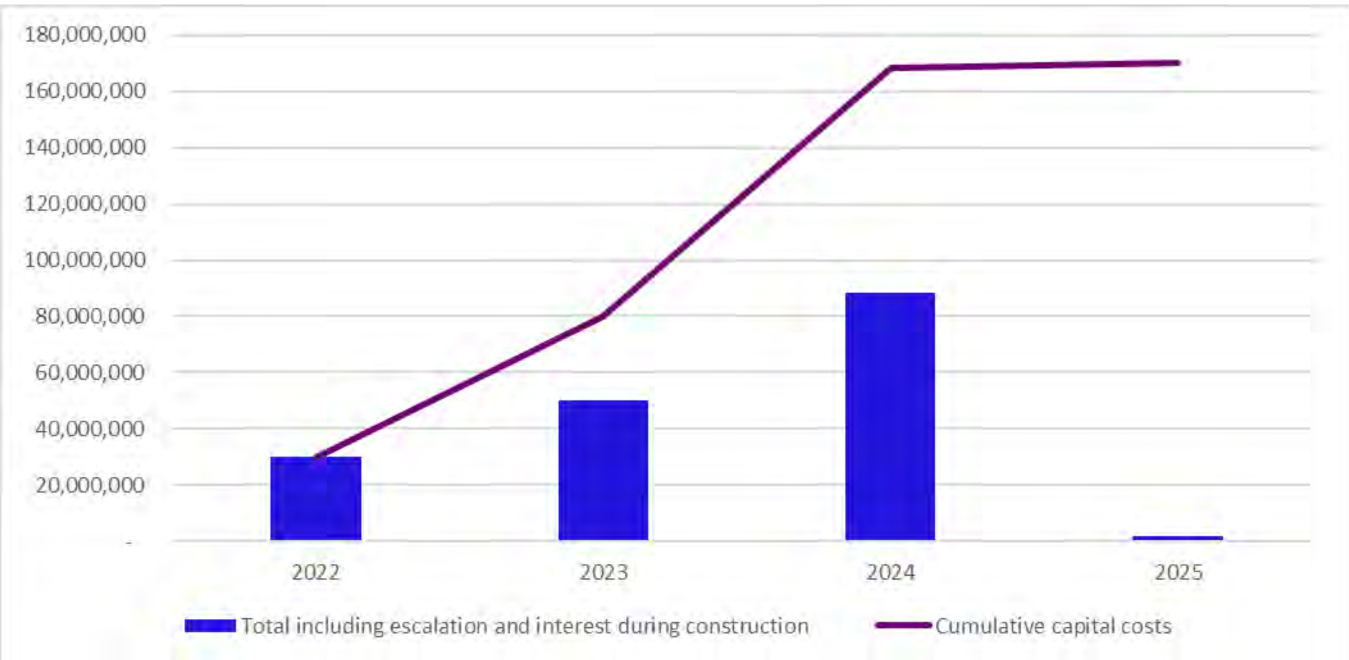
Probability level	P50	P90
Base cost	136.3	136.3
Intrinsic risk	2.9	9.7
Contingent risk	19.0	27.1
Total	**158.2**	**173.1**
Escalation	9.4	10.3
Total escalated costs	**167.6**	**183.4**
Interest during construction	2.6	2.6
Total including escalation and interest during construction	**170.2**	**186.0**

Note that the total costs before escalation and interest during construction is the economic capital costs of the project used in the economic analysis while the total costs (including escalation and interest during construction) is the financial costs.

15.5.1.4 Capital cost profile

The capital cost profile of P50 capital costs including the risk-adjustments, escalation and interest during construction are shown in with the scheme in **Figure 15.5**.

Figure 15.5: Capital cost profile (P50, $)



15.5.1.5 Risk adjusted operating costs

The risk-adjusted fixed operating costs are shown in **Table 15.11**.

Table 15.11: Risk-adjusted fixed operating costs (real, 2020 dollars, $ million)

Probability level	P50	P90
Base cost	1.37	1.37
Intrinsic risk	0.03	0.14
Contingent risk	-	-
Total	1.40	1.52

The risk adjusted variable costs associated with electricity is shown in **Table 15.12**.

Table 15.12: Risk-adjusted variable costs associated with electricity (real, 2020 dollars, $/ML)

Probability level	P50	P90
Base cost	39	39
Intrinsic risk		-
Contingent risk		21
Total	**39**	**61**

15.5.1.6 Seqwater charges

Seqwater charges are calculated so the expected additional manufactured water costs for Seqwater are recovered through either or both available allocations and the expected water use. These costs are recovered over a 30-year period, using Seqwater's nominal discount rate of 5.88% in 2020-21. We have developed three options for the Seqwater charges.

Table 15.13 : Seqwater charge options

Tariff	Part A Tariff - Mean cost per irrigation entitlement ($/ML)	Part B Tariff - Mean cost per irrigation use ($/ML)	Total ($/ML)
Option 1: Fixed Seqwater charges	210.25	-	210.25
Option 2: Variable Seqwater charges	-	287.40	287.40
Option 3: Fixed and variable Seqwater charges	100.00	160.51	260.51

15.6 Customer contributions

The customer contribution for the scheme, based on a contribution of $1,500/ML, is shown in **Table 15.14**

Table 15.14: Customer contributions (real, 2020 dollars, $ million)

Financial year	Total	2022	2023	2024	2025
Customer contribution (%)	100%	10%			90%
Customer contribution ($ million)	**51**	**5.10**	-	-	**45.90**

15.7 Funding sources

There are several funding sources for the scheme 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 scheme.

15.7.1.1 Implications of proposed entity structure

The proposed institutional arrangements for the developer and owner of the scheme is a not-for-profit company limited by shares that are owned by customers. This structure would enable producer investors to own an equity interest in proportion to their investment, sell their shares in the entity, and use their shares as security.

15.7.1.2 Australian and Queensland government grant funding

Australian and Queensland government grant funding may be required to meet the capital costs of the scheme in addition to the customer contributions. This grant funding is assumed to not be repaid and reduces the capital cost of the scheme to be funded by concessional loans. Types of grant funding include:

- Queensland Government grant funding
- Australian Government grant funding

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.

15.8 Funding scenarios

The financial analysis uses three funding scenarios for total capex (P90) including escalation and interest during construction:

- 50% Australian Government funding
- Equal funding between Australian and Queensland Government
- QLD funding matches customer funding

The funding scenarios are shown in **Table 15.15**.

Table 15.15: Funding scenarios

Contributor	50% Australian Government Funding	QLD matches Australian funding	QLD funding matches customers
Customers ($m)	51.0	51.0	51.0
Australian Government ($m)	93.0	67.5	84.0
Queensland Government ($m)	42.0	67.5	51.0
Total capex	**186.0**	**186.0**	**186.0**
Customers	27%	27%	27%
Australian Government	50%	36%	45%
Queensland Government	23%	36%	27%

The funding scenarios are based on the P90 capital cost. As there is a 90% chance the capital costs will be less, these funding requirements represent an expected upper limit. This allows governments to set aside funds with a high expectation they will be enough to fund the project. If capital costs are less, unused funding can be used for other projects.

15.9 Customer charges and revenues

Customer charges are calculated to recover the ongoing operating and capital costs of the scheme. Customer charges are separated into tariffs to reflect the costs they are recovering. They include:

- Part A: to recover Seqwater's additional manufactured water costs through fixed charges
- Part B: to recover Seqwater's additional manufactured water costs through variable charges
- Part C: to recover the fixed costs of the distribution scheme, including operating costs and ongoing capital costs
- Part D: to recover the variable costs of the distribution scheme, including variable electricity costs. We have calculated nodal pricing for the Part D Tariff to reflect the pumping costs to reach each area of the scheme.

There are three options to recover the Seqwater manufactured water costs, including a fixed, variable, or combined option. The fixed option places the revenue risk on irrigators, while the variable option transfers this risk to Seqwater. The combined option is midway between the two.

Table 15.16 : Manufactured water charges

Tariff	Part A Tariff - Mean cost per irrigation entitlement ($/ML)	Part B Tariff - Mean cost per irrigation use ($/ML)	Total ($/ML)
Option 1: Fixed Seqwater charges	210.25	-	210.25
Option 2: Variable Seqwater charges	-	287.40	287.40
Option 3: Fixed and variable Seqwater charges	100.00	160.51	260.51

Using Option 1 for the Seqwater charges, the Tariffs for each of the pumping areas are shown in Table 15.17.

Table 15.17 : Customer charges

Charge	Part A	Part B	Part C	Part D	Total
Average	**210**	-	65	39	314
Downstream of Wivenhoe Pump Station	210	-	65	10	285
Downstream of Atkinson Dam Pump Station	210	-	65	23	298
Downstream of Clarendon Dam Pump Station	210	-	65	36	311
Downstream of Gatton Pump Station	210	-	65	48	323
Downstream of Buaraba Pump Station	210	-	65	34	309
Downstream of Lake Dyer Pump Station	210	-	65	48	323
Downstream of Mulgowie Pump Station	210	-	65	64	339
Downstream of Ma Ma Creek Pump Station	210	-	65	61	336
Downstream of Mt Sylvia Pump Station	210	-	65	83	359
Downstream of Western Scheme Pump Station	210	-	65	61	336
Downstream of Scotbar (Western Scheme) Pump Station	210	-	65	110	385

Over the life of the scheme, the present value of these charges is $270 million.

Customer charges are developed using P50 costs, consistent with regulatory pricing for water utilities. For example, IPART have specified using P50 prices in its 2019 review of recycled water pricing[61]:

[61] https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/pricing-reviews-water-services-metro-water-review-of-recycled-water-prices-for-public-water-utilities/legislative-requirements-review-of-recycled-water-prices-for-public-water-utilities/final-report-pricing-arrangements-for-recycled-water-and-related-services-1-july-2019.pdf

Forecasting/budgeting is typically based on P50 estimates, where 50% of estimates exceed the P50 estimate and 50% of estimates are less than the P50 estimate

P50 estimates are appropriate for ongoing charges because unforeseen events are equally as likely to cause cost underruns as cost overruns. These are expected to average to the P50 value over the life of the project.

15.10 Financial analysis

15.10.1.1 Financial net present values

The financial net present value (FNPV) of the scheme, in the absence of government funding, has a negative financial NPV.

Table 15.18 : Financial NPV ($ million, P50 and P90 risk adjusted costs including escalation and interest during construction)

Discount rate	P50 (NPV, $m)	P90 (NPV, $m)
2.45%	-111.3	-109.5
3.22%	-109.2	-109.2
3.61%	-108.2	-109.0

15.10.1.2 Scenario analysis – maximum solar for a P90 of $200m

Scenario analysis was also undertaken to consider the impacts of maximum solar generation under a $200m P90 capital cost cap for the tariffs paid by customers. The impact of the additional solar generation on customer tariffs is shown in **Table 15.19**. Additional solar reduces the tariffs for the customers through the additional revenue generated by exporting solar energy.

Table 15.19: Customer tariffs – Part C and Part D – scenario analysis

Item	Core	Maximum solar scenario
Solar size (MW)	7.0	14.1
Part C ($/ML)	65	54
Part D (weighted average, all zones, $/ML)	39	39

16. Affordability analysis

16.1 Key points

- The affordability analysis assesses ability for customers to afford the upfront and ongoing charges as well as the potential government contributions. The government contributions reduce the initial capital cost of the options, resulting in a lower fixed customer charge.
- The Round 2 demand assessment generated non-binding Letters of Intent for 34,000ML of water to be supplied by the scheme at an upfront charge of $1,600/ML, Part A, B and C annual charge of $260/ML, and Part D variable charge based on the customer location.
- The capacity to pay assessment, which examined water trading data and net margins to determine whether there was capacity to pay by customers, concluded that:
  - the Lower Lockyer water supply scheme, located in the pipeline scheme are, has low water trading prices due to the reliability of the current water product but schemes located nearby (Central Brisbane and Warrill Valley) with reliability similar to the pipeline have water trading prices equal or above the upfront contribution
  - weighted average margin of the valley provided enough capacity to pay the upfront and ongoing charges. Broadacre crops, currently rainfed, may not be able to pay the ongoing charges but it is likely that new water provided by the scheme will increase the production of these crops or result in these areas transitioning to higher margin crops.
- The government funding scenarios assessed as part of this affordability analysis are shown in **Table 16.1**.

Table 16.1: Government funding scenarios ($ million)

Contributor	50% Australian Government Funding	QLD matches Australian funding	QLD funding matches customers
Customers	51.0	51.0	51.0
Australian Government	93.0	67.5	84.0
Queensland Government	42.0	67.5	51.0
Total	**186.0**	**186.0**	**186.0**

16.2 Approach

The affordability analysis assesses the affordability to customers and the Australian and Queensland governments if it were to financially contribute to the scheme. The affordability assesses:

1) What is the difference between cost-reflective water charges under each scenario and the results of the demand assessment?
2) What is the affordability for customers, Queensland Government and Australian Government?

16.3 Customer affordability

The customer affordability analysis considers the ability of the customers to afford the upfront and ongoing charges by analysing the:

- results of the demand assessment
- water trading data
- capacity to pay the modelled upfront and ongoing charges based on net margins.

16.3.1.1 Demand assessment

A demand assessment that assesses whether a scheme has customers and private sector investors is required under DNRME's Assessing Demand for Water: Guidance for Project Proponents. The full demand assessment is detailed in Chapter 13. Two demand assessments have been undertaken as part of this DBC:

3) Round 1: Expression of Interest (non-binding)

4) Round 2: Letter of Intent (non-binding)

A round 3 assessment, involving legally binding water sales, would occur post-DBC assuming this scheme proceeds.

The results of the Round 2 assessment are used in the affordability analysis. The Round 2 assessment, based on government grants of 50%, set a customer contribution in Round 2 that would be **$1,600/ML** up front. In summary, 90 people participated in Round 2 and 152 submitted non-binding letters of intent. The volumes of demanded – based on the product characteristics and prices provided above – is shown in **Table 16.2**

Table 16.2: Round 2 demand

Round 2 Demand	Result (ML)
Minimum	25,000
Likely	34,000
Maximum	42,000

The customer affordability analysis, based on the results of the Round 2 water demand assessment, is that there is likely demand (expressed by customers in non-binding letters of intent) for 34,000ML with an $1,600/ML upfront contribution, Part A, B and C annual charge of $260/ML, and Part D variable charge based on the customer location as shown in **Table 16.3**

Table 16.3: Annual charges for Round 2 demand assessment (net of solar revenue)

Tariff No.	Name of Tariff and Areas in Zone	Fixed – Part A, B & C ($/ML pa)	Variable – Part D ($/ML)	Total - Annual charge ($/ML)
1	Mainline Zone 1: Wivenhoe, Lockyer Creek and Patrick Estate (Tariff 1)	260	11	271
2	Mainline Zone 2: Atkinson, Buaraba, Brightview, Glenore Grove, Fernvale, Crowley Vale, Morton Vale Pipeline	260	25	285
3	Mainline Zone 3: Gatton, Lawes, Forest Hill, Redbank Creek and Lake Dyer	260	39	299
4	Mainline Zone 4: South Gatton, Grantham, Lower Tenthill and Winwill	260	50	310
5	Line Zone 5: Lake Dyer, Laidley South to Mulgowie	260	53	313
6	Line Zone 6: Mulgowie to Thornton	260	68	328
7	Line Zone 7: Upper Tenthill, Caffey to Mt Sylvia	260	67	327
8	Line Zone 8: Mt Sylvia to Woodbine	260	82	342
9	Line Zone 9: Ma Ma Creek to Mount Whitestone	260	61	321
10	Line Zone 10: Carpendale, Lilydale, Flagstone Creek, Helidon and Withcott	260	64	324

16.3.1.2 Capacity to Pay

A capacity to pay assessment was also undertaken to examine the likelihood that the results of the Round 2 assessment are overly optimistic such that customer are not able to afford the upfront and ongoing charges even though they have provided letters of intent.

The capacity to pay is the maximum amount a person or business would be willing to pay to consume a good or service. This assessment provides a ceiling for the price for water that customer could afford if new infrastructure provides additional hydrological benefits in availability or reliability.

The assessment, therefore, was informed by two components:

1) water trading—to reveal what customers pay for water in the permanent water trading market
2) net margins— to reveal what public data and local customer representatives suggest is the profit being made per megalitre of water.

16.3.1.3 Revealed capacity to pay - water trading

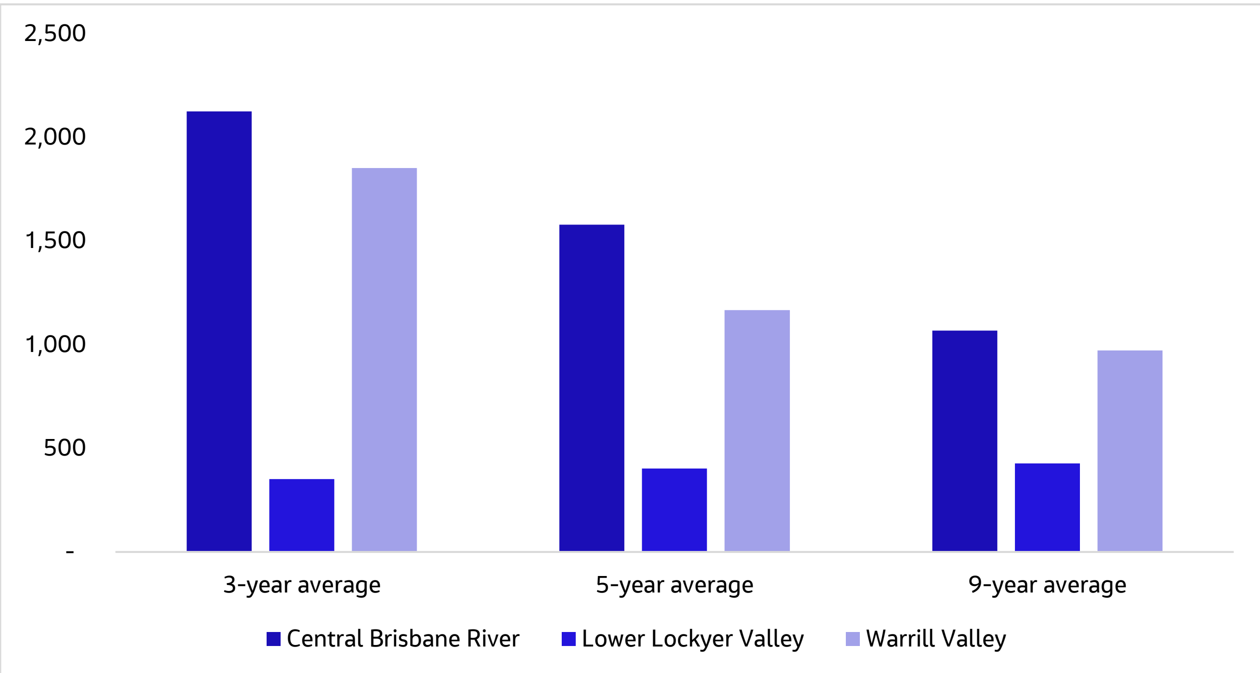
Production in the Lockyer Valley is primarily irrigated by groundwater as noted in the service need chapter. However, it is useful to explore the prices paid by irrigators for water in the Lockyer Valley and similar agricultural areas located nearby.

This section examines the medium priority water in the trading market as 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 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.

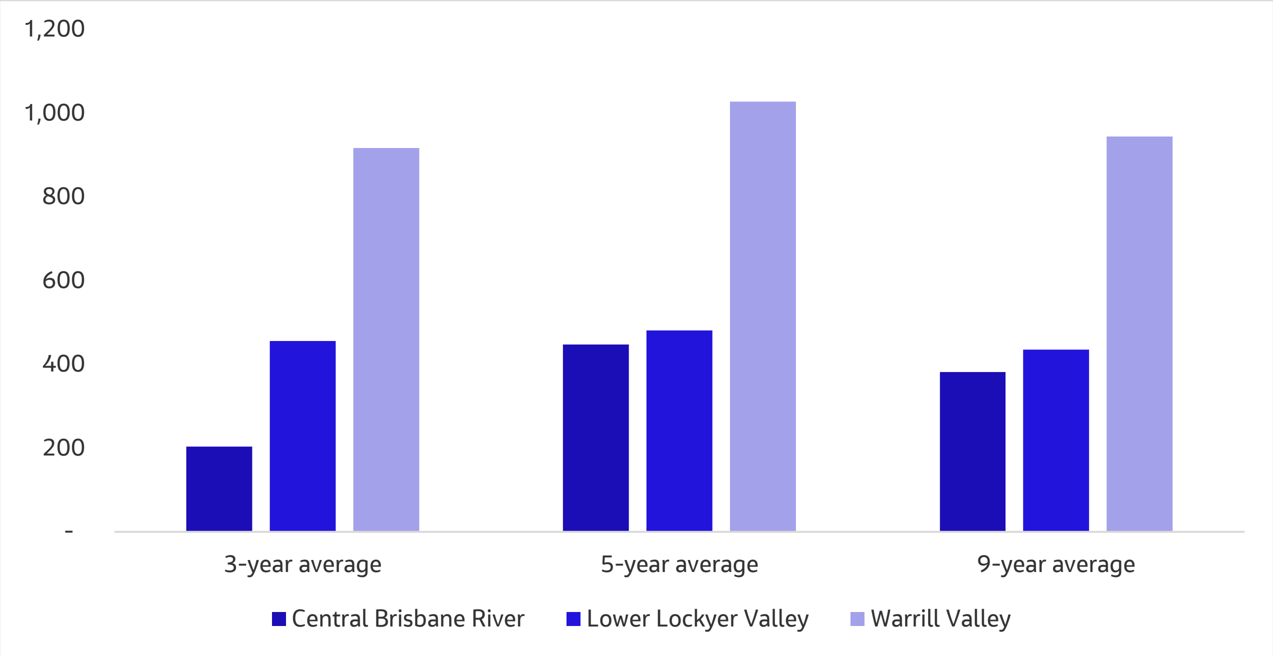
Jacobs have reviewed the historical water trading data for Water Supply Schemes within the Moreton Water Plan.

Figure 16.1: Weighted Average Price ($/ML) – Permanent Medium Priority surface water allocation trades



The weighted average price of trades vary across the water supply schemes in the area. The price of Central Brisbane River and Warrill Valley trades have increased in the last five years, whist they have decreased in the Lower Lockyer Valley.

Figure 16.2: Total Volume ML/a – Permanent Medium Priority surface water allocation trades



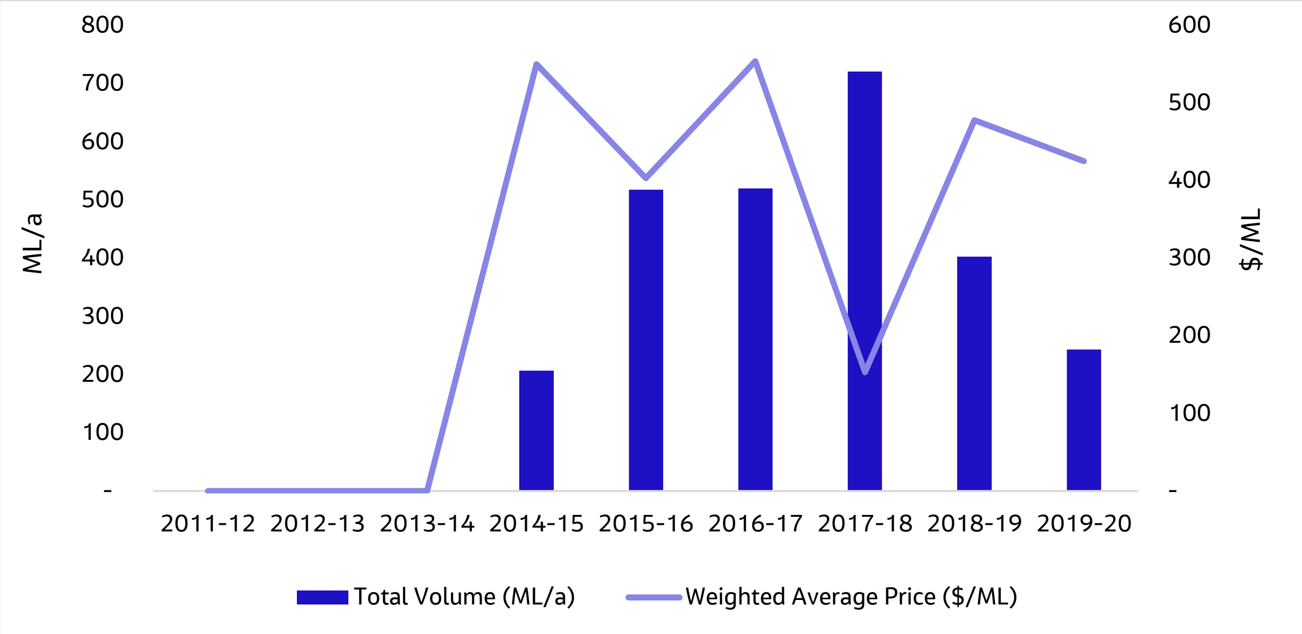
The total volume of trades in each water scheme have remained relatively stable of the past nine year. In the last 3 years however the volume of trades in the Central Brisbane River have halved. The historical average volume of trades each year is 450 ML for Lower Lockyer Valley and Central Brisbane River and 950 ML for the Warrill Valley.

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

16.3.1.4 Lower Lockyer Valley

The Lower Lockyer Valley Scheme is located within the Lockyer Valley and there are customers located in this scheme that will be serviced by the pipeline. Therefore, it is informative to examine trading data as shown in **Figure 16.3**.

Figure 16.3: Lower Lockyer Valley – Permanent Medium Priority water allocation trades



Water has traded at approximately $400/ML over to the most recent 5 years. An average of 450 ML was traded during that period each year. Trading prices in this scheme have been considerably lower than others in the region (Central Brisbane River and Warrill Valley).

The low value ($400/ML) and falling volumes is likely related to the peak nature of the water availability in the water supply scheme following floods in 2010. In the last three years, announced allocations have been 0% which has likely dampened water trading.

Table 16.4: Lower Lockyer Valley Water Supply Scheme – Medium Priority Announced Allocation (%)

FY	Announced allocation (%)
2008	0-16
2009	16-63
2010	27-100
2011	100
2012	100
2013	100
2014	100
2015	81
2016	31
2017	0-17
2018	0
2019	0
2020	0

Source: Seqwater

The water trading data in the Lower Lockyer Valley is not likely to reflect the capacity to pay for access to a new water source via the pipeline that will have an average reliability of 30 years of 72% with a 90%+ reliability in the early years.

16.3.1.5 Nearby water schemes

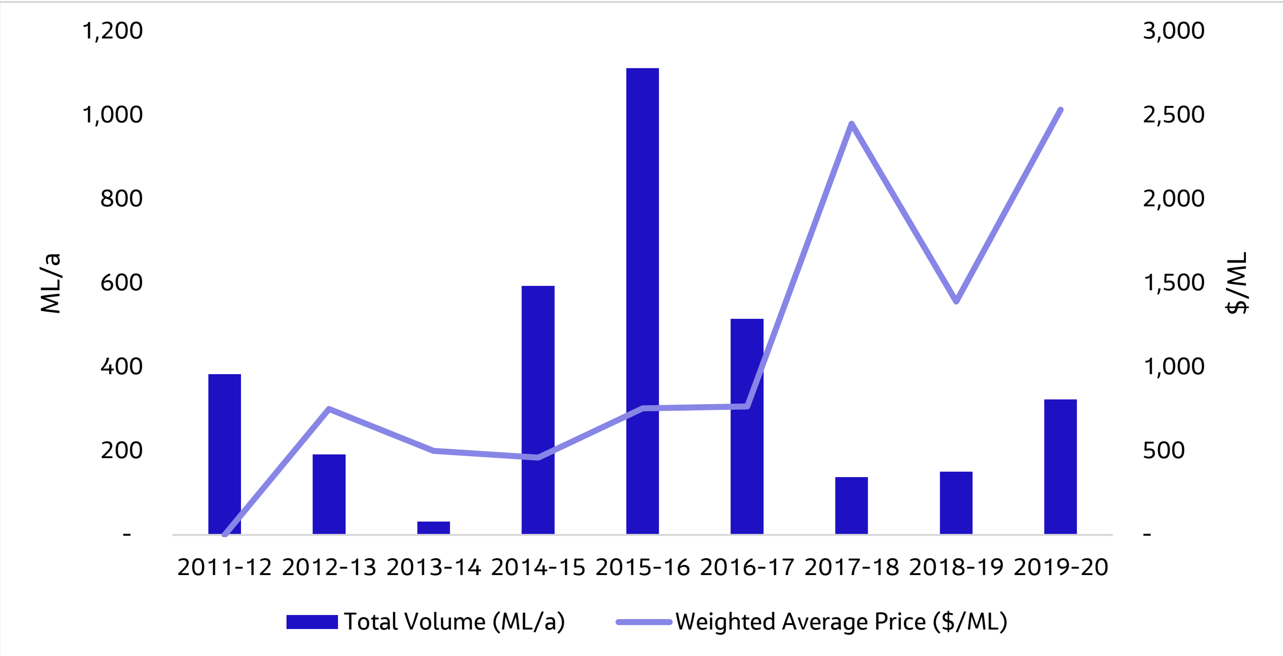
Two schemes (Central Brisbane River scheme and Warrill Valley scheme) located nearby provide an indication of the capacity to pay as these schemes may have reliability that is like the forecast reliability of the pipeline.

The Central Brisbane River scheme is located downriver of Wivenhoe Dam but upstream of Mt Crosby River. The reliability of medium priority water in the scheme is high with 100% reliability from 2015 to 2019, dipping to 85% in 2020.

In the Central Brisbane River scheme, water has been traded at an average of $1,579/ML over the most recent 5 years. An average of 450 ML was traded during that period each year with higher volumes coming in 2016 and 2017 (1,112 and 515 ML respectively). Water volumes traded have been lower than the historical average over the last three years. Since 2017 prices of trades have trended upwards from $766 to $2,533/ML.

Figure 16.4 outlines the historical total volumes and prices for Medium Priority water in the Central Brisbane River.

Figure 16.4: Central Brisbane River – Permanent Medium Priority water allocation trades



The trading data is volatile but the upward trending trading price with a high of $2,533/ML in 2020 suggests that a nearby water scheme with high water reliability, even higher than the pipeline, has a capacity to pay that is higher than the upfront contribution proposed for the pipeline.

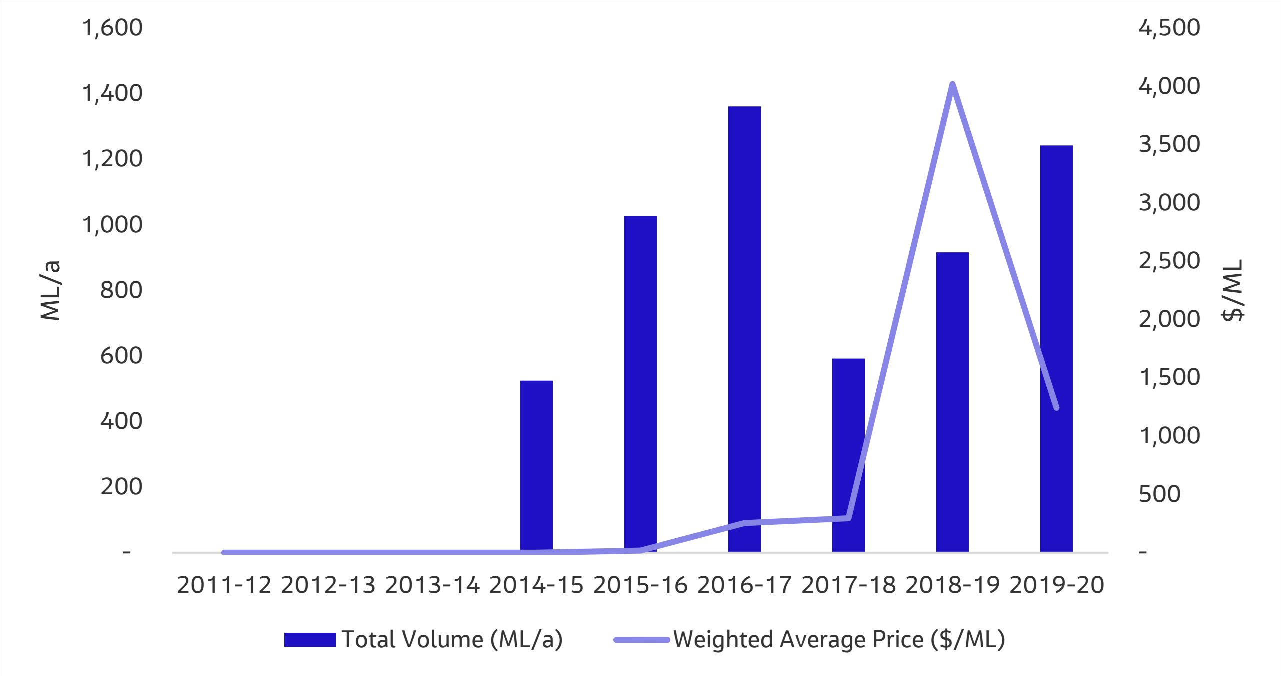
The Warrill Valley Scheme is located south of the Lockyer Valley. The reliability of medium priority water in the scheme has been 100% since 2011.

In the Warrill Valley Scheme, water has been trading at approximately $1,200/ML over the most recent 5 years. An average of 950 ML was traded during the period each year. Trading prices and volumes have been the highest in comparison to other schemes in the region (Central Brisbane River and Lower Lockyer Valley).

The average volume of trades has remained relatively stable over the assessment period. The highest volume was recorded in 2017 of 1,362 ML/a. There was a slight drop in the volume of trades in 2018 and 2019 (592, and 916 ML/a respectively).

There was also a spike in trading prices in 2019 of $4,021/ML before moving back towards the long-term average in 2020.

Figure 16.5: Warrill Valley – Permanent Medium Priority water allocation trades



Like the Central Brisbane scheme, the water trading prices in the Warrill Valley are equal or greater than the $1,600/ML upfront contribution, even accounting for the higher reliability.

16.3.1.6 Summary of water trading values

Water trading values and what they mean for willingness to pay are summarised in the table below. It is important to note that the care needs to be taken as the reliability of these products (particularly in the Lower Lockyer Valley and Warrill Valley) may be very different to the proposed reliability of the new water.

Figure 16.6: Summary of permanent surface water trading values in the Moreton Water Plan

Scheme	Average traded price over recent 5 years	Implications for willingness to pay
Central Brisbane River	1,579	NPV of net margin per ML should be $1,579. This could be expected to reflect the current reliability in the Central Brisbane River and the dominant crops grown.
Lower Lockyer Valley	400	NPV of net margin per ML should be $400. This could be expected to reflect the current reliability in the Lower Lockyer Valley and the dominant crops grown.
Warrill Valley	1,200	NPV of net margin per ML should be $1,200. This could be expected to reflect the current reliability in the Warrill Valley and the dominant crops grown.

Our analysis suggests that while the Lower Lockyer scheme has a lower water trading prices which likely due to the reliability of the water product, schemes located nearby with reliability like the pipeline have water trading prices equal or above the upfront contribution.

16.3.1.7 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 proposed scheme. The following table below outlines these enterprises. A full analysis of how these net margins were derived is provided in Section 14.4.1.5 in the economic analysis chapter.

Net margins for these crops vary from $280/ML for cereal crops to $6,410/ML for cherry tomatoes and tomatoes. The weighted net margin for the region is $1,520/ML.

Jacobs then used the 30-year average reliability of the scheme (72%) to adjust the net margins of the crops to give an indication of the capacity to pay of the upfront charge.

The net margins were then converted to a net present value in the tables below. An investment profile of 10 and 20 years and discount rates of 10-15% have been adopted to account for uncertainty (which reduces capacity to pay) and different investment horizons.

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.

Table 16.5: Adjusted net margins of crops ($/ML) – NPV over 10 years

Crop	Low return required (10%)	Medium return required (12.5%)	High return required (15%)
Lucerne / Crop rotations	2,350	2,118	1,920
Brassica (Broccoli, Cauliflower, Cabbage)	5,254	4,734	4,291
Hay	2,673	2,408	2,183
Potatoes & Sweet Potatoes	7,235	6,519	5,910
Onions	9,954	8,969	8,130
Carrots	6,314	5,689	5,157
Turf	20,692	18,644	16,901
Cereal crops	1,290	1,163	1,054
Pumpkin	7,143	6,436	5,834
Sweet Corn / Corn	2,949	2,657	2,409
Shallots	12,858	11,585	10,502
Pasture & Rhodes Grass	1,475	1,329	1,205
Melons / Watermelons	6,267	5,647	5,119
Nursery & Seed	18,987	17,108	15,508
Fodder & Silage	1,521	1,370	1,242
Beans	1,843	1,661	1,506
Cherry Tomatoes & Tomatoes	29,540	26,616	24,128
Lettuce	25,392	22,879	20,740
Peanuts	3,456	3,114	2,823
Beetroot	4,055	3,114	2,823
Fruit & Avocado trees	17,650	15,903	14,416
Wombok	7,235	6,519	5,910
Silver beet	7,235	6,519	5,910
Celery	7,696	6,934	6,286

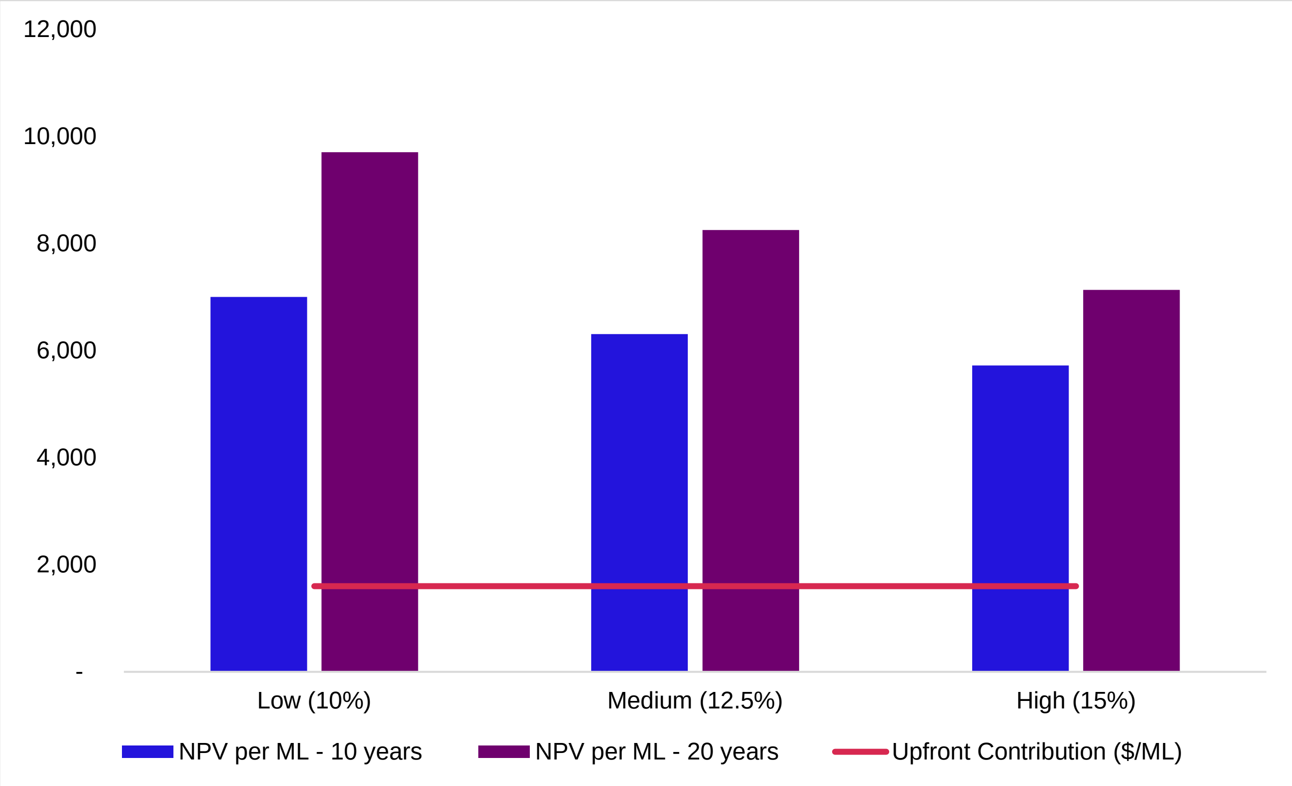
Table 16.6: Adjusted net margins of crops ($/ML) – NPV over 20 years

Crop	Low return required (10%)	Medium return required (12.5%)	High return required (15%)
Lucerne / Crop rotations	3,256	2,770	2,394
Brassica (Broccoli, Cauliflower, Cabbage)	7,279	6,191	5,352
Hay	3,703	3,150	2,723
Potatoes & Sweet Potatoes	10,025	8,527	7,370
Onions	13,792	11,731	10,140
Carrots	8,748	7,440	6,431
Turf	28,669	24,385	21,078
Cereal crops	1,788	1,521	1,314
Pumpkin	9,897	8,418	7,276
Sweet Corn / Corn	4,087	3,476	3,004
Shallots	17,815	15,153	13,098
Pasture & Rhodes Grass	2,043	1,738	1,502
Melons / Watermelons	8,684	7,386	6,385
Nursery & Seed	26,307	22,376	19,341
Fodder & Silage	2,107	1,792	1,549
Beans	2,554	2,172	1,878
Cherry Tomatoes & Tomatoes	40,929	34,813	30,092
Lettuce	35,182	29,925	25,867
Peanuts	4,789	4,073	3,521
Beetroot	5,619	4,779	4,131
Fruit & Avocado trees	24,455	20,801	17,980
Wombok	10,025	8,527	7,370
Silver beet	22,667	19,280	16,665
Celery	10,663	9,070	7,840

The weighted average net margin considers the volumes and individual net margins of each crop grown in the region. Jacobs have conducted the assessment above on this figure to give an indication of the scheme wide ability to pay for new water.

The following chart outlines the various NPV's of the regions weighted net margin in comparison to the Round 2 Demand assessment upfront contribution of $1,600/ML

Figure 16.7: Weighted Net Margin of crops ($/ML) NPV comparison



The regions weighted crop mix has a significant allocation towards high-value annual horticulture production. These crops have high margins and the ability to afford higher upfront contributions. However, there is broadacre crops (Cereals, Pasture & Rhodes Grass, Fodder & Silage, Lucerne) that may be unable to meet this level without using a greater portion of the crops net margin to purchase water.

In the absence of material changes in input costs and revenues, there is strong evidence to suggest that the region does have the capacity to afford the upfront contribution, based on the NPV per ML of the weighted net margin over a 10 and 20-year investment period.

16.3.1.8 Proposed changes to annual charges

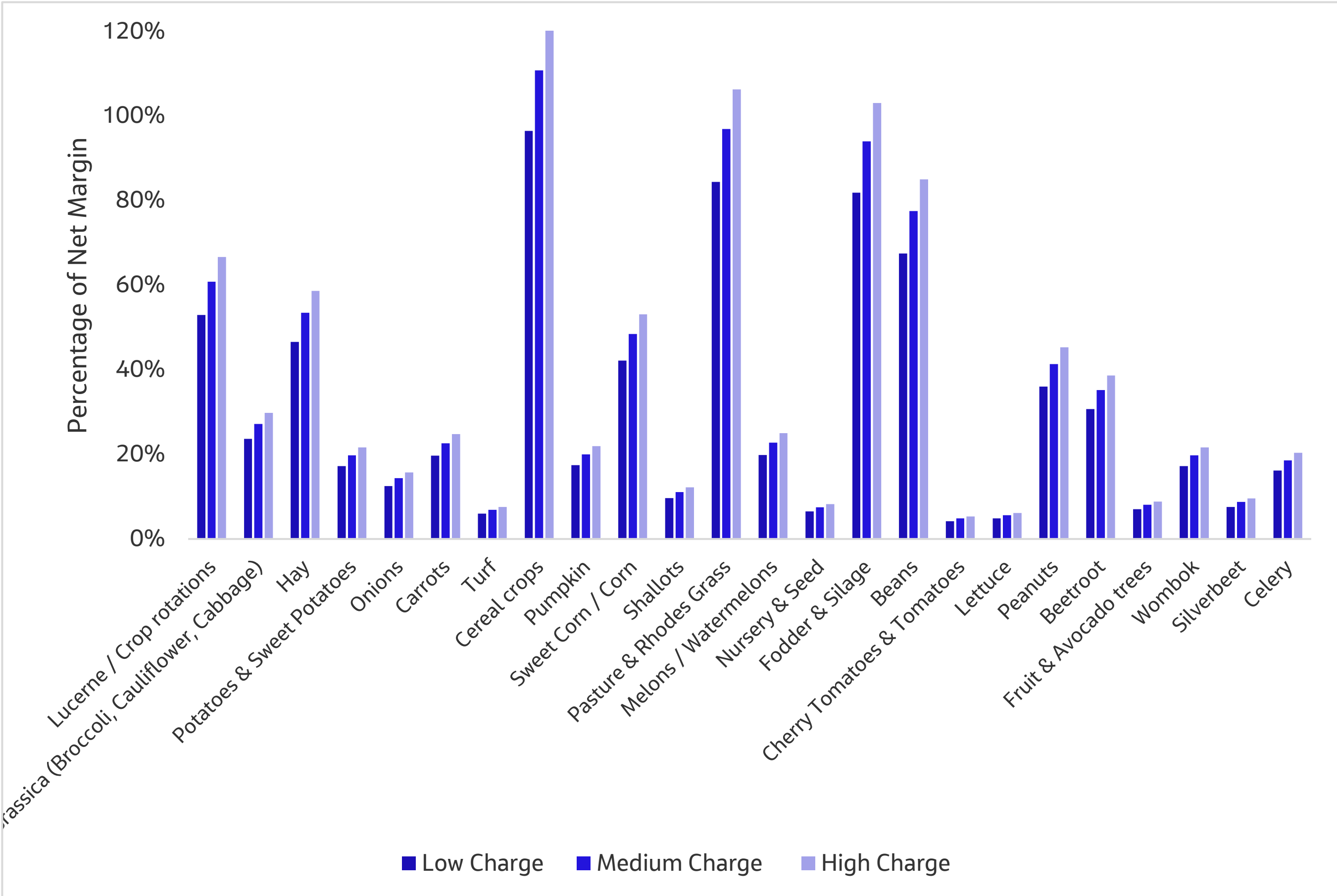
When addressing the capacity and ability to pay of customers, it is important to also consider the impacts of annual water charges on entitlements. The fixed and variable annual charges resulting from the Round 2 assessment range from $271 to $324 per ML (see section 16.3.1). The following table outlines the impact of the proposed annual charges on the net margins for each crop type. The higher the percentage the greater portion of margin that will need to be used to cover the cost of the annual charge.

Table 16.7: Portion of net margin required to cover the proposed annual charges

Crop	Low annual charge ($270/ML)	Medium annual charge ($310/ML)	High return required ($340/ML)
Lucerne / Crop rotations	53%	61%	67%
Brassica (Broccoli, Cauliflower, Cabbage)	24%	27%	30%
Hay	47%	53%	59%
Potatoes & Sweet Potatoes	17%	20%	22%
Onions	13%	14%	16%
Carrots	20%	23%	25%

Crop	Low annual charge ($270/ML)	Medium annual charge ($310/ML)	High return required ($340/ML)
Turf	6%	7%	8%
Cereal crops	96%	111%	121%
Pumpkin	17%	20%	22%
Sweet Corn / Corn	42%	48%	53%
Shallots	10%	11%	12%
Pasture & Rhodes Grass	84%	97%	106%
Melons / Watermelons	20%	23%	25%
Nursery & Seed	7%	8%	8%
Fodder & Silage	82%	94%	103%
Beans	68%	78%	85%
Cherry Tomatoes & Tomatoes	4%	5%	5%
Lettuce	5%	6%	6%
Peanuts	36%	41%	45%
Beetroot	31%	35%	39%
Fruit & Avocado trees	7%	8%	9%
Wombok	17%	20%	22%
Silver beet	8%	9%	10%
Celery	16%	19%	20%

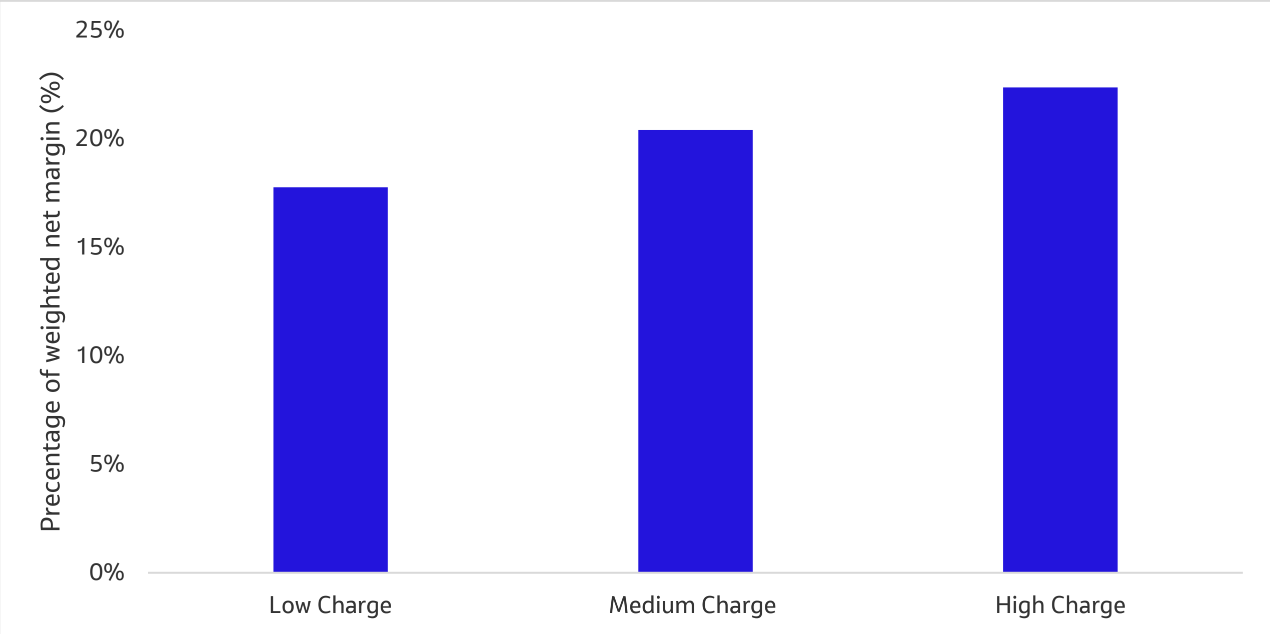
Figure 16.8: Portion of net margin required to cover the proposed annual charges



This assessment gives an indication of the impact of the proposed annual charges on the profit of each crop type allowing an insight into the capacity of the region to afford such costs. There is significant impact on the profit levels of most crop types in the region as a result of the proposed annual charges. Most crops will have to contribute over 20% of their net margin to cover these charges.

As evidenced with the upfront contribution, most of the broadacre crops will be unable to afford these annual charges at the current margin levels. The following figure outlines the impact of the proposed annual charges on the weighted net margin of the region.

Figure 16.9: Portion of net margin required to cover the proposed annual charges – weighted net margin



The impact of the annual charges on the weighted net margin is between 18 and 22%. The price impacts are considerable but are still within the revealed ability to pay. It is important to note that as the scheme develops and has access to a secure and reliable source of water, the region will drive towards the higher return crops. There is already evidence of this (Cherry Tomatoes and Tomatoes, Lettuce, Fruit and Avocado Trees and Silver beet) which are all impacted by less than 10% from the increase in annual charges. This transition and our assessment suggest there is an ability to afford the increased annual charges.

16.4 Australian and Queensland funding

The financial analysis uses three funding scenarios:

- 50% Australian Government funding
- Equal funding between Australian and Queensland Government
- QLD funding matches customer funding

The funding scenarios are shown in **Table 15.15**.

Table 16.8: Funding scenarios

Contributor	50% Australian Government Funding	QLD matches Australian funding	QLD funding matches customers
Customers ($m)	51.0	51.0	51.0
Australian Government ($m)	93.0	67.5	84.0
Queensland Government ($m)	42.0	67.5	51.0
Total capex	**186.0**	**186.0**	**186.0**
Customers	27%	27%	27%
Australian Government	50%	36%	45%
Queensland Government	23%	36%	27%

Under these funding scenarios, the customer upfront contributions and ongoing charges are affordable.

17. Appraisal summary

The purpose of this chapter is to summarise and evaluate the primary environmental, financial, economic and social impacts of the project that have been considered in this detailed business case. The Appraisal Summary Table below identifies and summarises the qualitative and quantitative impacts of the project.

	Impact description	Summary of key impacts	Quantitative impacts	Qualitative short-term impacts	Qualitative medium-term impacts	Qualitative long-term impacts	Impact / value
Environmental	The positive environmental impacts of relate to the enhancement of agricultural water security. The known negative impacts are primarily related to the construction phase, while further investigations will be required to understand and managed longer-term impacts to environment, aboriginal cultural heritage and residential amenity.	The positive impacts support an increase in the area of land used for irrigation and facilitate the diversification of agricultural land uses. The project may support the establishment of new land uses associated with the 'downstream' processing of agricultural products. The project will result in a short-term decline in, and potential long-term loss of, residential amenity. Most of the negative environmental impacts of the project are isolated to the construction phase and can be managed through careful planning. The medium-, and long-term negative impacts mostly relate to limited loss of flora and fauna, and some impact on waterways. The overall negative impact appears manageable at this stage although further investigations are required.	Clearance of up to: - 990 ha of non-remnant vegetation - 37 ha of remnant vegetation - 26.56 ha of core koala habitat Potential to impact: - seven EVNT TECs listed under the EPBC Act - seven REs listed under regulated vegetation management mapping prepared by DNRME - species or species habitat for 30 flora and 32 fauna EVNT species under the EPBC Act	During construction the adverse impacts could include: - Discharge of sediments and stormwater, the introduction of pollutants, localised adverse impacts for water geomorphology and aquatic habitat, and disposal of hydrostatic test water. - Air quality impacts, including dust and combustion emissions. - Ground water levels and quality may be affected. - Increased noise and vibration. - Reduction in landscape and visual amenity. - Effects on aboriginal cultural heritage. - Effects on historic heritage.	Detailed assessment was conducted of the medium -term impacts on the project area. The assessments identified some potential medium term-impacts that require further investigation: - Flora and fauna of conservation significance could be present in the project area. - Some negative impact on geological structural features that may be mitigated with identified measures. - Minimal impact on core water levels and quality that requires monitoring - Contaminated lands.	Detailed assessment was conducted of the long - term impacts on the project area. The assessments identified some potential medium term-impacts that require further investigation: - Removal of native vegetation - Displacement of resident fauna - Reduction of fauna habitat - Loss of residential amenity - Aboriginal cultural heritage - Emissions production	The environmental impact risks require further investigation through an environmental impact statement or impact assessment report. The project is likely to trigger environmental offset requirements, and there is a requirement for further consultation with traditional owners to understand and mitigate potential risks to tangible and intangible aboriginal cultural heritage.

	Impact description	Summary of key impacts	Quantitative impacts	Qualitative short-term impacts	Qualitative medium-term impacts	Qualitative long-term impacts	Impact / value
Economic	The scheme will result in a substantive increase in agricultural production, direct and indirect job creation and a net positive economic impact on Lockyer Valley.	A cost-benefit analysis was undertaken on the scheme in comparison to the base case, capturing the economic impacts for a detailed business case level assessment. The key benefits for the project include increased water availability and reliability that increases irrigated agricultural and other primary production in the valley. The economic impact assessment found that project will result in increased short-term (construction) employment) and significant medium-, and long-, term job creation.	The quantitative impacts identified through the detailed business case: - Total benefits of \$304.5 million and total costs of \$244.5 million. - Increased annual agricultural production of \$210 million. - 373 construction jobs. - 1,923 permanent jobs in agriculture and supporting industries.	The short-term impacts of the project relate primarily to the construction phase, which will have both positive impacts, through the creation of construction jobs, and costs for the construction of the pipeline, irrigation network and associated infrastructure. Assessments were conducted on the costs of the scheme, including short-term construction costs. The P90 and P50 cost estimates consider the intrinsic and contingent risks of the project.	The medium-term economic impacts of the project relate to the growth and investment in the agricultural sector, and growth in associated industries, including 'downstream' processing, transport and support services. The increased investment in higher value, export ready crops will increase the agricultural productivity of the region, and Australia, generally, through increased exports. Modelling was conducted to export focused crops for a 42,000ML scheme, which resulted in an increased BCR. The increased water availability will allow a new quarry to proceed in the region and achieve improved efficiency through onsite production.	The long-term economic impacts of the project relate to increases in employment and agricultural output. The analysis considered residual values and sensitivities.	BCR: 1.25 NPV: \$60.1 million

	Impact description	Summary of key impacts	Quantitative impacts	Qualitative short-term impacts	Qualitative medium-term impacts	Qualitative long-term impacts	Impact / value
Financial	The financial impact of the project is that it will require financial contributions from the Commonwealth and Queensland Government, and water customers.	The project has been comprehensively modelled, with cost estimates tested and assessed to measure financing options. The financial assessment generated risk-adjusted capital and operating costs, residuals values, financial NPVs and likely customer charges to consider the financial viability of the scheme.	The financial analysis modelled the recovery of the costs of the project, including on recovering water costs (both fixed and variable) and costs of the distribution scheme and infrastructure (both fixed and variable). The assessment considered and modelled the options and combinations for financing the project through various combinations of: - Customer contributions - Commonwealth government grant funding - Queensland government grant funding	The qualitative assessment identified that the viability of the project necessitates funding contributions from both Commonwealth and Queensland Governments. Modelling on customer contributions that were tested through a detailed and comprehensive demand assessment and identified that for the scheme to progress the majority of the funding must come from non-recoverable Government grants.	See qualitative short-term impacts.	See qualitative short-term impacts	P90: $186 million P50: $170.2 million

	Impact description	Summary of key impacts	Quantitative impacts	Qualitative short-term impacts	Qualitative medium-term impacts	Qualitative long-term impacts	Impact / value
Social	The social impact of the project will be largely positive for the community in Lockyer Valley and Somerset, with improvements on all relevant indicators relating to the social conditions and lives of the members of the community.	The Lockyer Valley and Somerset region will experience predominantly positive social impacts from the project. The positive impacts relate to the significant increase in employment through the construction and operational phase. The negative impacts relate to disruptions during the construction phase and longer-term impacts on private property rights, cultural heritage and the environment.	The quantitative impacts identified for the Lockyer Valley and Somerset region are: - 373 construction jobs. - 1,923 permanent jobs in agriculture and supporting industries.	During construction: • Increased employment in the construction sector • Influx of short-term workers, and a limited number of short-term residents. • Increased training and employment opportunities in the construction sector for residents. • Disruption to lifestyle and business activities. • Additional noise, dust and traffic • Land acquisition and land access easements impacting private land owners and residents.	Detailed assessment was conducted of the medium -term impacts on the project area, finding: • Increase in regional agricultural production and employment • Increased training and employment opportunities in the agricultural sector. • Changed land use to the production of higher value crops • Property impacts for private land owners relating to easements and permanent infrastructure • Potential impacts on cultural heritage • Environmental impacts	Detailed assessment was conducted of the long - term impacts on the project area, finding: • Increase in long term regional agricultural production and employment • Changed land use to the production of higher value crops • Potential impacts on cultural heritage • Limited adverse environmental impacts	The social impact risk identified for this project relate to the construction process and impacts on urban water users, the environment and cultural heritage. These risks are manageable through construction management, consultation with key stakeholders and adherence to proper processes for the protection and preservation of environmental and cultural assets.

18. Market considerations

18.1 Key points

- There is capacity and interest within Australian construction companies to construct the project.
- This assessment, like previous ones, has 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 may not have enough capacity or expertise to undertake a lead construction role by themselves, but could provide support through equipment hire, provision of materials and subcontracting arrangements. A partnership between a few local companies to undertake the lead contractor role could be an option.
- 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 in relation to 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 project, subject to further consideration of market conditions prior to tendering, particularly when the impacts of coronavirus pandemic are better understood.

18.2 Objectives

By investigating prevailing market conditions, it is possible to make an initial assessment of the capability of construction companies to deliver the project. The appetite of market participants to undertake a project has an impact on the preferred delivery model and the level of competition within the market at project tendering stage.

18.3 Approach

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. For example, 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. As this project does not have any relatively high-risk construction components (e.g. building a dam, unfavourable below-ground conditions), a contractor tendering will be more confident in being able to quantify and reduce any cost allocation to risk.

There is a limit to the frequency that contracting companies can be engaged on a project. 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.

Funding for this project is yet to be committed from either the Australian or the Queensland Government, and the commencement date of the project is uncertain. As a result, testing the depth of the market and assessing the market risk appetite and the availability of interested contractors have limited value, because these factors vary over time, in particular following the impacts of the coronavirus pandemic.

Once evidence becomes available that shows project funding is likely, a comprehensive market engagement and communication process would be necessary to ready the market to receive the tenders. It is likely that such a process would 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 of the date that tenders will be released improves the quality of the bid teams and thereby also 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 Lockyer region
- the requirements of the project
- recent assessments of capability and interest from the construction market for water infrastructure projects.

18.4 Contracting tiers

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 18 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.

Typically, the capacity to deliver a higher-value and higher-risk project would reside with a tier one contractor with a proven track record and capacity to deliver projects with a similar risk profile and level of complexity. Tier one contractors are the largest and most experienced and have a strong 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. Lower-risk and lower-value projects may be delivered by tier two and three contractors, including those located locally.

Projects delivered by tier one contractors may offer scope for the involvement of smaller tier two and three contractors if the project consists 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. Projects with smaller values and limited risks placed upon the contractor may be suitable for tier two or three contractors to undertake a lead contracting role on.

A contractor's ability to finance cash flow during construction (particularly with retentions and liquidated damages) is a significant part of a contractor's willingness to tender.

Table 18 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 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.

Tier one	Tier two	Tier three
	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 plant and equipment and have access to experienced machine operators.	They also usually own 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.

18.5 Market assessment

The construction of the project does not carry any significant risk, as most of the ground conditions are favourable for pipeline installation, and operating models for the pump stations are simple. The main areas of focus for construction of the project are the interface between the existing storages of Wivenhoe Dam, Atkinson Dam and Clarendon Dam; connecting the solar array to the power network; and managing construction through productive farmland and rural roads. This risk profile may provide the opportunity for a tier two contractor (or a group of tier two contractors) to complete the project and leverage their understanding of local conditions and/or benefit from their lower overhead cost structures.

Discussions were held with local representatives and the Lockyer Valley Regional Council to learn about 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 that several local contractors should be encouraged to participate in the build through providing design services, supplying equipment hire services and construction materials and taking up subcontracting roles. Such companies include Lockyer Designs, Joe Wagner Group, Newlands Group, RJ's Earthworks and Brooks Earthmoving & Quarries. These companies have had exposure to large-scale irrigation, pumping and associated control system works and would be capable to undertake aspects of the project. Local water and sewerage service provider Queensland Urban Utilities has established a comprehensive endorsed contractor and consultant list which further demonstrates the local capacity within the broader region.

Significant market feedback was received on two recently completed detailed business cases for large water development project—the detailed business cases for Cloncurry River Dam (Jacobs, 2019) and Gilbert River Dam (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, albeit of larger capital value than the preferred option for this project. They are also located remotely, whereas this project is located less than an hour west of Brisbane. The following comments and observations by the construction companies are also relevant for this project:

- Companies were positioning themselves as developers of water infrastructure projects, some of which were constructed recently.
- Companies were prepared to take on the inherent risks associated with constructing water infrastructure projects, including navigating below-ground conditions, managing the diversion of existing water courses and other wet weather events, 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, wet weather risk and other suitable risks to the contractor did not cause concern with these contractors; they saw this as business as usual, particularly if the pre-tender investigations were rigorous. Companies were comfortable with contracting the project 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 for and then target their limited project procurement budgets primarily on those selected projects.
- The construction market in Queensland was resource-constrained (note that this assessment was made before the coronavirus pandemic occurred).

To apply for Australian Government funding, the head contractor may be required to hold federal safety accreditation, due to the size of the Australian Government contribution[62]. This accreditation is typically held by tier one contractors, and some tier two contractors, particularly those involved with federal government-funded road projects. The costs associated with maintaining accreditation, such as systems upkeep, accreditation fees and auditing, limits the number of contractors with accreditation. For a contractor with federal safety accreditation, the systems and processors required by the Federal Safety Commissioner must be utilised on all work that the contractor performs, irrespective of a requirement for them to be held on any particular job. Early engagement with potential contractors is critical for this requirement to be understood to allow contractors to plan to either obtain accreditation or develop a partnership with a contractor who does.

However, there is significant scope to use local tier two and three contractors. A tier one contractor could engage 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 the interest of potential contractors and subcontractors to support the inclusion of local content.

18.6 Conclusion

Based on state-wide and local evidence, we conclude that the capability exists in the market to deliver the project.

The market assessment has also found that there is capability to deliver the project. 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 in relation to private sector projects. This may make capacity available during this period as some private sector projects may not proceed.

Once project funding is confirmed, further consideration of market conditions will be necessary, as well as significant consideration of the allocation of project risk and the conditions of a construction contract, to ensure an effective and efficient delivery model is adopted.

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[62] Federal safety accreditation is required if a head contract under the project includes building work of $4 million or more (GST inclusive) and:

- the value of the Australian Government contribution to the project is at least $6 million (including GST) and represents at least 50 per cent of the total construction project; or
- the Australian Government contribution to a project is $10 million (including GST) or more, irrespective of the proportion of Australian Government funding.

19. Delivery model analysis

19.1 Key points

- A design and construct (D&C) contracting model is recommended. The model allows the various engineers (geotechnical, design and construction) to collaborate progressively and respond to issues as they arise.
- Minimising the cost of tendering by providing comprehensive information and a preliminary design will be very important.
- The construction of the project does not carry any significant risk, as most of the below-ground conditions are favourable for pipeline installation, and operating models for the pump stations are simple.
- The focus for contractors would be on managing the interface of connecting the project with the existing storages of Wivenhoe Dam, Atkinson Dam and Clarendon Dam; connecting the solar array to the power network; and managing construction through productive farmland and rural roads.
- These risks are most cost effectively managed by the contractor and will be allocated accordingly.
- Like most irrigation projects, the project needs a cost-effective delivery model 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.
- One work package for pump stations and pipelines is recommended. This is because of the complex interface between the pump stations and pipelines to meet the project's performance. There may be an opportunity for the proposed solar array to be contracted separately.

19.2 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 19 1**).

Table 19 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, having gone 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)	In addition to the points noted under 'construct only':

Delivery model	Characteristics
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 ▪ Mt Crosby East Bank Water Treatment Plant, Centrifuge Upgrade Project, Seqwater	▪ 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. ▪ 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 design, 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, operational 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 project is complex or high-risk.

Delivery model	Characteristics
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: ▪ 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	▪ 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. ▪ 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 GCS 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.

Delivery model	Characteristics
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: ▪ Prospect Water Filtration Plant (NSW) ▪ Macarthur Water Filtration Plant (NSW)	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. ▪ 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).

19.2.1 Work packages

For this project, it is recommended that the work be tendered in one package for pump stations and pipelines and not be broken into discrete work packages. The construction of the project does not carry any significant risk, as most of the ground conditions are favourable for pipeline installation and operating models for the pump stations are simple. The main areas of focus for construction of the project are managing the interface of connecting the project with the existing storages of Wivenhoe Dam, Atkinson Dam and Clarendon Dam; connecting the solar array to the power network; and managing construction through productive farmland and rural roads

Awarding one work package to a single contractor provides that contractor with the flexibility to switch resources between several work fronts and thereby leverage efficiency gains. Construction work on the project is relatively similar overall, which provides overlap of standardised equipment and the skilled personnel required; therefore, if work at a location is delayed, the resources can be redeployed to other areas.

The proposed solar array is one element of the project that may benefit from a separate works package, engaging several contractors who have specific experience with large solar arrays, including experience in connecting to the power network. In addition, there may be opportunities to have the project proponent purchase specific items for the project and make them available to the contractor to remove any contractor mark-up. Items may include property outlets, pipeline fittings and HDPE pipe. However, the scope of this opportunity may be limited if the purchasing power of the proponent is less than that of the contractor.

19.2.2 Delivery models

The delivery model assessment was developed in a way that can allocate the construction risk related to below-ground conditions and weather to the contractor. This is because the contractor is best able to manage these risks and inject cost-effective responses to issues that arise. 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 19 2**) when measured against the criteria.

Table 19 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

Delivery model	Evaluation criteria					Likelihood of success	Comments
	1	2	3	4	5		
							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.
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,
Managing contractor	7	3	7	5	3	Possible	The option could be used as a variation to ECI, with the same strengths and weaknesses. Using 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 support (PPP is further discussed in section 19.3).
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.

19.3 Public private partnership

The value for money drivers in the national PPP guidelines are:

- complex risk profile and opportunity for risk transfer
- whole-of-life costing
- innovation

- measurable outputs
- asset utilisation
- better integration of design, construction and operational requirements
- 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 through the purchase of their water entitlements and the funding provided by Australian and/or Queensland governments. 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 servicing a limited number of knowledgeable customers. The likelihood of dissatisfaction and conflict is high.

19.4 Tendering process

The market needs to be informed of the project's progression through public notices well before tenders are released. The tender process should be open to all civil construction companies, in accordance with sound probity and procurement practices. The assessment criteria should be clearly stated in the conditions of tender so that each contractor will be able to assess the cost of tendering.

An open tender process is preferred, because an individual contractor's ability to perform and be competitive depend on the company's forecast capacity. Each company's available capacity will vary according to its success in winning other contracts, staff movements and the availability of subcontractors on which the company relies. The open tender process in effect lets the civil construction market self-assess the value of spending money on tendering.

This also allows the up-and-coming contractors to prove their competence in assembling the resources for a competitive bid.

The alternative is a two-staged process in which companies go through a process of providing evidence of capability, experience and capacity, so that a prequalified limited bid list can be compiled. Companies on the prequalified list are then offered the opportunity to tender. This requires very careful real-time analysis of each company's resources and work commitments. Companies are reluctant to declare all the information required to keep such an assessment current and are at times tendering for more than one job. A fully open tender process is therefore recommended.

However, this then raises the very real problem of the high cost of tendering when so many companies expend the resources to bid but are unsuccessful. Because of the significant amount of time and effort to submit a proposal, large companies usually rely on winning one in three tenders because of the cost involved. For a company to hold its cost of tendering down for this project will involve doing less work, which in turn leaves more unknowns. These must be addressed through higher contingencies, which leads to a higher bid price. One of the most effective ways to avoid this is to keep the cost of tendering low by providing the contractors the information they need as part of the tender documents. This means spending more money on the process of preparing tender documents. For this project, it includes preparing an excellent technical investigation and assessment but also preliminary designs that are developed well enough to make estimation easier for tenderers.

In the lead-up to tendering, it is important that the project is seen by the tenderers as being a desirable project to win because the likelihood of making their margin is high. Notification of the release of tenders well in advance will also allow them to assemble high-quality bid teams.

Long allowable construction timeframes also make a project more useful to contractors, as they will have more opportunity to coordinate the work with existing work commitments.

19.5 Risk management

Within the contracting plan, each risk will be allocated to the party best able to manage that risk. A construction risk management plan will be developed and updated by the proponent if the project proceeds to tendering.

Where appropriate, there should be a preference to transfer risk to the contractor. The contractor will price that risk and thus contribute to the proponent's understanding of total project cost prior to contract award. To ensure that this does not increase the contractor's risk margin and increase prices more than necessary, all relevant information should be shared, and the pre-tender investigation should be as comprehensive as reasonably practicable. Additional geotechnical investigations could be undertaken by the proponent prior to the release of tender documents and provided to potential bidders to reduce the uncertainty associated with below-ground conditions. The contractors may provide a lower quote as a result of less uncertainty. For example, preliminary designs and any other technical investigations should be provided, but great care should be taken not to provide interpretation of the data. This is consistent with the successful approach adopted by Tasmanian Irrigation.

The recommended approach provides the opportunity for each tenderer to innovatively modify the preliminary design to incorporate changes that add value to the project and improve their competitive offering. This transfer of risk (from proponent to contractor) also requires a tendering procedure that gives the contractors ample access to the site to make any further investigations they deem necessary. To facilitate this process, a minimum tendering duration of six to eight weeks is necessary.

Another risk and cost for the contractors will be cash flow. This will need to be carefully addressed in the contract documents, so as to reduce the quantum of financing needed by the contractors and the risk that accompanies large expenditures that cannot be claimed immediately. The contract sums involved are large and will cause significant additions to the tendered sums if not planned,

A significant part of maintaining the rigid fixed price contract is to ensure that as many project approval conditions as possible have been included as conditions in the tendering documents, so that they are priced by the contractors before award.

This tendering and contracting methodology has been used successfully more than 15 times by Tasmanian Irrigation, with no overspends. This performance-based approach allows the contractor maximum opportunity to apply the advantages of its specific plant and equipment and its experience to maximum effect, along with any design opportunities it can identify, principally in constructability.

19.6 Recommendation

Should the project 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 design and construction engineers, so that they can respond to issues as they arise right through the delivery of the project. 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 design and construction engineers, with the best people available throughout the project delivery.

Minimising the cost of tendering by providing comprehensive information and a preliminary design will be very important.

There is a modest construction risk with the project relating to the interface between the existing storages, pump stations and the pipeline network. It is likely that this risk is most cost-effectively managed by a single head contractor, rather than separating pump stations and pipelines into separate contracts. There may be opportunity for the proposed solar array to be contracted separately.

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.

20. Implementation plan

20.1 Key points

- Once the Commonwealth and Queensland Governments have approved this detailed business case and provided funding for the project there are several preconditions that must be met prior to construction commencing.
- The pre-construction activities are likely to cost between $6.6 million and $9.4 million and take between 15 months and 24 months to complete.
- Due to the complexity and large volume of work required to manage the pre-construction activities, it is recommended that a qualified and experienced owner's engineer and commercial advisors be engaged to oversee the activities, prepare necessary documentation and undertake key activities, such as binding water sales and various Government approvals.
- Negotiations between the Locally Managed Entity (LME) and Seqwater are critical to the project and should be prioritised during pre-construction.
- Binding water sales between the LME and water customers require careful management and stakeholder communication to maximise the value and efficiency of the water sales.
- An Environmental Impact Statement (EIS) or Impact Assessment Report (IAR) will likely be required and necessary initial steps should be commenced early in pre-construction as this is the activity that will take the longest time.

20.2 Summary of pre-construction activities

Once the Australian and Queensland governments have endorsed the detailed business case and provided funding support for the project, three conditions must be met before construction can commence:

1) All necessary construction approvals are obtained including for an EIS or IAR.
2) Private sector investment has been secured through binding water sales contracts for at least 85 per cent of the available water allocations from the project.
3) Conditional construction contracts have been secured within the budget constraints of the detailed business case.

Unequivocal support for the project and the LME from the Commonwealth, Queensland and Local governments will help secure commitments to purchase water and make it possible to attract construction bids that are within budget provisions.

To achieve the three conditions above, **Table 20.1** outlines the key pre-construction activities, including the estimated time and cost for each activity. Further detail on time and cost estimates are provided in this Implementation Plan. The activities identified in **Table 20.1** can be conducted simultaneously and so should be able to be completed within 24 months or less. However, as discussed, a necessary pre-condition for commencing construction is the re-commissioning of the WCRWS having commenced. While construction should not commence, the other necessary activities should still be progressed. Given the uncertainty as to the timing of the re-commissioning, a 'hold point' could be established where activities are paused. To continue to work of this business case, the activities below should be progressed as far as is possible. Otherwise, the enthusiasm and support for this project could reduce.

Table 20.1: Key pre-construction activities

No.	Activity	Time estimate	Cost estimate
1	Establishment and operations of Locally Managed Entity (LME) (inc. risk management, financial management, prospectus	24 months	$1.5 million to $2 million

No.	Activity	Time estimate	Cost estimate
	management, stakeholder engagement, board and management expenses and insurance)		
2	In good faith negotiations and contracting between LME and Seqwater (inc. additional hydrology modelling)	Up to 24 months, including regulatory approvals	$100,000 to $250,000
3	Binding water sales between LME and customers	10 months	$600,000 to $850,000
4	Engagement of owner's engineer (OE) and management of requirements by OE (inc. infrastructure easements)	24 months	$1 million to $1.5 million
5	Environmental Impact Statement or Impact Assessment Report	12 – 24 months	$1.2 million to $1.8 million
6	Commonwealth and State approvals (inc. cultural heritage management plan)	9 - 15 months	$1.5 million to $2 million
7	Tender specifications and post-water sales design	6 months	$450,000 to $600,000
8	Construction contracts	3 - 6 months	$250,000 to $400,000
	Estimated total	**24 months**	**$6.6 million to $9.4 million**

20.3 Establishment and operation of LME

A Locally Managed Entity (LME) is the recommended body to develop and operate the project. The initial step is to establish the LME to progress the project, including undertaking the necessary contracting with Seqwater, obtain construction and operating approvals, delivery construction tenders and other necessary commercial arrangements.

Chapter 8 of the detailed business case provides guidance on the structure and requirements of the LME. It will be necessary to obtain further specialised legal advice in the establishment of the LME to ensure that it has the necessary authority and control to enter into binding legal agreements and that the structure of the entity is appropriate for the intended purpose of the LME.

The LME will require a board of directors with combined experience in developing and operating water infrastructure projects as well as a project team with significant experience in financial management, commercial negotiations, construction and water operations.

It is expected that up to 24 months of funding for the LME would be required to oversee the project through post-detailed business case activities to commencement of construction. The LME would be responsible a range of project governance and management functions, including stakeholder engagement, risk management information technology, record keeping, financial management, prospectus management, insurances and support local government through the approvals. During operations, the costs of the LME will be recovered through annual charges levied on water allocation holders.

It is estimated these activities will last for the full 24 months of post-detailed business case activities and cost between $1.5 million to $2 million.

20.4 Negotiations and contracting between LME and Seqwater

The establishment of a practical, binding commercial agreement between the LME and Seqwater is critical to the viability of the project. Throughout the detailed business case there have been engagements between Seqwater and Jacobs to consider various issues relating to the potential agreement between Seqwater and the LME.

Seqwater expressed in principle support for the project, although have rightly not made any definitive commitments regarding commercial or legal terms for any future agreement.

Seqwater have indicated their willingness to work through these arrangements with the Collaborative after the completion of the DBC. This includes taking account of and addressing the key considerations that Seqwater raised at the Strategic Business Case Stage, which in some cases have advanced as the DBC has been developed. If changes are required to regulatory instruments (eg. for the use of airspace in the Lockyer Storage and/or for amended water accounting), this will extend the time needed for the agreements to be signed to accommodate the modelling and public consultation which would be required to obtain these approvals, plus the regulatory approvals themselves.

Seqwater have identified some significant issues that will require further consideration subsequent to the conclusion of the detailed business case. These are set out below:

Table 20.2: Key considerations to be resolved subsequent to the detailed business case

Key considerations	Details	Possible action post DBC
SEQ to be no worse off in terms of regulated bulk water charges and water security	Initial modelling conducted by Seqwater (and Jacobs) for the DBC indicates that an opportunity could exist to supply water to the Lockyer Valley when SEQ Grid storages are at high levels and until SEQ urban demand approaches the full supply yield of the system. This opportunity exists after the Western Corridor Recycled Water Scheme (WCRWS) has been recommissioned to augment drinking water supplies in SEQ. Initial modelling conducting by Jacobs (not Seqwater) has developed prices to compensate Seqwater for the additional costs it will incur in providing the water to the project. This modelling has been done consistently with the initial hydrological modelling for the purpose of the business case only and is not intended to bind any party in future negotiations. Given the complexity inherent in the various project options, more work is required before Seqwater can commit to any specifics including an operating regime, pricing and other arrangements to support cost recovery.	Seqwater and LME negotiate a delivery regime and defines the supply conditions which provides binding legal and operational protections that prioritise Seqwater's mandate to provide and protect urban water supply security in South-East Queensland. Seqwater and LME negotiate a price and other contractual conditions that provide appropriate financial compensation for costs and risks incurred by Seqwater in the provision of water to the LME. All residual risks will be identified, with Seqwater receiving appropriate compensation for these risks.
Impact on the initial recommissioning of the WCRWS	Seqwater remains of the view that any supply to the Lockyer Valley would occur only after the WCRWS has been recommissioned and regulatory approvals in place to release Purified Recycled Water into Wivenhoe Dam for drinking water supply. Seqwater have stated that they will not supply water to the Lockyer until the WCRWS has been re-commissioned for the purpose of urban water users. The re-commission will occur as required, depending on water levels in the Grid 12. This is largely dependent on future rainfall, which is unpredictable. Therefore, it may be many years until re-commission, or it could be a shorter period.	The negotiated contract will be based on the WCRWS already been recommissioned for drinking water supply. This is consistent with the DBC and well understood by all stakeholders.

Key considerations	Details	Possible action post DBC
Consistency with the water supply regime	As with all water supply schemes, all water used from the Central Brisbane River Scheme must be accounted for. Seqwater anticipates that it could use its 'High Priority A' allocations in the Central Brisbane to provide water to the Lockyer Valley until such time as these allocations are fully utilised providing urban water supply. Once these allocations are fully utilised, any water supplied to the Lockyer Valley may need to be directly attributed to manufactured water, along with the associated costs.	Seqwater work with DNRME to establish an annual water accounting and reporting framework within which it can be demonstrated how the total volume taken by water allocation holders (including Seqwater) in any year is consistent with the volume of water that is available under the authority of all the water allocations in the scheme plus the net water that is available as a result of the addition of manufactured water into the system. In the first instance, Seqwater will need to develop such a framework for utilising the WCWRS prior to its initial commissioning (even without the Lockyer Irrigation Project in place). Once this arrangement has been bedded down, it will need to be incorporated into the relevant scheme planning instruments. This will involve a period of public consultation, in addition to confirming consistency with the Moreton water plan. Extending this framework further to incorporate the proposed project may trigger a similar amendment process and public consultation. An initial examination of the modelled scenarios suggests that the total average volumes of water taken from Wivenhoe for urban and project irrigation purposes is materially less than the total average volumes of water available under the combined authorities of Seqwater's water allocations and the net water available from the WCWRS. However, having surplus allocation allows Seqwater to balance regional supply via the SEQ Water Grid. Surplus water can be moved to the regions when required, providing Seqwater with the flexibility to respond to supply shortfalls, sub-regional droughts or local demand increases. Seqwater may also consider seeking additional provisions to support this flexibility (e.g. carry over and forward draw mechanisms) to enable the smoothing of 'unders' and 'overs' of water account balances between water years.
Asset ownership and funding	Seqwater has a strong preference not to invest in or own new assets to connect the Lockyer Valley. Seqwater has not yet examined the merits of a transferring any of its irrigation assets to the new LME. Any change to ownership or operational arrangements should not adversely impact existing water allocation holders, such as Seqwater's irrigation customers.	The DBC concluded that using the existing irrigation dams was beneficial overall. There is also a strong view among all stakeholders that existing water allocation holders are not adversely affected. Part of the contract negotiations will be for Seqwater to allow the LME to use some of the air space in irrigation storages, subject to appropriate conditions, including a storage charge and operating rules to ensure existing customers are no worse off. It is not contemplated that these assets will be transferred to the LME at this stage. Any investigation of asset transfer would be subject to a separate process.
Only recycled water of PRW quality standard	The production or transport of lower quality water would compromise Seqwater's ability to use the pipeline to	The Reference Project did not contemplate the use of lower quality water. Seqwater's preference is

Key considerations	Details	Possible action post DBC
will be used within the WCRWS assets	supply PRW standard in future, which could then risk stranding the significant investment in the WCRWS.	consistent with the DBC and well understood by all stakeholders.
No constraint to supply to existing recycled water (non-urban) customers	Seqwater must be able to supply industrial customers with recycled water under commercial negotiated contracts as the circumstances require.	The negotiated contract will specify the triggers levels and will not seek to constrain Seqwater in obtaining additional customers
No change in risk to SEQ bulk water security	The modelling indicated that, on the basis of a long term stochastic assessment, it would be technically feasible to increase the triggers for manufactured water production to account for water usage for the Lockyer Valley without affecting urban water security using a single water security metric. It also showed that the modelled average volume of water available will deteriorate over time as demand increases and as climate change projections affect water availability Notwithstanding the results of the modelling, factors which will affect the level of security of supply to the Lockyer Valley irrigators also include: ▪ Prolonged droughts – past experience demonstrates that SEQ water storages could be below the modelled trigger level for supply to the Lockyer for extended periods of time. ▪ Operational use of the Gold Coast Desalination Plant (GCDP) – Seqwater uses the GCDP to provide additional supply to the Grid when required, for example when Water Treatment Plants are off-line for maintenance or renewal. This will increasingly be the case in the future as demand increases. ▪ New commercial customers for the WCRWS –capital costs associated with the WCRWS are a material component of bulk water prices. New industrial customers for the WCRWS may in future provide an opportunity to reduce the pressure on prices for urban customers. If this occurred, these arrangements may reduce the capacity of WCRWS that is available to replace the volumes used by the Lockyer Valley. ▪ Future uses of the WCRWS post the initial recommissioning and triggers for production, which may change over time in accordance with changing water security needs, risks, service levels and information. ▪ Urban bulk water demand and the effects of climate change, to the extent that this is greater or less than the modelled assumptions. ▪ New sources of urban bulk water supply.	The negotiated contract is expected to provide for water storage triggers to be set and modified via future iterations of the Water Security Plan, above which water would be supplied. The contract will not provide for a minimum reliability. The project acknowledges that drought, operational and commercial matters will impact on the ability of Seqwater to supply water. Irrigators will bear the risk of whether water can be supplied in accordance with the triggers.
Recognition of Lockyer Valley irrigation usage in water security planning	Seqwater is willing to incorporate potential supply to the Lockyer Valley in future water security programs for SEQ, as part of scenarios that consider operating arrangements after the WCRWS has been recommissioned. This process will enable a more fulsome assessment of the opportunity and operating rules (including any triggers) in the context of the urban water supply outlook each time the water security	This is a significant body of work that looks at long term plans for urban water security in SEQ and therefore inclusion of the Lockyer Valley potential irrigation supply will ensure formal recognition of this opportunity. When (and if) circumstances allow for supply to be considered formally (e.g. via a contract) Seqwater would expect the availability of water and operating

Key considerations	Details	Possible action post DBC
	program is updated (generally every 5 years). The next version of the water security program is in development, and due to be completed in March 2022.	rules would be set through the water security program process at that time.

It is expected that the contract will be negotiated to cover:

- Clarity on the process for setting trigger points for various events under the agreement.
- Water pricing and changes to water pricing.
- Additional hydrology modelling to underpin water reliability assessments
- Provision of enforceable security to protect the interests of Seqwater.

The negotiations with Seqwater will require specialised legal and commercial advice, especially in relation to the structure and terms of the agreement between the parties. The execution of the agreement will be coordinated with Activity 3 so that the LME's agreements with the water customers align the LME's agreement with Seqwater.

It is estimated these activities will take around 6 to 12 months and cost between $100,000 and $250,000, but may not be finalised until after March 2022, depending on the timing of the water security program.

20.5 Binding water sales

Once it is established, the LME will need to engage in binding water sales with the scheme's customers. This process will require specialised legal and commercial advice and management due to the legislative requirements relating to the funding of the LME through a prospectus. Chapter 8 of the detailed business case provides guidance on the funding of the LME and the interaction within binding water sales.

The water sales process will secure private sector investment before construction of the project. The purchase of water allocations will occur through binding contracts at an agreed price including a one-off capital contribution.

Once the up-front capital contribution from customers and investors is settled, their payment could consist of:

- a 2 per cent deposit upon contract signing
- an 8 per cent deposit on confirmation of the commencement of construction
- the balance (90 per cent) due upon notification of the practical completion of the project (e.g. typically just prior to the commissioning and operation of the scheme).

Preconstruction water sales not only significantly reduce the private sector funding risk of the project but also influence the final design of the project to ensure cost effective delivery infrastructure is defined. The final design is discussed further at section 20.9.

For the preconstruction water sales to be finalised, it is necessary to:

- undertake an extended period of advertising and engagement with potential enterprises and investors ahead of formal water sales including facilitating access to land
- execute a well-advertised water sales process over a sufficiently lengthy period to enable investors to consult with their families or business decision-makers, accountants, lawyers and financial institutions
- secure conditional binding water sales contracts and finalise supporting documentation
- review and accept offers to purchase water allocations from the project.

Confidence in the project will be boosted if water sales can start as soon as the Australian and/or Queensland governments make their respective funding announcements. If government grant funding is announced, the water sales target will then have the best chance to be reached.

The proponent will engage a professional service provider with significant relevant experience to lead and deliver the binding water sales process. The binding water sales can be coordinated by the owner's engineer provided they have the necessary experienced and expertise.

It is estimated these activities will take around 10 months and cost between $600,000 and $850,000.

20.6 Owner's engineer

The LME or Lockyer Valley and Somerset Water Collaborative should engage an owner's engineer to manage and coordinate the pre-construction activities. The pre-construction process has multiple critical elements and must be managed professionally in order to ensure the project progresses successfully to construction.

The owner's engineer will be responsible for the management of most of the activities outlined in this Implementation Plan, including:

- Conducting or overseeing binding water sales (section 20.5).
- Overseeing the contractor undertaking the EIS or IAR (section 20.7).
- Managing Commonwealth and State approvals (section 20.8).
- Overseeing the contracting preparing the final design (section 20.9).
- Managing the construction procurement and contracting (section 20.10)

In addition, the detailed business case identified various matters that require consideration during pre-construction and should be managed by the owner's engineer. It is possible that not all these activities will be required, and it will be up to the owner's engineer to determine which activities should be undertaken. The activities include:

- Aboriginal cultural heritage - full Aboriginal cultural heritage due diligence assessment should be undertaken in accordance with the Aboriginal Cultural Heritage Act along the extent of the proposed pipeline alignment to determine the likelihood of project-related impacts to previously unidentified Aboriginal cultural heritage values.
- Rezoning - assessing the necessity for rezoning of any areas within and adjoining the project area are zoned for urban purposes (e.g. low-density residential, rural residential, industry and community facilities).
- Native title – all land dealings within the corridor are required to be assessed in accordance with the native title work procedures to ensure that native title rights and interests are appropriately considered and addressed. This assessment may result in necessary applications and additional documentation.
- Construction close to existing infrastructure - All required approvals and permits to conduct project works within these key infrastructure corridors must be secured from the relevant operating entities.
- Landholder agreements - where construction of the pipeline must occur on private properties, landholder agreements with affected property owners will be established. The land will be fully reinstated following construction. Agreements regarding limited access temporarily. Agreements that provide for ongoing access for the purpose of maintenance of the pipeline.
- Easements – secured over property that will have permanent infrastructure.
- Contaminated Land - site-by-site review of the Environmental Management Register (EMR) and Contaminated Land Register (CLR) of all properties within the project area (part of the detailed design stage).
- Bore census - conducted to confirm the precise location and operational status of registered and unregistered bores near the proposed route, and measures should be taken to maintain an appropriate offset from existing assets to minimise the risks of ground disturbance affecting those assets.
- Flood impact investigation - investigation of the flood impact of proposed spoil disposable locations be undertaken to identify safe storage areas for spoil and construction materials.
- Ecological assessment of the proposed pipeline alignments.

- Field ecological assessment of the preferred pipeline network.
- Final environmental offset calculation following completion of final pipeline design.
- Historical cultural heritage due diligence assessment
- Social impact evaluation to assess and mitigate loss of residential amenity
- Qualitative assessment of emission production
- Engagement of suitably qualified experts present during construction to ensure flora and fauna adverse impacts are managed and minimised.
- Consulting with the Lockyer Valley Regional Council and Queensland Government in relation to the Council's draft planning scheme for the local government area that is currently under review by the Queensland Government and has not yet been released for public consultation.

The owner's engineer will also be required to prepare a volume of project specific documentation for the pre-construction and construction of the project. This documentation may include, but is not limited to:

- Detailed technical assessment of potential impacts on surface water quality
- Erosion and sediment control program and plan
- Construction management plan (CMP)
- Environmental management plan (EMP)
- Vegetation management plan (VMP).
- Detailed technical assessment of potential impacts on surface water quality
- Species management plans
- Construction environment management plan.

Some of this documentation may be prepared as part of the approvals processes discussed at section 20.8.

These activities will take the full period of the pre-construction and cost between $1,000,000 and $1,500,000.

20.7 Environmental assessment

The scale and scope of the project indicate that there may be potential environmental impacts and therefore an application as a coordinated project under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) is recommended. This application should be undertaken by the owner's engineer as early as possible in pre-construction.

If the project is declared a coordinated project, or it is otherwise assessed as required, an EIS or IAR must be obtained. The IAR process is shorter and simpler than the EIS process. As the EIS process can take up to 24 months, it is recommended that the process be commenced as soon as the owner's engineer is appointed, and funding is secured.

A suitably qualified environmental consultant will be engaged to undertake the EIS or IAR. The environmental consultant will also manage any associated environmental, cultural heritage and native title applications and approvals (including many of the approvals identified in section 20.8).

It is estimated these activities will take between 12 months and 24 months and cost between $1 million to $1.54 million.

20.8 Commonwealth and Queensland approvals

The detailed business case identified many approvals required to progress, construct and operate the project. **Table 18.3** sets out the approvals that are likely to be required, although it will be necessary to obtain further specialised legal and environmental advice to ensure that all necessary approvals have been obtained.

Table 18.3: Commonwealth and Queensland approvals

Approval	Legislation	Description/Action	Timing	Responsible authority
Commonwealth				
Referral - 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. If the project will, or is likely to have, a significant impact on a matter of national environmental significance a referral will be required.	The referral should be made as soon as possible. Following receipt, the Minister has 20 business days to determine whether the action is a controlled action.	Department of the Environment (Commonwealth)
State approvals				
Declaration as a coordinated project	*State Development and Public Works Organisation Act 1971* (Qld)	A declaration as a coordinated project for which an EIS is required under 26 of the SDPWO Act.	As soon as possible after project go ahead.	The coordinator general under the SDPWO Act. Department of State Development, Manufacturing, Infrastructure and Planning
EIS and Evaluation Report by coordinator general	*State Development and Public Works Organisation Act 1971* (Qld)	EIS process and evaluation by coordinator general. More detailed provided at section 20.6	Following declaration. Allow 2 years.	The coordinator general under the SDPWO Act. Department of State Development, Manufacturing, Infrastructure and Planning
Application for designation of the infrastructure	*Planning Act 2016* (Qld) S35	A designation of the project obtained under the Planning Act will allow the project to proceed without development permits required under the Planning Act. Footprint for the project will be required before making the application.	Following declaration as coordinated project. Timing to be further considered. Allow 2 – 3 months. Consultation period will be required.	Minister for the Department of State Development, Manufacturing, Infrastructure and Planning
Development permits	*Planning Act 2016* (Qld) *Planning Regulation 2017* (Qld) *Vegetation Management Act* *Fisheries Act* *Water Supply (Safety and*	Should the designation not be achieved a development application will need to be made for at least the following: • operational work that is clearing vegetation • operational work that involves taking or interfering with water under the Water Act	Prior to constructions Applicable if designation for the project is not obtained	State Assessment and Referral Agency Lockyer Valley Regional Council, Somerset Regional Council

Approval	Legislation	Description/Action	Timing	Responsible authority
	Reliability) Act 2008 (Qld) *Water Act 2000* (Qld) *Nature Conservation Act 1992* (Qld)	• operational work that is constructing or raising waterway barrier works[63]		
Environmental Approval for Environmental Relevant Activities (ERAs)	*Environmental Protection Act 1994* (Qld)	The proponent will be required obtain environmental authorities for any environmental relevant activities (ERAs)	Prior to construction	Department of Environment and Heritage/State Assessment and Referral Agency
Registered suitable operator	*Environmental Protection Act 1994* (Qld)	The proponent must be registered as a suitable operator for carrying our ERAs	Prior to construction	Department of Environment and Heritage/State Assessment and Referral Agency
Authority for works in a protected area	*Nature Conservation Act 1992* (Qld)	The proponent must obtain authority to construct the works within the area of a resources reserve (protected area)	Prior to construction	Department of Environment and Heritage
Exemption Certificate (or Development Permit) – Heritage Places	*Queensland Heritage Act 1992 (Qld)*	Any works on a local or state heritage place will need to either fall within a general exemption or an exemption certificate or a development permit will be required. Consent of the owner of the property will be required for the application.	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)	Development application required for any assessable building works against the Building Act	Prior to construction	Lockyer Valley Regional Council, Somerset Regional Council
Ancillary works and encroachment approval	*Transport Infrastructure Act 1994* (Qld) (section 50)	Approval is required to construct infrastructure within the area of a state-controlled road	Prior to construction	Department of Main Roads and Transport
Application to close a local road	*Land Act 1994* (Qld)	Required if any road is to be closed permanently	Prior to construction	Department of Natural Resources, Mines and Energy
Approval to interfere with a local road	*Local Government Act 2009* (Qld)	Required for local roads affected by the construction works	Prior to construction	Lockyer Valley Regional Council, Somerset Regional Council

[63] Schedule 8, Table 4 of the Planning Regulation

Approval	Legislation	Description/Action	Timing	Responsible authority
Water Permit	*Water Act 2000* (Qld) (section 137)	Required to take water during construction.	Prior to construction	Department of Natural Resources, Mines and Energy
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)	Permit 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)	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	
Operating approvals				
Distribution operations licence and operations manual	*Water Act 2000* (Qld)	Required to operate a water service	Prior to operations	Department of Natural Resources, Mines and Energy
Service provider registration	*Water Supply (Safety and Reliability) Act 2008* (Qld)	Required to operate as a supplier of a water service	Already registered	Department of Natural Resources, Mines and Energy
Species management program	*Nature Conservation Act 1992*	-	No statutory timeframe	
Approval for works within a protected area	*Nature Conservation Act 1992*	-	No statutory timeframe	
Protected plant clearing permit	*Nature Conservation Act 1992*	-	No statutory timeframe	
Disposal permit for contaminated soil	*Environmental Protection Act 1994*	-	10 business days	
Waste levy for contaminated soil	*Environmental Protection Act 1994*	-	Not applicable	
Waste levy for other waste	*Environmental Protection Act 1994*	-	Not applicable	
Constructing or raising waterway barrier works	*Planning Regulation 2017*	-	12 weeks	

Approval	Legislation	Description/Action	Timing	Responsible authority
Development on or adjoining a Queensland heritage place	*Queensland Heritage Act 1992*	-	12 weeks	
Heritage Exemption Certificate	*Queensland Heritage Act 1992*	-	No statutory timeframe	
Road corridor permit	*Transport Infrastructure Act 1994*	-	No statutory timeframe	
Application to carry out work on a road reserve or council-owned land (Somerset Regional Council)	*Local Government Act 2009*	-	No statutory timeframe	
Application to undertake works on a road	*Local Government Act 2009*	-	No statutory timeframe	

Due to the long timeline required to obtain some of the approvals, it is recommended that the necessary applications and referrals be lodge as early as possible in the pre-construction process.

The coordination of the various approvals processes will be managed by the owner's engineer with specialised legal, environmental and other advice as required.

It is estimated these activities will take between 9 and 15 months and cost between $1.5 million to $1.8 million. This time and cost estimate does not include an EIS or IAR.

20.9 Tender specifications and post-water sales design

Following completion of the binding water sales, the tender specifications for the project can be undertaken and completed.

The preliminary design was informed by location of the arable land, and by demand based on the detailed business case demand assessment process. The tender specifications will use the actual water sales figure and change the preliminary design accordingly where necessary to deliver required volumes to specified property locations. The tender specifications will include the delivery locations of the water allocations and adjust the reference design accordingly where necessary.

The preparation of the tender specifications will require the engagement of a specialised water and pipeline engineering contractor. The detailed business case recommends that the contractor that prepared the preliminary design be engaged to prepare the tender specifications in order to capture the maximum value and efficiency from the knowledge and understating formed during the detailed business case process.

It should also be considered whether a pipeline design challenge contractor should be engaged to peer review the tender specifications and the final design proposed by the preferred contractor. This is a useful risk mitigation and quality assurance mechanism for the project.

It is estimated these activities will take around 6 months and cost between $450,000 and $600,000.

20.10 Construction contracts

The owner's engineer will be responsible for the management and coordination of the construction procurement and contracting, with specialised legal and other advice as required.

Chapter 19 of the detailed business case recommends that the preferred contracting approach is a design and construct (D&C) contracting model.

The market for contractors in Queensland, including in the project area, is presently defined by high demand and it is forecast that this will continue throughout the project's construction. However, the prevailing conditions of the contracting market will have to be considered prior to going to tender to understand the impact of the coronavirus pandemic. It will be critical an experienced facilitator be engaged by the proponent to run a competitive construction tender process, oversee the contract formation and set up the contract administration. The owner's engineer can perform this function f they are sufficiently qualified and experienced.

The tendering and contracting process will be documented in a procurement plan (outlined in Chapter 19).

For construction contracts to be finalised within budget, it is necessary to:

- finalise performance specification for the project following the completion of the water sales process.
- develop tender documentation based on the Australian Standard General Conditions of Contract.
- ensure all approval conditions are declared prior to tendering and/or conditional award.
- confirm award to the preferred contractor, conditional upon notification that project funding has been received.

It is estimated these activities will take around 3 to 6 months and cost between $250,000 and $400,000.

21. Conclusions

This detailed business case delivers a comprehensive, robust assessment the proposed irrigation project that would deliver of new, reliable water to the Lockyer Valley. The analysis found that the reference project would supply new, reliable water to an established agricultural region, which will result in a $210 million annual increase of agricultural output. The increased agricultural output will result in 1,923 permanent jobs in agriculture and supporting industries, in addition to 73 construction jobs during the project development, and increased output from 'downstream' processing industries.

The problem and opportunity

The Lockyer Valley is one of the most fertile growing areas in the world and has the potential to significantly increase agricultural output if a secure, reliable water source can be established. The Valley accounts for 28% of Queensland's total horticultural production and is a key supplier to Australian markets in winter months. Without increased supply and reliability, a substantive increase in output would be unlikely and a decline in existing water supply and reliability would potentially lead to decreased agricultural output and increased unemployment in the region.

The Lockyer Valley is presently dependent on groundwater bores that are unreliable and variable, especially during and after periods of drought. The unreliability of water in the region is constraining investment and growth in the agricultural industry and, critically, the types of crops that can be grown in the region. Investment in high value crops requires confidence in water supply over the medium and long term, and without the reference project that is unlikely to be possible for irrigators in the Lockyer Valley.

The demand

The detailed business case is built on a foundation of a comprehensive, robust demand assessment that identified, tested, analysed and confirmed demand and intended usage for the water across the Valley. Through two rounds of in-person, detailed interviews, the demand assessment confirmed solid demand for 34,000ML of new water.

These customers for a potential new water scheme are made up of xx entities spread across xx blocks in the region growing a range of crops, plus a small volume of non-agricultural users. The intended uses of the water were analysed, including the proposed crop mix, and the benefits calculated and comprehensively mapped.

The proposed crop mix provides a platform for economic growth in the region by targeting crops with both demand and capacity in the domestic market, and strong, and increasing export potential with Australia's close trading partners.

The solution

This detailed business case concludes that the reference project is the best, most secure pathway to increased agricultural output, economic stability and regional growth for the Lockyer Valley. The business case identified the preferred model for the reference project is:

- Sourcing water directly from Wivenhoe Dam, via a pump and pipeline network.
- Construction of a new pipeline from Wivenhoe Dam to three existing dams in the region and distributing that water through a new irrigation network directly to irrigators and other water customers.
- A structured, arrangement with Seqwater that provides for the release of water to the new scheme only when certain water level triggers are met so that Seqwater's primary obligation of urban water security in South-East Queensland is not disrupted or impeded.

Extensive modelling and risk management planning has been undertaken to ensure that Seqwater's commercial position and operational mandate are protected by the project. Final terms and agreement between the project proponent and Seqwater must be confirmed in the pre-construction period, and legal advice has been provided to the proponent to facilitate and guide that negotiation. Importantly, while Seqwater have indicate support for the project in principle, they have made no final commitment and are rightly waiting on the outcome of this and other assessments of the project.

Assessing the solution

The economic, financial, environmental and social impacts of the project are summarised in the appraisal summary in Chapter 8. The project will have an overwhelmingly positive impact on the region provided that the potential negative impacts, relating to environment, and Aboriginal and historical cultural heritage, can be managed and mitigated effectively.

The analysis considered the public interest and social impact of the proposed infrastructure project and identified that the local region will experience a predominantly positive impact, including providing new opportunities for the local population that presently has 73.4% of people in the first and second most socio-economically disadvantaged categories.

Significant work has been undertaken to minimise the adverse impacts of the project, including focus on the pipeline alignment to mitigate and manage certain environmental, contaminated lands and land owner impacts. Notwithstanding this, it is anticipated that an EIS or IAR will be required to comprehensively investigate and address the environmental impacts of the project. The project is likely to trigger environmental offset requirements, and there is a requirement for further consultation with traditional owners to understand and mitigate potential risks to tangible and intangible aboriginal cultural heritage.

The project proponents have sought to set a standard for environmental management, and so the project design includes the use of renewable energy generated from solar panels to power the pumping stations, with auxiliary connections to the electricity grid as a back-up power supply when required.

The outcome of the economic analysis is a highly positive assessment of the project, with a benefit cost ratio of 1.2, total benefits of $304.5 million and a net present value of $60.1 million. Based on the overwhelming economic and social benefits, and strong public interest, in the project it is recommended that both Commonwealth and State funding be sought.

Next steps

The final recommendations of this detailed business case are set out in Chapter 20. The conclusion of this analysis is that the project should proceed to pre-construction activities and that funding should be sought from Commonwealth and State Governments for pre-construction and the construction of the project. The timeframe for completion of the project and delivery of the first water is 2 to 3 years. The implementation plan for preparation, development and construction of the project is set out in chapter 20.

22. Recommendations

The detailed business case makes the following recommendations, subject to the Queensland Government deciding to recommission the Western Corridor Recycled Water Scheme to supplement urban water supplies:

Recommendation 1: Form a business entity and commence negotiations with Seqwater

It is recommended that an irrigation entity be established. This entity can negotiate with Seqwater the supply arrangements including:

- delivery regime and supply conditions, including triggers, which provides binding legal and operational protections that prioritise Seqwater's mandate to provide and protect urban water supply security in South-East Queensland.
- price and other contractual conditions that provide appropriate compensation for costs and risks incurred by Seqwater in the provision of water to the locally managed entity.

Recommendation 2: Commence pre-construction activities

It is recommended that the established irrigation entity commence pre-construction activities for the development of the preferred project model, including procuring an environmental assessment, undertaking formal water sales and all management, design, engineering and approvals required to prepare the project for construction.

Recommendation 3: Commonwealth and State governments provide in-principle financial support

It is recommended that the Commonwealth and State governments provide in-principle financial support subject to:

- Binding water sales
- Successful negotiation with Seqwater to contract for the supply of water
- Receiving the necessary permits and authorisations.

The Commonwealth should provide $100 million during the construction of the project. The State Government should provide $50 million, including an initial $10 million to fund pre-construction activities to become rapidly shovel-ready.

Recommendation 4: Proceed with construction of direct pipeline and irrigation network

It is recommended that the LME proceed with financing and construction of the preferred project model of purchasing water from Seqwater to be supplied from Wivenhoe Dam via a new trunk main and distribution network that utilises existing irrigation dams.

The description of the pre-construction activities required to action Recommendation 3 are set out in the Implementation Plan.

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