Department of Energy and Water Supply

Queensland bulk water opportunities statement

July 2017

Queensland Government

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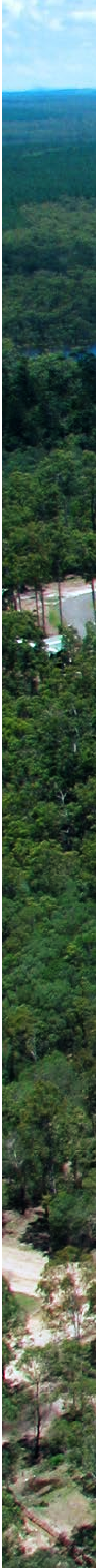
Front cover image: Julius Dam, North Queensland

Back cover image: Lake Wivenhoe, South East Queensland (courtesy of Shutterstock)



Lenthall Dam aerial

Summary

The *Queensland bulk water opportunities statement* (QBWOS) is the future water security strategy for the state. This strategic infrastructure document is intended to provide a framework through which the Queensland Government can support and contribute to sustainable regional economic development through better use of existing bulk water infrastructure and investment in new infrastructure.

There has been heightened public interest in new water infrastructure due to:

- increased incidence of extreme weather events, including prolonged dry conditions in many parts of Queensland and significant flooding
- consideration of how new infrastructure can promote regional economic growth
- responses to various state and federal initiatives, including the Queensland Government's *State infrastructure plan* and the Australian Government's National Water Infrastructure Development Fund.

Queensland is well serviced by a major bulk water infrastructure portfolio that supports communities and businesses across the state and is a key driver of economic growth in many regions. Construction and utilisation of bulk water infrastructure (dams, weirs, pipelines etc.), and the accompanying contribution to local economies, has varied over time across the state. There are more than 400 dams, weirs and barrages in Queensland. Significant periods of construction for this infrastructure was after World War II, during the 1970s and 1980s to support regional economic growth and, later, the large-scale development of the resources sector. The need to upgrade dams to maintain safety standards is currently driving another significant period of investment.

An assessment conducted as part of the QBWOS found that there are more than 270 000 megalitres of uncommitted water across the state and approximately 300 000 megalitres of under-utilised allocations in eight major water supply schemes (of the 46 large systems across Queensland).[1] Alone, these amounts are almost double the total allocations from Wivenhoe Dam (approximately 286 000 megalitres), with other systems potentially containing more under-utilised water. These are significant quantities of water that could be used for economic development without the need for new bulk water supply infrastructure. However, this water may not be available where the demand is, or in suitable volumes or with suitable reliability to meet current or future development needs.

The key issue is how the government, with the involvement of various Queensland stakeholders, best invests in opportunities for the future. It is imperative that governments spend ever more wisely on ideas and projects that provide economic benefits, while at the same time not impeding the ability of the private sector or commercial bulk water service providers to pursue projects that are commercially viable.

The QBWOS provides a clear statement of the Queensland Government's objectives for bulk water supply when considering the investment and broader competition for public funds. These objectives are:

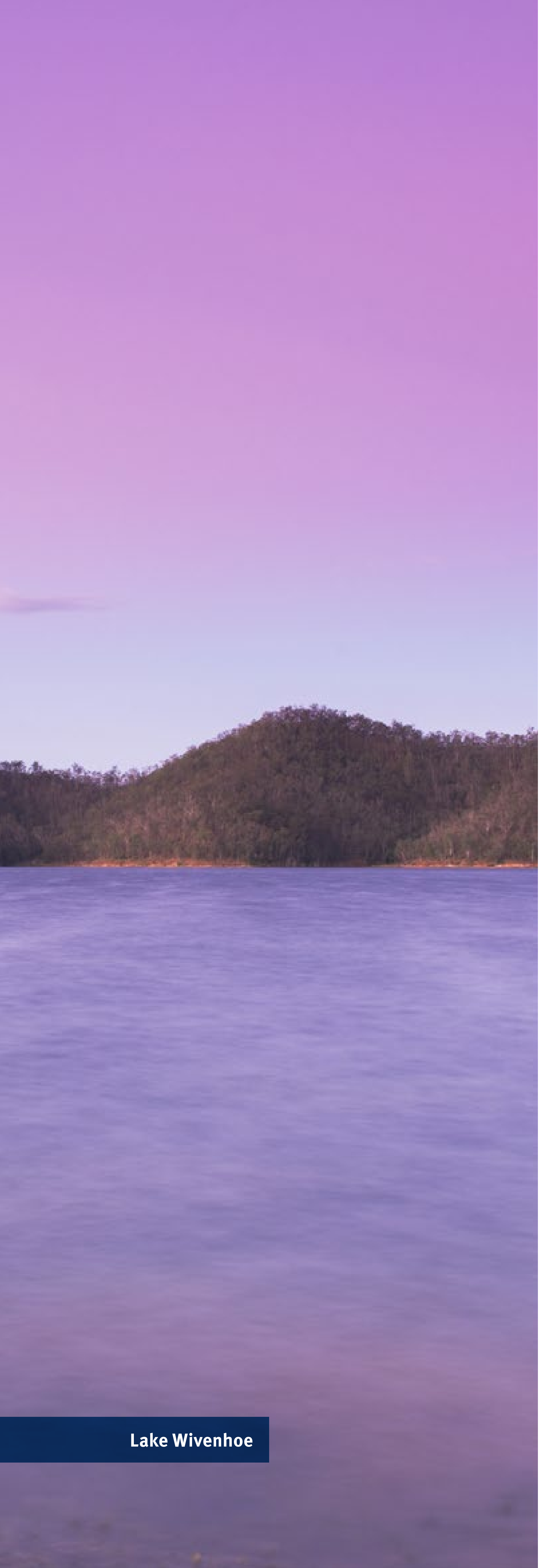
- safety and reliability of dams and urban water supplies
- use existing water resources more efficiently
- support infrastructure development that provides a commercial return to bulk water providers
- consider projects that will provide regional economic benefits.

To support these objectives, clear principles have been identified that should be applied when considering investment in infrastructure.

The QBWOS identifies opportunities for our regional communities and the state as a whole. The focus is on maximising the use of, and benefits from, existing investments and carefully considering the benefits and costs of new infrastructure.

It is important to take into account the challenges and limitations of constructing more bulk water infrastructure. These projects can be expensive (up front and often on an ongoing basis) and often require careful environmental management. In a time of constrained budgets and uncertain agricultural and resource commodities futures, significant investments

1 Refer to p. 25 for stocktake of under-utilised water.



Lake Wivenhoe

for new bulk water supply infrastructure need to demonstrate a high degree of certainty about economic value, environmental acceptability and a broader contribution to the community. In particular, any proposed water infrastructure projects adjoining the Great Barrier Reef must pay particular consideration to potential impacts on the Reef, from both infrastructure development and the end uses of the water (such as agriculture, mining, industry and urban development).

The focus of the QBWOS is therefore on reducing the barriers to using available water within existing bulk water supply infrastructure and considering new projects that demonstrate economic benefits within the context of competing budget and environmental constraints.

The QBWOS presents a framework for achieving a balance between making better use of what we already have and committing to new projects in the future.

The QBWOS provides details of existing bulk water infrastructure in Queensland and details of water infrastructure projects that are currently, or have recently been, the subject of feasibility or environmental assessments. Importantly, the QBWOS also outlines water availability from existing infrastructure (based on an assessment of volumes of water utilised in the major water supply schemes in Queensland). This document also clarifies the roles and responsibilities of government agencies, bulk water entities (such as SunWater) and other water service providers in the provision of bulk water to the state.

The QBWOS provides a timely reminder that the approaches to bulk water infrastructure projects in the past may not be the most appropriate into the future. There have been, and will continue to be, new and innovative approaches to addressing water needs across the state.

It is intended that Queensland's priority list for new water infrastructure will be provided in future versions of the QBWOS, together with progress statements for previously identified opportunities and reports on changes in the broader water infrastructure planning space.

Contents

Introduction

Purpose and content

The *Queensland bulk water opportunities statement* (QBWOS) provides a framework for sustainable regional economic development through better use of existing bulk water infrastructure and investment in new infrastructure. It also provides a focal point for discussion with the community and the water sector about water security planning in Queensland and future bulk water infrastructure supply options to support growth and economic development in regional communities.

The QBWOS provides:

- a clear statement of the objectives for the state's investment in bulk water supply infrastructure
- principles to guide bulk water investment decision-making if state government investment is to be considered
- key infrastructure and policy initiatives and opportunities.

The QBWOS also provides background and contextual information, including:

- the policy environment, planning complexities, unique risks and general considerations
- a description of bulk water entities and their infrastructure
- a summary of bulk water supplies, including latent capacity and reserves
- the roles and responsibilities of various entities.

The QBWOS focuses on raw water supplied from bulk water supply systems that primarily access surface water resources. Details of groundwater and non-traditional water supply sources were also reviewed in the preparation of the QBWOS. However, these alternative sources will be further considered in future versions.

The QBWOS consists of this document, a story map and a layer in Queensland Globe to provide more detailed data to project proponents.

The story map provides a visual (spatial and graphical) representation of existing bulk water supply infrastructure and current activities across Queensland. It provides details of water entitlements and availability, and useful climate-related data. It also provides details of bulk water infrastructure projects currently and recently under investigation.

The bulk water infrastructure layer in Queensland Globe provides an interactive online tool with a detailed graphical display of key information for Queensland bulk water supply infrastructure information that is integrated with other Queensland Globe layers.

Importantly, to address our water security challenges, the QBWOS will be reviewed annually. This will ensure we are responsive to changing community priorities, using up-to-date project assessments, new knowledge and feedback. It will also provide an opportunity to regularly update the community on the progress of proposed initiatives and investments under consideration.

Context

In late 2015, it was identified that a more coordinated approach to the planning, assessment and development of bulk water supply infrastructure would benefit the state. Work commenced on a document that has evolved into this QBWOS.

In early 2016, the *State infrastructure plan* was released with a commitment to an infrastructure reform agenda. As part of the implementation of the plan, the Department of Energy and Water Supply (DEWS) was tasked with developing a future water security strategy to inform future regional plans. The QBWOS satisfies these requirements, providing clear direction for strategic infrastructure decisions.

State infrastructure plan

The QBWOS is one of five strategic infrastructure documents outlined in the *State infrastructure plan* (released in March 2016).

These five strategic infrastructure documents are designed to provide a clear policy direction for strategic infrastructure decisions across transport, water, energy, digital and social asset classes.

A key objective of these five documents is to inform future regional plans. In setting the strategic direction for each asset class, these documents also strive to achieve the broader social, economic and environmental outcomes sought by the Queensland Government.

Figure 1: The five state strategic infrastructure documents

1. Objectives, principles and initiatives

1.1 Bulk water supply objectives

The Queensland Government aims to develop frameworks that support and enable the efficient and effective delivery of bulk water supplies across the state to support growth and underpin economic development. A critical component of these frameworks is a clear statement of the government's objectives for bulk water supply.

A range of boundary conditions (overleaf) were considered during development of the objectives, and the objectives are supported by clear principles to guide the state's decisions regarding investment in bulk water supply infrastructure.

The Queensland Government supports commercially viable infrastructure development that does not place a financial burden on the state's budget. It is preferable that proponents, water users and water service providers work together to determine water needs and come to an agreement on a suitable solution through commercial negotiations. The Queensland Government's role in such cases is to ensure the frameworks are in place so proponents can advance their project, including appropriate processes for regulatory approvals.

In instances where there is a public or economic benefit, but market failure or the scale of the problem or solution is such that private proponents and service providers are unable to advance their project on a commercial basis, there may be a role for the state government. The QBWOS provides information on the circumstances that could trigger government involvement, and the associated objectives and principles for potential state government consideration of water projects.

Objectives

The Queensland Government's objectives for bulk water supply are as follows:

1. **Safety and reliability of dams and urban water supplies**—As a dam owner and regulator, the Queensland Government has an obligation to keep its dams safe, consistent with national standards and state regulatory requirements through the Queensland *Water Supply (Safety and Reliability) Act 2008* (the Water Supply Act). The Water Supply Act also protects community interests by establishing obligations for water service providers to deliver safe water and ensure continuity of supply.
2. **Use existing water resources more efficiently**—Significant volumes of uncommitted and under-utilised water are currently available in Queensland that could be used for economic development without the need to construct new bulk water supply infrastructure.[2] Governments at every level are experiencing fiscal constraints, and a prudent response is to fully and better use the substantial water resources and bulk water supply infrastructure already available before investing in new infrastructure.
3. **Support infrastructure development that provides a commercial return to bulk water providers**—The Queensland Government supports commercially viable infrastructure development that does not place further burden on the state's budget.
4. **Consider projects that will provide regional economic benefits**—These projects would be identified on a case-by-case basis through a standardised best practice assessment process. To be considered, they must provide significant economic benefits to the state over the long term.

The hierarchy of the objectives are driven by safety and efficiency first, followed by the need for further investment (Figure 2 overleaf).

2 Refer to p. 25 for stocktake of under-utilised water.

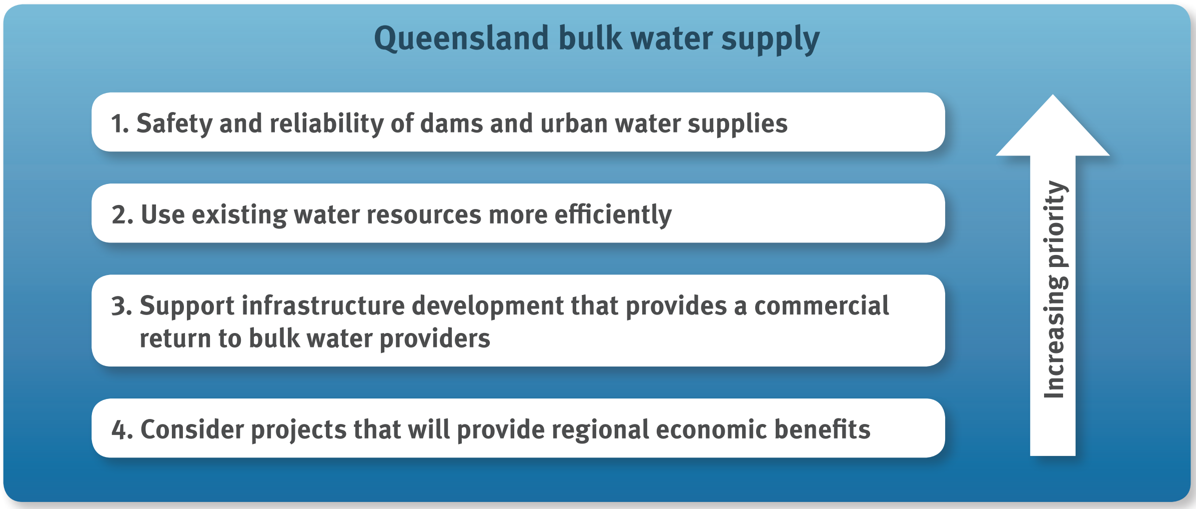


Figure 2: Queensland's bulk water supply objectives hierarchy

Boundary conditions

A range of boundary conditions were considered during development of the objectives, including the following:

- Queensland has a well-established water planning process in place that sustainably manages the allocation of water to meet the state's current and future water needs.
- Dam owners are responsible for dam safety.
- Drinking water service providers are responsible for the provision of water that is safe in quality.
- Under the *Water Supply (Safety and Reliability) Act 2008*, responsibility for urban water supply security (continuity of supply) lies with water service providers. In South East Queensland this is the responsibility of Seqwater. Outside South East Queensland, this responsibility generally lies with local governments.
- All investment of public funds must minimise risks and costs to the government and community, maximise outcomes for Queensland, and must be considered in the context of all competing budget demands.
- Queensland has a well-established project assessment framework in place that must be considered when preparing evaluations, particularly concerning environmental, social and financial sustainability.
- Bulk water supply infrastructure proposals must satisfy all requirements for environmental and other approvals.

Considering economically beneficial projects

A key initiative for the Queensland Government will be a better process for considering projects that provide an economic benefit to the state (see sections 1.3 and 6.1). While these projects may not provide a full commercial return to a bulk water provider, the projects may enable job creation and broader benefits such as investment and financial returns from industry and agriculture. Together, these may result in a net economic benefit for the state.

The decision tree overleaf (Figure 3) can be used as a filter to determine how to treat economically viable projects as distinct from pathways for commercially viable projects. When integrated with the required project assessment frameworks, the decision tree process provides key points of consideration to better guide relevant agencies when assessing commercially viable or economically beneficial projects. There are many types of investigations required before making a decision on whether to construct new infrastructure—including engineering assessments, environmental impact assessments, demand studies, social impacts and economic costs and benefits. Further discussion on project assessment is provided in Section 6.5.

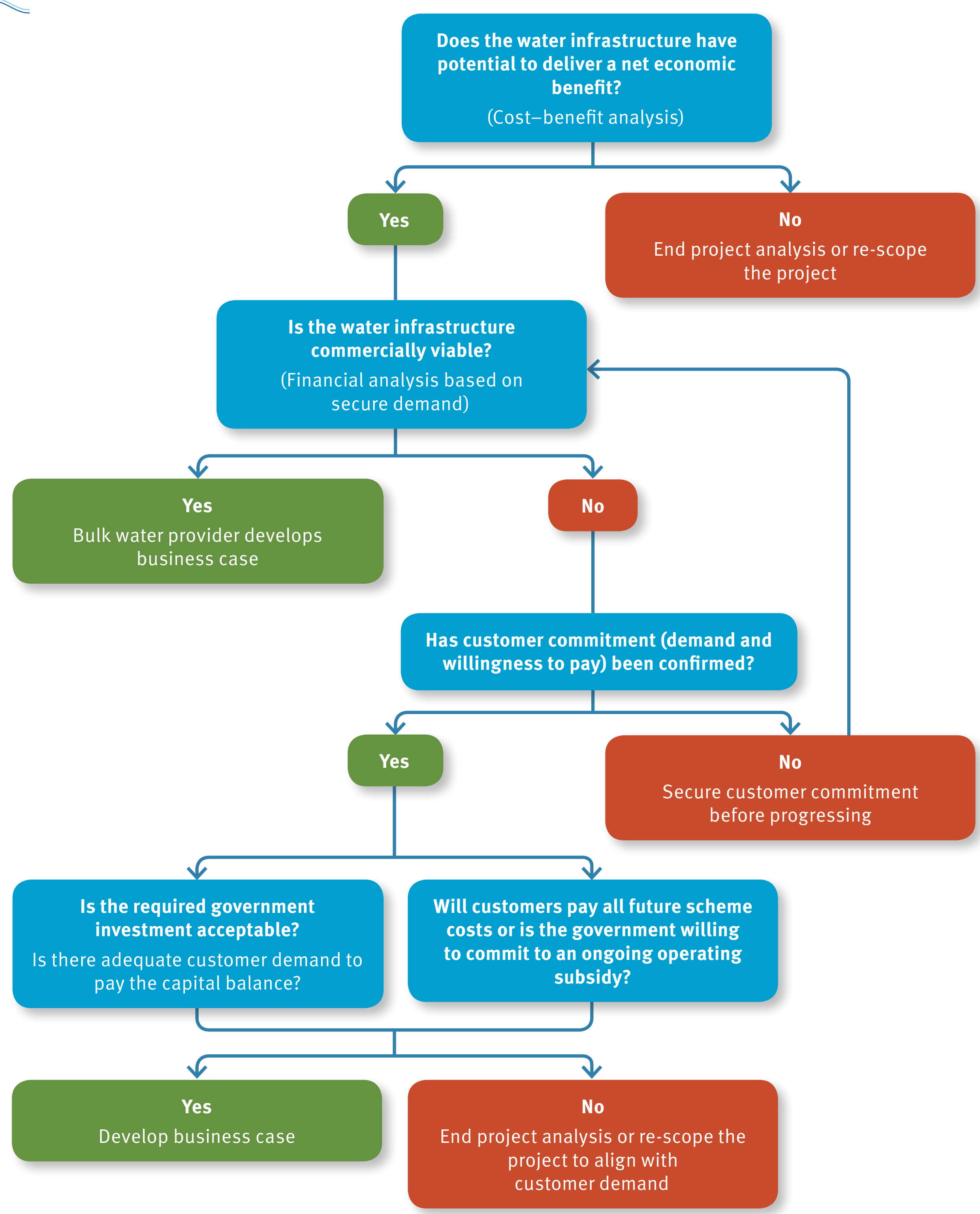


Figure 3: Decision tree to support investment assessment processes

1.2 Principles for investment

Increasingly, there is an expectation that bulk water supply infrastructure should be paid for by customers and beneficiaries, consistent with the principles of the National Water Initiative. If this can't be achieved directly and a contribution is requested from the state government, then the economic benefits need to be demonstrated and considered by government through a process that allows prioritisation of expenditure across a range of proposals.

The following principles have been developed to guide bulk water investment decision-making if state government investment is to be considered (for projects that may not be commercially viable but may provide regional economic benefits).

The application of these principles will help ensure that all relevant options and risks are meaningfully assessed by stakeholders—including potential customers, proponents and decision-makers—when considering potential infrastructure projects.

These principles should be read in conjunction with existing government guidance on investment decision-making, including the Project Assessment Framework developed by Queensland Treasury and the Business Case Development Framework developed by Building Queensland.

1.3 Summary of initiatives

The initiatives contained in this document will commence in the 2017–2018 financial year. Table 1 (overleaf) provides a summary of bulk water supply policy initiatives and opportunities under development. These have been aligned with the objectives described in Section 1.1, with further details of each initiative presented in Section 6. Details of key bulk water supply infrastructure initiatives are provided in Section 4.

Principles for state government investment in proposed bulk water supply infrastructure

1. State government investment should only address a market failure that cannot be addressed by proponents, local governments or other stakeholders. If projects are economically beneficial but not commercially viable, state government investment should be considered on a case-by-case basis. These investment decisions will be made in conjunction with consideration of the state's budget constraints and other government priorities.
2. Proposed investments should provide the highest net benefit of all options considered according to best practice assessment of proposals, including options analysis, demand assessment, transparent cost sharing and cost–benefit analysis.
3. Economic assessments that underpin potential investment in new water infrastructure should:
    a. consider environmental and social implications using the best available information
    b. consider the potential wider benefits to the Queensland community
    c. systematically address risks, including the risk of overestimation of benefits such as forecast revenues and wider benefits to the community.
4. For proposals with a significant urban supply component, there should be a local government financial contribution as a default.[3]
5. For proposals with a significant industrial or agricultural component, there should be strong private sector support with financial contributions if appropriate.
6. Projects should align with the National Water Initiative principles, including appropriate cost recovery. If full cost recovery is not deemed feasible (including capital), any federal, state or local government subsidies should be transparent to the community.
7. If the state government makes the majority investment in infrastructure, it should own and manage the assets either directly or through its statutory authorities or government-owned corporations.

3 Noting there are different institutional arrangements in South East Queensland

Table 1: Summary of QBWOS policy initiatives and opportunities

Objectives	Policy initiatives and opportunities
Safety and reliability of dams and urban water supplies	• State entities (including SunWater and Seqwater) will continue to direct significant capital funds to dam safety upgrades for relevant dams (approximately $1.5 billion combined through to 2027). • DEWS will continue development of the regional water supply security assessments to assist local governments plan for urban water supplies. • The Department of Infrastructure, Local Government and Planning and the Department of State Development (DSD) will enhance local government funding programs to encourage consideration of alternative water supply options and fit-for-purpose solutions.
Use existing water resources more efficiently	• The Department of Natural Resources and Mines (DNRM) will lead a project to supply customers and investors with proactive assistance, integrated advice and online services to provide better access to water information and available water. • DNRM will review and enhance market and trading arrangements to better suit Queensland conditions, and improve the way market information is provided to make the most of existing infrastructure. • DNRM will remove constraints to accessing water associated with existing infrastructure by assessing processes to achieve greater and more effective movement of water within a water supply scheme. • DNRM will review the process for release of unallocated water to improve uptake of unallocated water reserves. • DNRM will investigate the short-term options for allowing alternative use of water currently reserved for strategic infrastructure needs. • DEWS will provide better public access to data and information on available volumes of water and bulk water infrastructure assets across Queensland (through the QBWOS story map and Queensland Globe). • DEWS, DSD, Department of Agriculture and Fisheries (DAF) and DNRM will promote active consideration of new technologies and approaches in water security planning. • SunWater will develop an integrated strategy to better use latent capacity of existing assets (including pricing to support the use of latent capacity, making water products better suit business needs and removing constraints). • SunWater will develop options to better support the government's objectives for regional economic development.
Support infrastructure development that provides a commercial return to bulk water providers	• State entities will continue to develop infrastructure proposals for commercial return. • DSD will investigate opportunities for non-urban water infrastructure development that supports regional economic development.
Consider projects that will provide regional economic benefits	• If state funding is requested, DEWS will evaluate and prioritise new bulk water infrastructure proposals for government consideration. • DEWS and Queensland Treasury will develop a best practice infrastructure assessment process with stakeholders to ensure appropriate management of risks, such as demand and environmental impacts. • DEWS will continue to coordinate National Water Infrastructure Development Fund project activities.

2. Background and current considerations

2.1 History of bulk water in Queensland

Water is extremely valuable to both Indigenous and non-Indigenous peoples, and is used for many different purposes. Water is also important to both for different reasons. Indigenous peoples' water values are regionally diverse and complex, but there are some commonalities. In particular, Indigenous peoples' relationships with water are holistic—combining land, water, culture, society and economy. As well as underpinning social and economic wellbeing, Indigenous peoples' relationship with water, land and the resources of each is crucial to cultural vitality and resilience.[4] Access to, and management of, water by Indigenous peoples is provided for under the National Water Initiative (to which Queensland is a signatory). Queensland also has laws in place to protect Indigenous peoples' cultural heritage, including their property, land, sea and water rights, which must be integrated into decision-making for new infrastructure.

Following settlement, Queensland's water supply sources were initially developed to support early economic and population growth. Later, development promoted and supported growth in the agricultural sector via irrigation schemes and supported the rapid expansion of mining in the 1960s to 1980s.

From the early 1940s, water resource development was driven through the Department of Local Government, which was given responsibility for town water supply, sewerage and urban drainage works. The Irrigation and Water Supply Commission was established in 1947 and was responsible for water supply, conservation and irrigation. Over the next 50 years, small-scale water resource development (weirs) occurred across the state, and major dams were constructed at key sites from the 1970s through to the early 2000s. In 1978, the Queensland Water Resources Commission was established, with the additional functions of allocating water rights, planning, monitoring and managing the state's water resources.

In the 1980s, regional growth and, to a lesser extent, mining development drove water resource development in Queensland. The 1980s were the beginning of a period of significant change in Australia, with sweeping economic reform, increasing exposure to international competition and increasing environmental consciousness reflected in new environmental protection legislation. For water supply planning this meant environmental impacts needed to be considered and addressed in detail to obtain approval for new dams. At the same time, planning for new dams and management of existing dams also evolved to embrace a new understanding of the potential impacts of high rainfall events.

In the mid 1990s, federal and state government leaders committed to a further program of economic reforms known as the National Competition Policy. In 1994, the Council of Australian Governments (COAG) adopted a water reform framework informed by this policy. These reforms covered pricing, rural water schemes, water trading, resource management, institutional reform and public consultation.

In Queensland, this led directly to the development of the *Water Act 2000*, which underpins water resource planning and management. Bulk water service providers (SunWater and Seqwater) were separated from the state agencies responsible for water resource management and for protecting public health and safety, and an independent pricing regulator was established (Queensland Competition Authority). In 2004, COAG agreed to the National Water Initiative as the blueprint for water reform into the future.

Beyond the COAG reforms, the severity of the Millennium Drought of the 2000s brought a renewed focus to urban water security. A more conservative

4 Aboriginal and Torres Strait Islander Social Justice Commissioner 2009, *Native title report 2008*, chapter 6, Australian Human Rights Commission.

approach to water supply security planning was adopted in South East Queensland based on level of service objectives—these are broadly defined in terms of the acceptable frequency, severity and duration of water restrictions, and are fundamental to the estimation of the supply yield of a system. This approach is now being progressed across the rest of the state, with regional water supply security assessments discussed in more detail in Section 2.4.

In January 2011, one of the largest floods on record occurred in South East Queensland and other parts of the state. As a result of the very significant impacts of the flood, the Queensland Floods Commission of Inquiry was established. Its focus was wide ranging, considering floodplain management, planning instruments, development, essential services, emergency responses and dam operations. The implementation of the inquiry's recommendations has clarified responsibilities and accountabilities for flood risk management and has led, for the first time, to integrated regional consideration of water resource planning, water supply security, weather forecasts, dam operations, flood mitigation and dam safety matters.

2.2 Current policy environment

Queensland has a well-established project assessment framework in place, including guidance on investment decision-making provided by Queensland Treasury, Building Queensland and other entities. There are a range of legislative instruments to consider when planning and assessing potential infrastructure projects, both on a state and federal level. These including planning, environmental and financial sustainability requirements.

State and federal initiatives

In March 2016, the Queensland Government released the *State infrastructure plan* and committed to an infrastructure reform agenda. As part of the implementation of the plan, DEWS was tasked with developing a Queensland future water security strategy—the QBWOS.

Water infrastructure projects are typically long-life assets that are complex and expensive to build, own and operate. The QBWOS is an important step in building a framework that stands the test of time, supporting better use of existing infrastructure and informing construction of new infrastructure if appropriate.

In mid 2015, the Australian Government announced the establishment of the National Water Infrastructure Development Fund (NWIDF). The NWIDF arose from the federal *Our north, our future: white paper on developing northern Australia and Agricultural competitiveness*. It includes $59.5 million for feasibility projects and another $440 million for capital contributions towards new water infrastructure that supports regional economic growth, including irrigated agriculture. In 2016, 15 Queensland-based proposals were awarded funding for feasibility studies under the NWIDF, and one project (Rookwood weir) was identified for capital funding should it prove feasible. A decision on the federal component of capital funding for state projects is expected in mid 2017.

The Queensland Government is committed to ensuring that consideration of water infrastructure projects includes rigorous technical and economic assessments, and ensuring the demand for water is proven.

Government support for economic development

There is a general acknowledgment that governments of all levels should consider the benefits of investing in infrastructure to support growth and regional economic development. Much of the recent bulk water infrastructure development in the state, particularly during the resources boom, readily demonstrated a commercial return. However, following the global financial crisis of 2007–2008 and ensuing global economic downturn, there now needs to be broader consideration of the long-term economic and social benefits of new water infrastructure.

While consideration of the commercial viability of infrastructure projects is important, and still the priority, the state government also has a role to facilitate and support projects demonstrated to be in the best overall interests of the state (economically viable).

The focus has shifted to reducing the barriers to using available water within existing bulk water supply infrastructure and considering new projects with demonstrable economic benefits within the context of all competing budget constraints.

2.3 Planning complexity

The process of planning and constructing water supply infrastructure is complicated, with many uncertainties and risks to be managed in association with demand, supply, cost, and environmental and social impacts. Some of these are unique to bulk water supply, and some are greater in magnitude and impact than other asset-rich services.

These risks and uncertainties include the following:

- The **long life** of some bulk water infrastructure and associated high investment costs means that demand risks tend to be more significant than for some other infrastructure planning activities. A dam may have a design life of more than 100 years, yet predicting demand for water (even 20 years into the future) involves considerable uncertainty—some demands may be expected to continue into the future (such as agriculture), whereas a mine development will have a limited life. Predicting revenue to cover operational costs and provide a return on capital over 100 years is even more difficult.
- **Demand forecasting** is complicated by the fact that significant variation in demand can occur from year to year, often with an inverse relationship between demand and supply. That is, when a dam is full (such as when there has been significant rainfall and inflows) demand for water is often lower, especially from the agricultural urban sectors (through reduced outdoor water use).
- Water infrastructure is unique in that **supply risks** remain after construction. Unlike a bridge for example, where full capacity is available after commissioning, a dam's utilisation capacity is always subject to the uncertainty of rainfall and streamflow conditions from year to year and over longer periods. Even with the largest dams, during low inflow periods there may be, at times, less water available than needed.
- **Cost risks** can be very significant for bulk water infrastructure projects due to the large expenditure involved, the long planning and construction periods, and the long life of the asset. A medium to large dam may cost upwards of $500 million in planning and construction costs, and will have ongoing operation and maintenance costs in the millions per annum. Dams can also incur large capital upgrade costs if there are significant changes to populations downstream or if 'worst-case' rainfall events are predicted to increase with consequent design risk implications (discussed further in Section 5.3).

Water supply planning for urban needs can be further compounded by uncertainties such as the following:

- **Residential water-use behaviour**—Household water demand has a very significant discretionary component that is difficult to estimate at times. Much of the last two decades in Queensland have been spent in a state of drought or flood, making estimations from past records difficult—particularly where there were varying degrees of water restrictions in place.
- **Changes in population and economic growth**—In general, as the number of people in a community increases, so too does the demand for water for both household and business use. It can be difficult to accurately predict the level of population change in a community or region, as it can be affected by surrounding businesses and industry and influenced by factors such as unpredictable demand for a local commodity or the closure of a significant employer. Similarly, any increase in economic activity within or near a community can lead to an increase in water

demand, either directly through water needs of the commercial or industrial activity, or indirectly through increased population from greater employment opportunities. Proposed large developments can rely (at least partially) on the same water source as a community, creating uncertainty for the community's future water supply performance. Factors such as electricity costs and global markets can impact commercial activities, particularly mining and agriculture, leading to significant fluctuations in water demands.

- **Climate**—Extreme events such as floods and droughts can have significant impacts on the reliability of water supplies. Flooding can cause physical damage to water storage, treatment and supply infrastructure, as well as increase water treatment complexity in the short term. While water security may be high during normal circumstances, the adequacy of a water supply is tested during drought. Communities that rely on regular seasonal rainfall to replenish their water supplies are likely to be most affected. High-quality planning is needed for such circumstances so that, at a minimum, urban water supplies can be maintained to a community. Pre-planning for climate resilience should result in well thought out, appropriate responses—as opposed to reactive measures that can often be more expensive and less effective. Decisions also need to be made about how often communities are willing to be on water restrictions balanced by how willing they are to pay for higher levels of water security. Section 5.1 contains further discussion on planning for climate uncertainty.

Like many other large infrastructure projects, bulk water supply works frequently have significant environmental and social impacts. The impacts and often large geographical areas involved mean that a greater variety of studies and impact assessments may be required compared to other forms of infrastructure. Typically these assessments include hydrology, environmental flow, transmission loss, aquatic ecology, fluvial geomorphology, geotechnical, flora and fauna, Indigenous and European heritage, land capability and socio-economic impact.

Unlike many sectors, developing bulk water supply infrastructure is complicated by the requirement to assess an extensive number of factors that might impact viability. For example, while the assessment of telecommunications or transport infrastructure has to consider uptake scenarios and associated revenue projections (and there can be domestic factors that affect these), water infrastructure with agricultural, industrial and resource sector demands is perhaps uniquely and particularly exposed to unpredictable and changing domestic and international market circumstances.

2.4 Drivers of bulk water use

Queensland has a dynamic climate—from dry and hot in the west to tropical in the north, and some of the highest and lowest rainfalls in the country. Throughout Queensland's history, water supplies have been developed to meet urban, industrial and agricultural demands, and to support communities and economic development. The objectives for the development of water supplies have changed significantly over time, most recently to meet the rapid urban development and population increases of the last 20 years, the significant growth of the resource sector and the push to develop northern Australia (in particular to support agricultural development).

Water for urban needs

The provision of safe, secure and affordable drinking water supplies underpins the social wellbeing, economic prosperity and development of our communities. About 10.5% of Queensland's total water use is for urban supply.5 Overall, Queensland's population growth has slowed in recent years and the population profile also continues to change—the rate of population ageing is slowing, and the difference in growth rate between South East Queensland and regional Queensland has narrowed significantly.6 While some regions have experienced reduced growth resulting from the downturn in the resources sector, other regions are growing with increases in tourism and other industries.

5 Australian Bureau of Statistics 2016, '4610.0—Water account, Australia, 2014–15', Australian Government, Canberra, ‹http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4610.0Main+Features12014-15?OpenDocument›.

6 Queensland Government Statistician's Office 2016, Queensland Treasury *population growth highlights and trends, Queensland, 2016 edition*, Queensland Government, ‹http://www.qgso.qld.gov.au/products/reports/pop-growth-highlights-trends-qld/index.php›.

To protect public health, the Queensland Government closely monitors and regulates the provision of drinking water in Queensland—this has quality and quantity components. Drinking water service providers involved in treating, transmitting or reticulating water for drinking purposes are required to have an approved drinking water quality management plan in place, and comply with the details of that plan.

In South East Queensland, water supply planning and bulk water infrastructure management for the entire region is undertaken by Seqwater. This regional approach is driven by the physically interconnected bulk water supply system (South East Queensland Water Grid), which was built in response to the Millennium Drought. Seqwater developed a detailed Water Security Program that outlines future water supply requirements for this region (available on their website at **www.seqwater.com.au/waterforlife**). The Water Security Program is based on defined level of service objectives for the region, and stable and relatively low water demand.

Outside South East Queensland, the responsibility for urban water supply planning lies with the local drinking water service provider—in most regional areas it's the local council. Local water service providers are entrusted to have the best knowledge of a community's water supply and future demand needs. They generally own and operate the infrastructure to supply treated water, and this allows town planning and water supply planning to be undertaken together.

It is essential that water infrastructure planning is timely, cost-effective and appropriate for a community's needs. To help support water supply planning efforts, DEWS is partnering with councils across Queensland to undertake regional water supply security assessments (RWSSAs) for identified communities. The RWSSAs quantify and forecast growth in water demand for identified communities in order to identify the likelihood, timing and magnitude of supply shortfalls between the bulk water supply system's current capacity and the community's projected water demand.

RWSSAs do not provide supply solutions—they build on the local knowledge of councils and use advanced hydrological modelling to assess water supply risks and help develop a shared understanding of the level of current and future water supply security. Local governments and water service providers remain responsible for deciding what should be done and implementing actions to provide an appropriate level of water security for their communities. This includes decisions around the level of service objectives for water supply and the priorities for future water supply investments.

The sequencing of RWSSAs is undertaken according to a collaborative, risk-based prioritisation of communities, and has also sought to accommodate councils that specifically request assistance with water security assessment. Following development of the RWSSAs, many councils have recognised that the next step to ensuring secure water supplies is to develop and/or review the specific level of service objectives for their community. Water security level of service objectives set out the desired level of performance to be achieved. The level of service objectives commonly include statements about:

- how much water the supply system will typically be able to supply
- how often and for how long water restrictions might occur
- the possibility of emergency water supply requirements due to a prolonged drought.

Such transparent statements help to align the level of investment in water supply infrastructure with community expectations and needs.

An overview of the findings of completed RWSSAs is provided in Table 2 (overleaf). Another nine RWSSAs are under development—Cloncurry, Chinchilla, Emerald, Kingaroy, Mackay, Mount Isa, Mount Morgan, Mossman and Warwick. It is important to note that every RWSSA is a point-in-time assessment based on the best available information at that time. It is expected that RWSSAs will be reviewed and updated, with particular attention given to the recorded demand compared to the forecast water demand profile.

Table 2: Regional water supply security assessment (RWSSA) summaries

Urban centre	Date	RWSSA water security outlook at the time of assessment*	Actions identified by partner council
Bundaberg	Feb 2016	The council holds sufficient water allocation to meet projected water demand for Bundaberg beyond the mid 2030s. However, the council may need to use more of its existing surface water to meet demand if groundwater availability is restricted.	• Regular review of water security position • Consider purchasing additional water allocation
Cairns	Oct 2014	The council holds water allocations that should be sufficient to meet projected demand for Cairns to the mid 2030s. However, with the council's current water allocations and treatment capacity, restrictions that constrain supply by at least 10% will probably be required at least one year in two. This may increase up to 25% and in frequency and/or duration as demand continues to grow.	• Review water strategy • Determine appropriate level of service objectives • Finalise demand management strategy • Assessment of future water supply options
Charters Towers	Feb 2016	The council holds water allocations that should be sufficient to meet projected water demand for Charters Towers beyond the mid 2030s. However, restrictions that constrain supply by 15%–40% are expected every one to two years as part of this security outlook.	• Review demand management measures • Review water operations for improvements • Investigate increasing effluent reuse • Determine appropriate level of service objectives • Assess future water supply options
Gladstone	Feb 2017	Through its relationship with the Gladstone Area Water Board, the council has access to sufficient water allocations to meet projected water demand for Gladstone beyond the mid 2030s. However, the board may impose restrictions on the council (and others) as demand grows across its entire customer base.	• Strategic modelling and planning • Assess potential demand management measures • Increase supply efficiency (e.g. minimise leaks/losses in network)
Gympie	Dec 2016	The council holds water allocations that should be sufficient to meet projected water demand for Gympie to the mid 2020s. However, projected demand could exceed the council's existing water allocations before 2030 and, and in the medium term, the council will need additional measures to improve security.	• Purchase additional water allocation • Look at options for increasing security of supply (e.g. investigate possibility of increased regional urban supply storage) • Assess potential demand management measures

Table 2 (continued)

Urban centre	Date	RWSSA water security outlook at the time of assessment*	Actions identified by partner council
Hervey Bay	Apr 2015	The council-owned, Wide Bay Water Corporation holds sufficient water allocation to meet projected water demand for Hervey Bay beyond the mid 2030s. However, water restrictions that constrain supply by up to 40% are expected to form part of this security outlook, and the corporation will need additional allocations and measures to improve security.	• Continue regular review of water strategy • Review demand management • Assessment of future supply options
Maryborough	Apr 2015	The Wide Bay Water Corporation holds sufficient water allocation to meet projected water demand for Maryborough beyond the mid 2030s. Water restrictions that constrain supply by 10%–20% are expected to form part of this security outlook.	• Continue regular review of water strategy • Review demand management • Assessment of future supply options
Rockhampton	Feb 2016	The council holds sufficient water allocation to meet projected water demand for Rockhampton beyond the mid 2030s. However, the supply is vulnerable because of its short storage duration and heavy reliance on seasonal inflows. The council is expected to be able to meet water demand in most years over the long term.	• Continue demand management activities • Assessment of future infrastructure and non-infrastructure options (including reducing water losses and recycled water substitution)
Stanthorpe	Nov 2016	The council holds sufficient water allocation to meet projected water demand for Stanthorpe beyond the mid 2030s. However, water restrictions that constrain supply by 15%–25% are expected to form part of this security outlook.	• Continue demand management activities • Assessment of future infrastructure and non-infrastructure options to improve water supply security
Townsville	Oct 2014	The council holds sufficient water allocations to meet projected water demand for Townsville to around 2030. However, it remains vulnerable to an over-reliance on Ross River Dam and could increase security by drawing earlier on its allocation in Burdekin Falls Dam and improving demand management. Improvements to water security may not be required immediately, but water security will reduce over the next 10–15 years to less-acceptable levels.	• Secure additional high-priority water (expected to be needed by 2020) • Determine appropriate level of service objectives • Assessment of future supply options, including accessing additional water from the Burdekin River
Whitsunday	Aug 2016	The council holds water allocations that should be sufficient to meet projected water demand for the Whitsunday communities to the mid 2020s. The council will need to consider additional allocations and measures to improve security.	• Purchase additional water allocation • Revise demand management strategy • Undertake groundwater reliability assessment • Determine appropriate level of service objectives

* For more detailed information on the water security outlook for any of these communities, please refer to the individual RWSSA documents on the DEWS website at www.dews.qld.gov.au.

Water for industry

The availability of a reliable water supply is critical to support industry. The total volume of water used for industrial purposes outside urban water supply systems is currently less than 5% of the total water use in the state—but it is of great economic importance. This is an indication that well-planned and timely water infrastructure development is an important economic enabler for the state. The drivers of industrial water use in Queensland into the future are likely to continue to be mining and minerals processing and, to a lesser extent, power generation.

Significant coal reserves are available in the state's Bowen and Surat basins and in the yet-to-be-developed Galilee Basin. However, the timing of any potential developments in these areas is highly dependent on trends in international markets for coal and, in the case of thermal coal, concerns regarding the impacts of greenhouse gas emissions on the world's climate. The volumes of additional water supply required to support mining developments and the timing of these requirements is therefore difficult to predict. A number of feasibility studies and environmental impact statements have been finalised for construction of dams that could support expansion of coalmining in Queensland, including Connors River Dam and Nathan Dam if required.

Additional water demands for power generation are likely to be modest for the foreseeable future for a number of reasons. Technological improvements and the scarcity of water in the Surat Basin coal areas have resulted in the state's recent base load power stations (Millmerran and Kogan Creek) being air-cooled rather than water-cooled. Additionally, the recent gas-fired power station developments in the state have a minimal water requirement for their operation. Although an expensive option, the availability of purified recycled water in South East Queensland (when the Western Corridor Recycled Water Scheme is operational) allows the Swanbank and Tarong power stations to use this resource during drought periods rather than using their normal surface water sources. Finally, the state's renewable energy targets are encouraging increased power production from sustainable energy sources, such as wind and solar that use little or no water.

Water for agriculture

Rural water use accounts for approximately 60% of the state's total water use.[7] Water is essential for much of the state's rural production, particularly agricultural irrigation and stock grazing.

State government investment in large-scale irrigation development began in the Mareeba–Dimbulah area on the Atherton Tableland in Far North Queensland, with the completion of the major storage (Tinaroo Dam) and supporting water supply scheme in 1958. Construction of water supply infrastructure by the state government followed in the Warrill Creek, Mary River, Callide Creek, Burnett River, Logan, St George, Emerald, Pioneer and Proserpine areas, and resulted in major increases in the area of land under irrigation across the state. Many of these schemes also provided mining and/or urban water supplies. The largest water supply scheme in the state, the Burdekin Haughton Water Supply Scheme, is based on the Burdekin Falls Dam (completed in 1987), with construction of the channel scheme following. This water supply scheme supplies rural producers that irrigate around 45 000 hectares.

In addition to the state's bulk water infrastructure, many landholders (particularly in the south-west of the state) have developed large off-stream storages filled by diversions from stream flood flows or overland flows. As well as surface water supplies, subartesian groundwater is also an important source of supply for irrigation in areas such as the Lockyer and Callide valleys and the Don and Burdekin river delta areas. Artesian groundwater from the Great Artesian Basin is critical to maintaining stock water supplies for much of western Queensland.

The QBWOS recognises there is a push to develop Northern Australia and to create a business environment that will support economic growth. In particular, access to secure and tradeable water is considered to be one of the foundations for development of Northern Australia. The Australian Government is currently progressing assessments of northern water resources, including the Mitchell River catchment in Queensland.[8] To develop 'greenfield' irrigation areas such as those considered in the Gulf basins (in addition to the bulk water infrastructure), major costs will be involved to establish the essential

7 Australian Bureau of Statistics 2016, '4610.0—Water account, Australia, 2014–15', Australian Government, Canberra, ‹http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4610.0Main+Features12014-15?OpenDocument›.

8 Australian Government 2015, *Our north, our future: white paper on developing northern Australia*, ‹http://northernaustralia.gov.au/›.


Clarendon Dam tower

supporting and enabling infrastructure and services required to convert land currently used for grazing into areas of irrigated agriculture.[9] Mega-scale greenfield irrigation developments (e.g. Ord River in Western Australia) can often be unpredictable, with a number of challenges to understand and overcome, including harsh climates, unique pests and difficulties getting product to market.[10] By comparison, the development of an irrigation expansion area (i.e. an area near an existing irrigation area) is likely to have only marginally higher costs compared to the existing irrigation areas.

Drought

The widespread drought across the state has caused many landholders severe hardship. A drought declaration made by the Queensland Minister for Agriculture and Fisheries, based on the advice of local drought committees, is an official acknowledgment by government that an area or individual property is affected by poor seasonal conditions. Amongst other things, drought-declared producers can access emergency water infrastructure rebates and water carting subsidies as part of the Queensland Drought Assistance Package. DNRM waives annual water licence fees in local government areas that are drought-declared.

In the first quarter of 2017, there were 43 council areas and 3 part council areas drought-declared, with 53 'individually droughted properties' in a further 9 council areas. At the time, this equated to over 87% of the area of Queensland officially in drought. Current rainfall prospects are poor, with all parts of Queensland except the far north expected to have less than average rainfall into the 2017 winter season.[11]

9 Ash, A & Gleeson, T 2014, *Northern Australia: food and fibre supply chain synthesis study*, CSIRO/ABARES Australia.

10 Ash, A 2014, *Factors driving the viability of major cropping investments in northern Australia—a historical analysis*, CSIRO, Australia.

11 Australian Bureau of Meteorology 2017, 'Climate outlooks—monthly and seasonal', Australian Government, retrieved from ‹http://www.bom.gov.au/climate/outlooks/#/rainfall/summary›.

3. Existing bulk water arrangements in Queensland

3.1 Accessing water

In Australia, water is controlled by governments that allow other parties to access and use it for a variety of purposes, including irrigation, industrial use, mining and servicing rural and urban communities, or for amenity values. The framework within which water is allocated attaches both rights and responsibilities to water users—a right to a share of the water made available for extraction at any particular time, and a responsibility to use this water in accordance with conditions set by government. Likewise, governments have a responsibility to ensure that water is allocated and used to achieve socially and economically beneficial outcomes in a manner that is environmentally sustainable.

Queensland's bulk water supply systems, including dams, weirs, pipes, channels and other assets, are owned and managed by bulk water entities (SunWater, Seqwater, Gladstone Area Water Board and Mount Isa Water Board), private entities (such as mining companies) and local councils (especially outside South East Queensland). Further components of associated urban water supply systems can include water treatment plants, manufactured water plants (desalination and recycled water) and distribution networks. These are owned and operated by a range of water service providers.

3.2 Bulk water infrastructure

Much of Queensland's bulk water supply infrastructure has been planned, designed and built by the Queensland Government, and today it is largely owned and operated by state government–owned bulk water supply businesses and local governments.

In South East Queensland, Seqwater owns the bulk water supply infrastructure (dams and weirs), including water treatment facilities and bulk distribution networks. Seqwater is also responsible for long-term water supply planning for the region. In South East Queensland, councils and council-owned statutory authorities provide water distribution and retail services to homes and businesses.

Outside South East Queensland, SunWater owns most of the bulk water infrastructure. Some councils also own water supply infrastructure. Councils own most of the water treatment facilities and generally provide distribution and retail services to homes and businesses. Local councils are also responsible for the water supply planning for urban supplies.

The QBWOS online story map provides a centralised, visual (spatial and graphical) representation of existing bulk water supply infrastructure, with current water information and infrastructure projects being considered across Queensland.

Outside South East Queensland

Bulk water supply
SunWater, Gladstone Area Water Board, Mount Isa Water Board, some local governments

Water treatment
Water service providers

Distribution and retail
Local governments

Within South East Queensland

Bulk water supply
Seqwater

Water treatment
Seqwater

Distribution and retail
Unitywater, Queensland Urban Utilities, Redland City Council, Logan City Council, City of Gold Coast

Figure 4: The division of responsibility for bulk water supply, distribution and retail from source to end user

The state's role

The Queensland Government is responsible for a number of bulk water entities that provide essential water supply services to the community, including critical water supply infrastructure such as dams and water treatment plants. The state's bulk water entities include one government-owned corporation (SunWater), one statutory authority (Seqwater) and two category 1 water authorities (Gladstone Area Water Board and Mount Isa Water Board). These entities support economic development by supplying bulk water to grow businesses and develop new enterprises. They can provide water from existing supplies or from new infrastructure, if required and justified.

The state government is also responsible for the administration and oversight of category 2 water authorities. These tend to be much smaller than the bulk water entities listed above. The list of category 2 water authorities is available on the DNRM website at www.dnrm.qld.gov.au.

SunWater

SunWater is a bulk water infrastructure developer and operator, owning and managing more than $10 billion in water infrastructure assets and supplying approximately 40% of all water used commercially in Queensland. SunWater's extensive network of water supply infrastructure supports mining, power generation, industry, urban development and irrigated agriculture throughout the state.

SunWater's irrigation prices are determined by the state government on the advice of the Queensland Competition Authority. SunWater provides water services to irrigators operating within 23 water supply schemes and 8 distribution systems. SunWater deliver in excess of 1.3 million megalitres of water annually to over 5000 bulk water customers. Irrigators account for the majority of SunWater's customers but represent a relatively small contribution to SunWater's revenue.

Of the four bulk water entities, SunWater alone is corporatised under the *Government Owned Corporations Act 1993*, which sets out the principles and framework for its operation. Under the governance framework, SunWater is required to operate on a commercial basis as far as practicable.

Seqwater

The Queensland Bulk Water Supply Authority (trading as Seqwater) is a statutory authority. Seqwater delivers water supply to South East Queensland, and provides essential flood mitigation services and manages catchment health. It also provides water for irrigation to about 1200 farmers and offers community recreation facilities enjoyed by more than 2.5 million people each year.

Seqwater is responsible for managing and operating the South East Queensland Water Grid—a network of bulk water supply assets extending from the New South Wales border to the base of the Toowoomba ranges and north to the Sunshine Coast. The existing water infrastructure was interconnected and expanded to form the water grid during the Millennium Drought, with the primary aim of improving water security to the region. The works included significant investment in the construction of major pipelines and two manufactured water supplies—the Gold Coast Desalination Plant and the Western Corridor Recycled Water Scheme.

South East Queensland is the only region in the state where a standard of water security performance (i.e. level of service objectives) has been prescribed by government. Seqwater must undertake long-term planning to facilitate achievement of this specified level of performance and outline its plans in a Water Security Program. Outside South East Queensland, local governments and water service providers are encouraged to develop their own level of service objectives that are appropriate for the community they service.

Seqwater's bulk water and irrigation prices are determined by the state government on the advice of the Queensland Competition Authority. When the Queensland Government took over responsibility for bulk water supply in South East Queensland in 2008, it established a 10-year 'price path' of annual price increases to gradually recover the cost of infrastructure and achieve a common bulk water price across all South East Queensland councils. The bulk water prices are designed to provide Seqwater with sufficient revenue to recover the costs of providing treated bulk water through its extensive network of dams, water treatment plants and pipelines.

Gladstone Area Water Board and Mount Isa Water Board

The Gladstone Area Water Board (GAWB) was established in 1973 to help the Gladstone Town Council and Calliope Shire Council cope with the heavy financial demands imposed on them to upgrade the water supply system serving the area, as a result of high industrial growth. Similarly, the Mount Isa Water Board (MIWB) was established in 1974 to carry out water activities in the Mount Isa region. Both GAWB and MIWB are also category 1 commercialised statutory water authorities under the *Water Act 2000*.

GAWB owns and operates Awoonga Dam on the Boyne River, along with a network of delivery pipelines, water treatment plants and other bulk water distribution infrastructure in the Gladstone region in Central Queensland. GAWB's total asset base is valued at over $670 million. GAWB holds an allocation of 78 000 megalitres per annum from Awoonga Dam on the Boyne River. Of the total water supplied by GAWB, 80% is delivered to industrial and power generation customers, while approximately 20% is supplied to the Gladstone Regional Council as potable water.[12]

MIWB maintains $131 million of water supply and treatment infrastructure, including 86 kilometres of transmission pipeline from Lake Julius to Mount Isa. Each year, MIWB supplies nearly 20 000 megalitres of water from Lake Moondarra (the city's primary water source) and Lake Julius to customers. MIWB is responsible for the supply of bulk water to industrial customers and drinking water to Mount Isa City Council, which reticulates potable water to approximately 20 000 people.[13]

GAWB and MIWB are responsible for ensuring that the water needs of their customers are met, now and into the future.

12 Gladstone Area Water Board 2016, *Gladstone Area Water Board 2016 annual report*, ‹http://www.gawb.qld.gov.au/documents/40241572/0/Annual%20Report.pdf›.

13 Mount Isa Water Board 2016, *2015–16 Mount Isa Water Board annual report*, ‹http://www.mountisawater.qld.gov.au/wp-content/uploads/MIWB-Annual-Report-2015-16.pdf›.

3.3 Bulk water supplies

In Australia, water for urban, agricultural and industrial use has traditionally been sourced from surface or groundwater resources such as dams, weirs and bores. In Queensland, water supply sources are generally classified as either supplemented or unsupplemented sources according to the scale of associated infrastructure and its operation:

- **Supplemented water** is provided in a regulated scheme, usually supplied from either a dam, weir or other improvements (e.g. barrage, off-stream storage), but can include natural stream flow. It generally has higher reliability than unsupplemented water. Supplemented water supply schemes are operated by a water service provider, with releases made from infrastructure to meet water demands while maintaining the needs of the environment.
- **Unsupplemented water** is available for use outside regulated schemes or from non-regulated sources where no in-stream improvements or transportation assets are supplied. Sometimes referred to as 'run of river', these water sources include rivers, creeks, overland flow and groundwater. Individual water users are usually responsible for building and operating any local-scale infrastructure required to access and distribute their individual water entitlement.

Bulk water supply systems consist of two main supply types:

- **designated water supply schemes**—with associated water allocations identified and authorised through a water planning instrument
- **standalone water supply infrastructure**—typically developed at a local scale to provide for a single-purpose use.

Owners/operators are responsible for bulk water supply systems and managing the infrastructure and water entitlements within the system. There are more than 46 existing surface bulk water supply systems in Queensland. Within these systems there are more than 140 dams and weirs. Outside these systems there are approximately 270 additional dams, weirs and barrages across the state.

The QBWOS focuses on raw water supplied from bulk water supply systems that primarily access surface water resources. Details of groundwater and non-traditional water supply sources were also reviewed during preparation of this document. These alternative sources will be further considered and developed in future versions of the QBWOS, with information provided as part of Queensland Globe and the online story map. Initiatives to improve access to information are provided in Section 6.2.

Understanding potential available water across Queensland

Water availability can be complex and is dependent on many factors. In Queensland, water availability is determined through the water planning process managed by DNRM. Since commencement of the *Water Act 2000*, significant water resource planning has been undertaken across the state. The water planning process is designed to manage the allocation and sustainable management of water to meet Queensland's current and future water needs. Water plans (previously water resource plans) and their supporting instruments (water management protocols, resource operations licences, water entitlement notices and operations manuals) set the water entitlements and the reliability, availability and environmental standards to be maintained within individual catchments. For more on these arrangements, visit the DNRM website at www.dnrm.qld.gov.au/water.

To understand water availability in existing bulk water supply systems, it is important to clarify the relationships within the water supply system (Figure 5 overleaf).

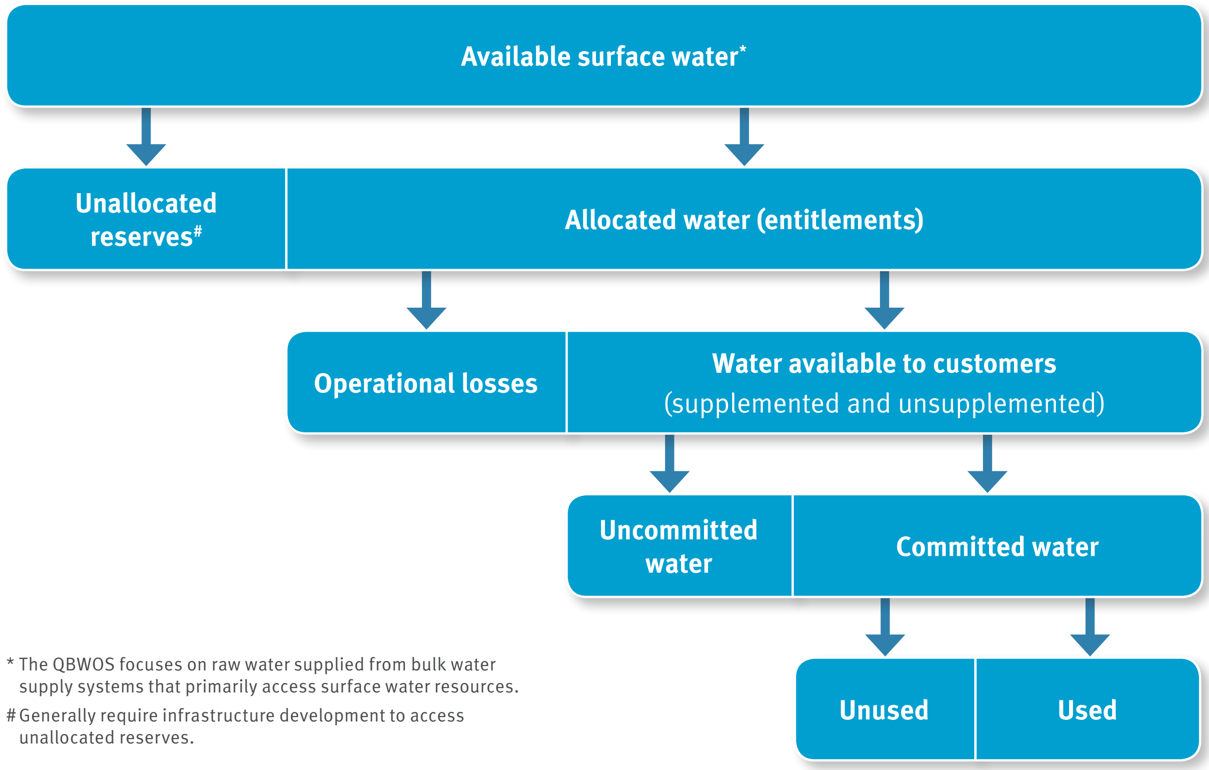


Figure 5: Water supply system relationships

The surface water available for use by end users from the water planning process (**available surface water**) is determined by considering the catchment's natural climate and hydrology, environmental conditions, key assets and current and potential water use developments. This available surface water is defined for use and either allocated to customers and bulk water supply system operators (**allocated water** as water entitlements) or set aside as **unallocated reserve** for future use or to facilitate construction of storage. There are several types of reserves set aside in a water plan (previously a water resource plan)—general, strategic, town water supply, state and Indigenous—each with their own specific intended purpose.

Water users can hold their own water entitlements and bulk water supply system operators (such as SunWater) can contract, sell or lease their allocations (a specific type of water entitlement) to end users—**committed water**. Bulk water supply system operators also provide the ongoing storage and release services for delivery of the water, including the management of system operational losses, for which specific non-saleable allocations are sometimes defined. **Uncommitted water** allocations are entitlements that are generally held by the bulk water system operator that have not yet been contracted, sold or leased. These uncommitted allocations may be available for temporary or permanent sale or contract, or may be held for future business opportunities.

Water allocations are generally assigned a priority (essentially reliability) as either medium or high. High-priority water is commonly used to supply urban and industrial demands and some agriculture, as it is more reliable compared to medium priority, which is typically used by primary producers (irrigators). There are rules in water plans and associated instruments that determine the share of water available to each priority group in any water year.

Of the allocations that are held by bulk water users or customers (considered to be **committed water**), some may be **used** by the customer and some may be **unused**. Allocations may be unused in any given year for many reasons—infrastructure limitations (such as channel capacity), water performance might not match customer needs (the water availability is out of alignment with crop needs), changed or improved agricultural practices, or it may no longer be required but there is no market demand. It is common practice for some customers to gain access to additional water allocations for use as insurance against drought (particularly to protect high-value crops) or for other business reasons.

It is important to differentiate between the availability of water allocations and the day-to-day, year-to-year availability of water for access under those allocations. While the total volume of water allocation remains consistent, there are a number of factors that constrain access to water and the demand for water from a system on a year-to-year basis. These include:

- how much water is physically held in storage that can be delivered to customers—this is affected by the weather (rainfall patterns, evaporation, temperatures) and the rules for sharing the water
- characteristics of the entitlements, including volumes, reliability and water market arrangements (such as where can the allocation be traded)
- proposed application of the water and broader market factors—which may be affected by the viability and productivity of farming land (such as by salinity or recent drought) or the risks to sensitive environments (such as the Great Barrier Reef).

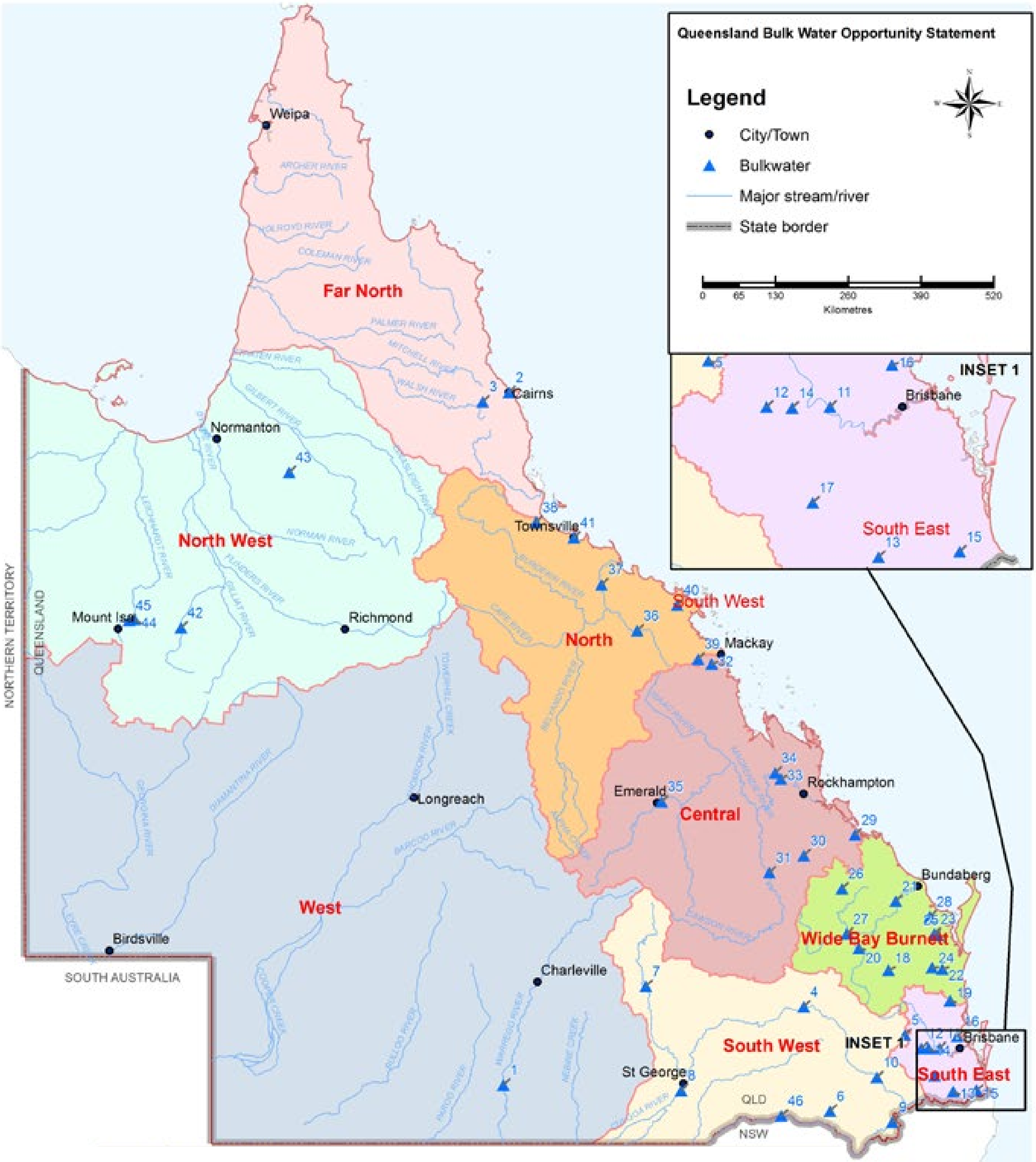
While the current Queensland water market arrangements have been developed with a clear intent to allow for water allocations that are under-utilised or not used to be permanently or seasonally traded, there remains opportunities to improve access to water allocations or maximise the value of water that is available seasonally and over the long term.[14] Initiatives to improve current market trading arrangements for water are discussed in Section 6.3.

Water storage capacity and entitlements

For representational purposes, the state has been divided into eight bulk water supply regions (Figure 6 overleaf). The regions were selected based on major drainage basins, with consideration of catchments, water plan areas, local government boundaries and other factors, but does not fully align with any one of these groups of information.


Wivenhoe Dam

14 Refer to p. 25 for stocktake of under-utilised water.



LEGEND

1 Cunnamulla Water Supply Scheme
2 Cairns Water Supply
3 Mareeba Dimbulah Water Supply Scheme
4 Chinchilla Weir Water Supply Scheme
5 Cressbrook Creek Water Supply Scheme
6 Macintyre Brook Water Supply Scheme
7 Maranoa River Water Supply Scheme
8 St George Water Supply Scheme
9 Stanthorpe Water Supply
10 Upper Condamine Water Supply Scheme
11 Central Brisbane and Stanley River Water Supply Schemes
12 Central Lockyer Valley Water Supply Scheme
13 Logan River Water Supply Scheme
14 Lower Lockyer Valley Water Supply Scheme
15 Nerang Water Supply Scheme
16 Pine Valleys Water Supply Scheme
17 Warrill Valley Water Supply Scheme
18 Barker Barambah Water Supply Scheme
19 Baroon Pocket Water Supply Scheme
20 Boyne River and Tarong Water Supply Scheme
21 Bundaberg Water Supply Scheme
22 Cedar Pocket Water Supply Scheme
23 Lower Mary River Water Supply Scheme
24 Mary Valley Water Supply Scheme
25 Teddington Weir Water Supply Scheme
26 Three Moon Creek Water Supply Scheme
27 Upper Burnett Water Supply Scheme
28 Wide Bay Water Supply Scheme
29 Awoonga Water Supply Scheme
30 Callide Valley Water Supply Scheme
31 Dawson Valley Water Supply Scheme
32 Eton Water Supply Scheme
33 Fitzroy Barrage Water Supply Scheme
34 Lower Fitzroy Water Supply Scheme
35 Nogoa Mckenzie Water Supply Scheme
36 Bowen Broken Water Supply Scheme
37 Burdekin Haughton Water Supply Scheme
38 Paluma–Crystal Water Supply
39 Pioneer River Water Supply Scheme
40 Proserpine River Water Supply Scheme
41 Townsville Water Supply
42 Cloncurry Water Supply
43 Croydon Town Water Supply
44 Julius Water Supply Scheme
45 Moondarra Water Supply Scheme
46 Border Rivers Water Supply Scheme

Figure 6: QBWOS bulk water supply regions

Appendix 1 lists the bulk water supply systems that make up the eight bulk water supply regions. Further information on the bulk water supply systems is provided in Appendix 2, including information on the infrastructure within each system, total water storage capacity, total volume of water entitlements and primary water users.

Table 3 (overleaf) provides key water storage statistics for the eight bulk water supply regions, including water storage capacity and entitlements. Figure 7 (overleaf) provides a graphical summary of the statistics.

Note: Total water storage capacity (the volume of water actually stored at any time) can be much less than the storage capacity, due to the weather and catchment characteristics. The total storage capacity is significantly larger than the total water allocations for this reason. For simplicity, all water priority types have been added together in Table 3 for each region.

Latent capacity in the bulk water supply system

There are significant water resources currently available in some Queensland regions that could be readily accessed to support economic development without any new bulk water storage infrastructure being developed. However, these water resources are not always located where the demands are or in the quantities desired. Within some existing water supply schemes, this available water is held as uncommitted and under-utilised allocations.

In consultation with bulk water service providers across the entire state, there is estimated to be in excess of **270 000 megalitres of uncommitted supplemented allocations**[15] that may be available for contract, sale or lease within existing bulk water supply schemes. In addition, a stocktake of under-utilised water in eight water supply schemes that was based on an assessment of actual use and consideration of risk mitigation practices in the 10 years to 2016, found that approximately **300 000 megalitres of committed allocated water was under-utilised, even in the dry years when demand was high and water was available**. This water was over and above that water kept for insurance purposes.

While these uncommitted, unused and under-utilised allocations are in different locations across the state and of different priorities, together they total nearly twice the annual allocations from Wivenhoe Dam (286 000 megalitres). Access to these uncommitted and under-utilised allocations will be dependent on the amount of water actually available seasonally, in accordance with established water sharing rules. Initiatives to support improved access to this water are discussed in Section 6.3.

15 An entity such as SunWater may have allocations that it has not yet contracted, sold or leased—**uncommitted water.** These uncommitted allocations may be available for temporary sale and use, future permanent sale/contract or may be held for future business opportunities.

Stocktake of under-utilised water

As part of the development of the QBWOS, DEWS undertook a stocktake of under-utilised water for eight Queensland water supply schemes (of the 46 major water supply systems).[16] These were the Burdekin, Lower Mary, Bundaberg, St George, Eton, Dawson, Emerald and Mareeba irrigation schemes.

For the purposes of this assessment, under-utilised allocations represent water that is committed (sold, leased or contracted) but has not been used for the past 10 years, regardless of availability (e.g. during dry years when demand was high and water was available).

Estimates were based on the volume of entitlement not used, even in the highest demand year, and derived by considering water availability and delivery data by scheme in the 10 years to 2016. This estimate of under-utilised allocations has taken into account climatic conditions, crop demand and water availability. The approach used provides information that considers longer term patterns in water use considering water availability, interaction of market forces and water users' approach to water security.

In conducting the stocktake, it is acknowledged that some water may be held for risk mitigation (insurance) purposes to ensure some supply during low availability years. The analysis took this risk management approach into account, together with the impacts of drought events on land management practices and associated water usage. Noting that each individual's risk management approach is different, this stocktake sought to ensure there was consideration of this 'insurance' water and that this was **not included** in the estimated volume of under-utilised water.

> For the eight schemes examined (over the 10-year period), approximately **300 000 megalitres of committed allocated water was under-utilised, even in the dry years when demand was high and water was available**. There is likely more under-utilised water in the 38 systems not examined.

DEWS will continue to collate information (with bulk water system operators) on water use across Queensland bulk water supply schemes for future versions of the QBWOS. As the QBWOS initiatives (see Section 6) are developed and expanded, finding information on available water across Queensland will be made easier. Feedback from water allocation holders on initiatives such as this will be important to ensure the right kind of information is available on the right basis in the most effective way.

16 The eight water supply schemes examined were selected based predominately on size and activity in the scheme. They had readily available, good quality historical entitlement, availability, demand and delivery data.

Water reserves

Additional water resources could also be made available from unallocated water reserves to potentially support the future development of new or expanded bulk water supply infrastructure. Unallocated water is reserved under water planning instruments and can be made available for future use without compromising the security of existing users or the environmental values within a catchment. However, access to this water may require modification and/or development of new infrastructure—in some cases, significant investment may be required.

Water reserves have been identified in various statutory water plans developed by DNRM. The plans identify reserves that have different characteristics and locations that lend themselves to opportunities for different scale developments. However, it is important to note that not all water reserves identified in a plan would be suitable to support the development of bulk water supply systems. Table 3 provides a summary of the unallocated water reserves held in each of the eight bulk water supply regions and at a state level, which may support the development of new and/or expanded bulk water supply systems. The reserve volumes provided are for surface water only and are those categorised as strategic or town water supply reserves or strategic infrastructure reserves.

Water reserves are specified in water plans with location, volume and conditions. These plans are developed and administered by DNRM. Information on water planning frameworks and links to water planning documents at a catchment level are available on the DNRM website at www.dnrm.qld.gov.au/water.

Table 3: Water statistics for Queensland by QBWOS bulk water supply regions*

Bulk water supply region	Total water storage capacity** (ML)	Surface water entitlements# (ML)	Operational losses (ML)	Committed to customers (ML)	Uncommitted water† (ML)	Reported 2015–2016 water use (ML)	Unallocated surface water reserves‡ (ML)
Far North	478 710	251 110	45 000	206 110	-	184 955	49 900
North	2 908 593	1 356 079	197 568	1 054 992	103 519	814 529	300 600
North West	222 283	82 210	2 500	68 860	10 850	21 013	52 232
Central	2 514 885	542 981	43 361	485 620	14 000	376 922	257 400
Wide Bay Burnett	1 715 350	646 292	48 538	454 754	143 000	270 256	183 640
South East	2 376 386	518 447	5 398	513 049	-	275 804	37 150
South West	668 481	343 500	9 726	333 774	-	118 779	4 600
West§	4 770	2 612	-	2 612	-	1 882	3 300
Queensland	**10 889 458**	**3 743 231**	**352 091**	**3 119 771**	**271 369**	**2 064 140**	**888 822**

* For simplicity, all water priority types have been added together.
** This is the physical size of a dam or weir. It excludes dedicated flood storage compartment capacity for those dams that have it. It is not an indication of system yield.
# All water available for use from the system on a long-term basis (including committed, uncommitted and operational losses) excluding the reserves.
† May be held for future business purposes or may be available for supply by contract, sale or lease.
‡ Water held in reserve in a water plan that may be suitable to support the development of bulk water supply systems includes strategic and town water supply reserves and strategic infrastructure reserve (source: Water Service Providers, DNRM).
§ For much of western Queensland, water is sourced from Great Artesian Basin groundwater. This is not included here.

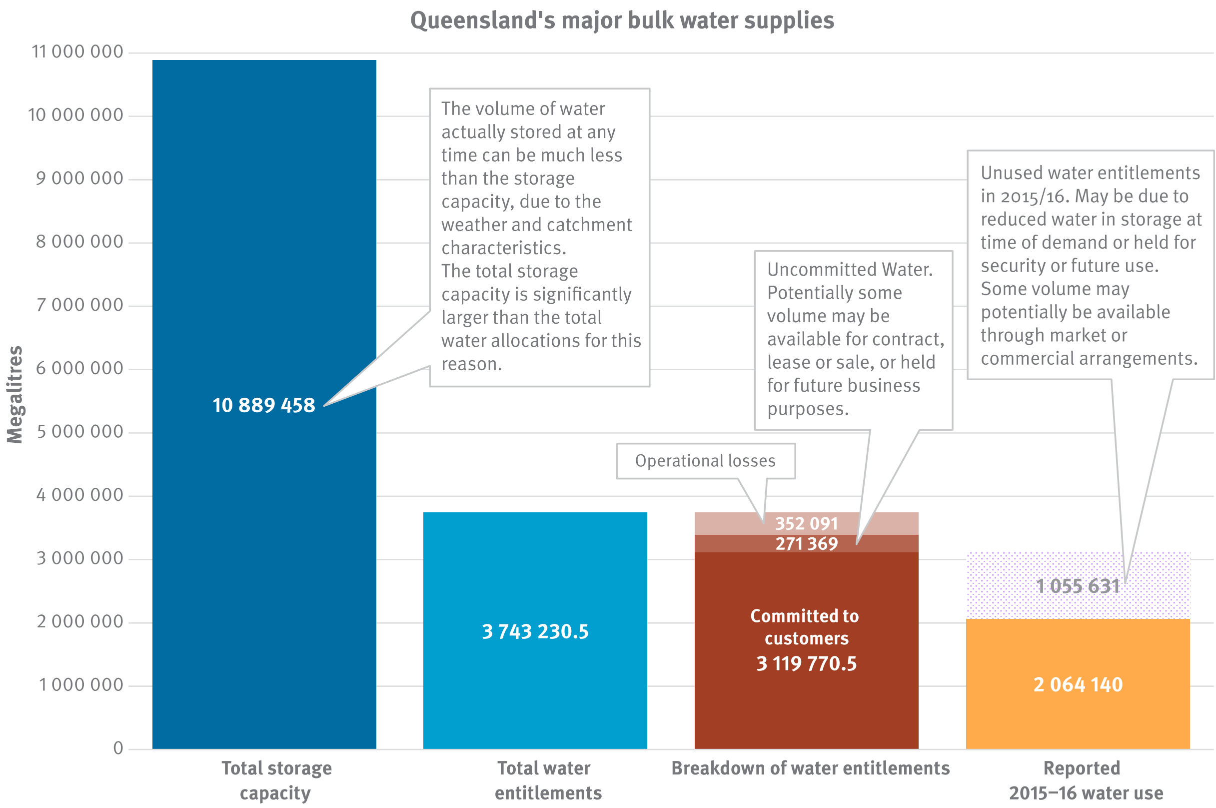


Figure 7: Summarised bulk water statistics for Queensland

3.4 Accessing latent capacity

While investigations indicate there is substantial water available in Queensland's existing water infrastructure that could be made available for economic development, there are barriers to customers taking up this water. For example, water may be associated with infrastructure in remote locations that requires additional investment to access, or it may be in a location that will not easily support agricultural development due to soil quality, topography or other reasons.

The QBWOS is an important step in reducing these barriers to support the objective of better using existing water infrastructure and supporting new infrastructure development, where appropriate and particularly where water is a major constraint to economic growth.

The initiatives outlined in Section 6 include the provision of proactive assistance to help customers navigate water information and provide solutions, make water markets and trading more efficient, and make water products better suit business needs. These initiatives will be developed in consultation with all stakeholders and subsequent versions of the QBWOS will contain updates on the progress of their implementation.

4. Key infrastructure initiatives and opportunities

There are a range of drivers for building, upgrading and improving bulk water infrastructure across the state, which include:

- meeting the needs of a growing population
- continuing to meet compliance obligations and regulatory requirements (e.g. for dam safety and water quality)
- increasing climate variability (including reduced surface water, but with increased intensity and flooding)
- using the state's existing and extensive bulk water supply infrastructure more efficiently
- promoting regional economic growth.

With regard to the government's objectives for bulk water supply (see Section 1.1), the priority driver for bulk water supply infrastructure is the safety and reliability of existing dams and urban water supplies, followed by efficiency opportunities and the need for further investment.

4.1 Initiatives to keep our dams safe

Over the past decade, the Bureau of Meteorology has revised its forecast of the size of rare but major rainfall events. This has meant that many of Queensland's dams need to be upgraded to deal with an updated 'probable maximum flood' (see Section 5.3 for further details). To reduce public safety risks, it is estimated that the Queensland Government bulk water entities will need to spend around $1.5 billion on dam safety upgrades through to 2027. Table 4 (overleaf) outlines key dam safety projects that are currently underway or in planning. The regulations allow for a staged approach to dam safety upgrades based on risk profiles, with all dam safety upgrades required to be complete by 2035.[17]

17 Department of Energy and Water Supply 2016, *Guidelines on acceptable flood capacity for water dams: August 2016*, Queensland Government, ‹https://www.dews.qld.gov.au/water/dams/safety/guidelines-referable-dams›.

Julius Dam

Table 4: Dam safety projects

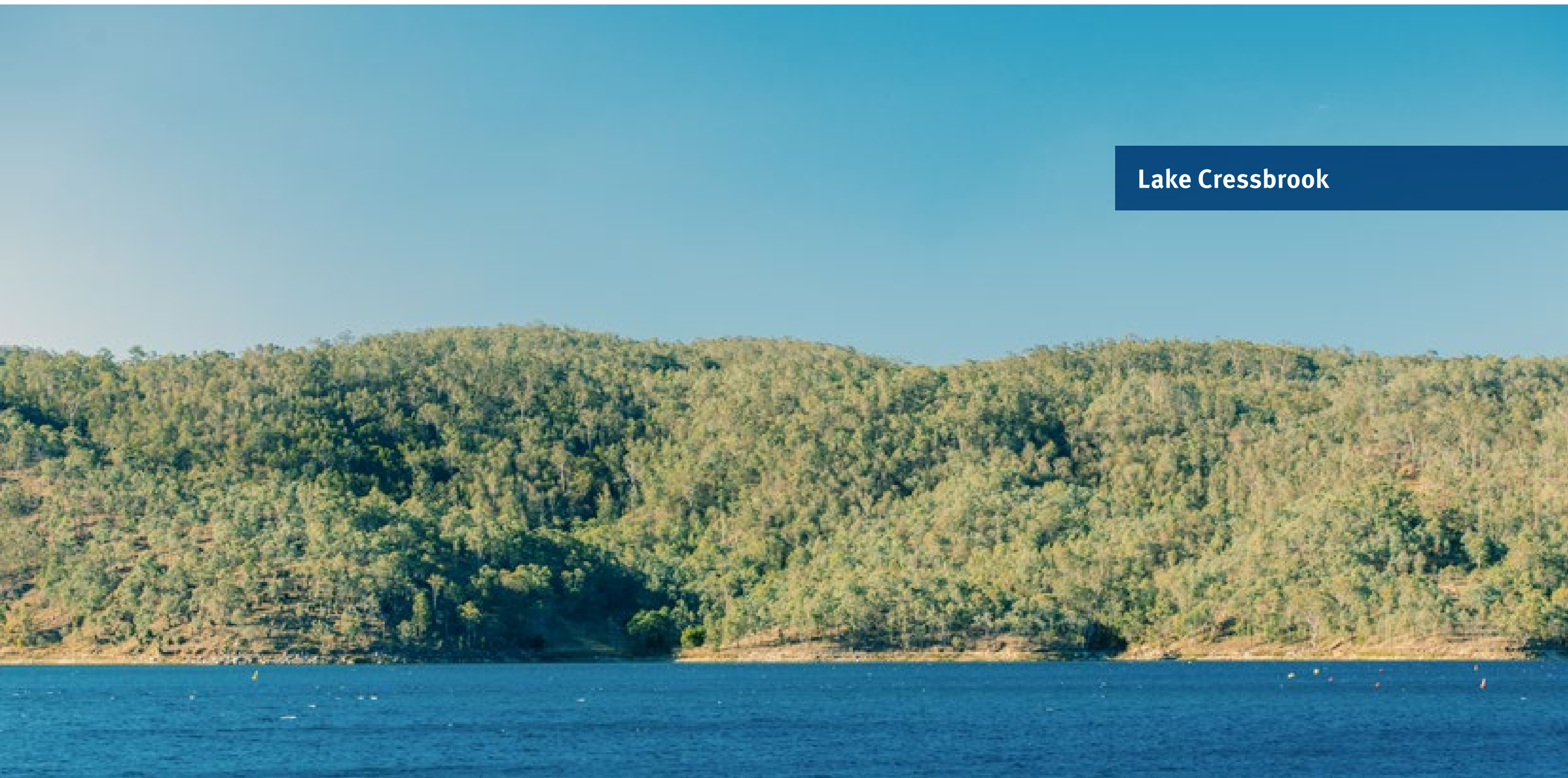
Project name	Proponent	Purpose	Status
Burdekin Falls Dam Foundation Drainage Improvement Project	SunWater	Dam safety improvement project to improve the efficiency of the dam's foundation drainage systems to ensure it continues to operate as designed A future stage of dam safety improvement upgrade works is expected to involve raising of saddle dams and strengthening the spillway	Construction of drainage works scheduled to be completed in March 2018 Work on business case is progressing for future stage of dam safety improvement project
Cooloolabin Dam—Safety Upgrade Project	Seqwater	Dam safety upgrade to main embankment abutments and saddle dam 'A' for piping, earthquake and embankment stability	Detailed design completed and business case submitted to Seqwater Board for approval
Ewen Maddock Dam—Safety Upgrade Project	Seqwater	Dam safety upgrade to main embankment and spillway for earthquake, piping and flood capacity	Preliminary design underway—to be completed by June 2017
Fairbairn Dam Spillway Improvement Project	SunWater	Dam safety improvement project that involves work on the spillway lower chute floor to return the spillway to its designed functionality	Construction scheduled to be completed in November 2018
Lake MacDonald (Six Mile Creek Dam)—Safety Upgrade Project	Seqwater	Dam safety upgrade to main embankment and spillway for stability, earthquake and flood capacity	Detailed design to commence in 2017, with environmental approvals due for completion in late 2018
Leslie Dam Safety Improvement Project	SunWater	Dam safety improvement project that involves strengthening of spillway abutment monoliths and reduction of scour potential downstream of abutments	Business case to be developed in 2017–2018 financial year
Leslie Harrison Dam—Safety Upgrade Project	Seqwater	Dam safety upgrade to main embankment and spillway for piping, stability and earthquake	Detailed design underway and due for completion in late 2017—business case required for approval
Paradise Dam Strengthening of Monoliths	SunWater	Dam safety improvement project that involves strengthening the base of the primary spillway, downstream protection of the left-hand side dam wall and construction of an access and drainage culvert	Construction scheduled to be completed in October 2018
Sideling Creek Dam (Lake Kurwongbah)—Safety Upgrade Project	Seqwater	Dam safety upgrade to main embankment and spillway for piping, earthquake loading and flood capacity	Business case for upgrade approved in late 2016 and detailed design has commenced
Somerset Dam—Safety Upgrade Project	Seqwater	Dam safety upgrade to main dam and spillway for stability and flood capacity	Concept design underway to determine preferred upgrade option/s

Table 4 (continued)

Project name	Proponent	Purpose	Status
Teemburra Dam Safety Improvement Project	SunWater	Dam safety improvement project that involves raising of the main embankment and saddle dams to increase spillway capacity and filter installation to protect against piping	Business case to be developed in 2017–2018 financial year
Wappa Dam—Safety Upgrade Project	Seqwater	Dam safety upgrade to left embankment and auxiliary spillway for piping and earthquake	Project under construction—work to be completed by May 2017
Wivenhoe Dam—Safety Upgrade Project	Seqwater	Dam safety upgrade to increase flood capacity and investigate additional flood mitigation	Feasibility design underway to determine preferred upgrade option/s to be submitted to government

4.2 Initiatives to support reliable urban supplies

The Queensland Government supports water service provider and local government planning for urban water supplies through the Regional Water Supply Security Assessments program (see Section 2.4). In addition, the Queensland Government provides limited funding for urban water supplies through a number of grant schemes on a competitive basis. Table 5 (overleaf) provides details of urban water supply projects currently underway that have received funding under the state government's schemes.



Lake Cressbrook

Table 5: Urban water supply projects

Project name	Proponent	Purpose	Status
Charleville West Water Supply project	Murweh Shire Council	The project will improve the security of supply to the Charleville community. It will save some homes and businesses from losing water supply during floods, and provide capacity for more development.	Project works due for completion mid 2017 Supported by funding from the Queensland Remote and Indigenous Communities Fund
Herberton Water Supply Upgrade	Tablelands Regional Council	The project will deliver a more economically and environmentally sustainable bulk water supply, with enhanced storage capacity and sufficient pressure to meet firefighting guidelines.	Project works due for completion mid 2018 Supported by funding from the Queensland Regional Capital Fund
New Water Reservoir—Georgetown	Etheridge Shire Council	The project will improve the security of supply to the Georgetown community by constructing a new 3 ML water reservoir. This will support growth in the community and tourism with associated economic benefits.	Construction underway and due for completion mid 2017 Supported by funding from the Queensland Remote and Indigenous Communities Fund
Townsville Water Supply	Townsville City Council	The project will improve Townsville's short-, medium- and long-term water security and achieve a sustainable level of service.	Townsville Water Security Taskforce interim report delivered 30 June 2017 Final report due 30 September 2018

4.3 Initiatives to improve efficiency

The second objective for bulk water supply infrastructure (see Section 1.1) is using existing water resources more efficiently. Section 6 outlines several opportunities to make more efficient use of water available in existing infrastructure, including reviewing latent capacity pricing, water markets and trading. Table 6 (overleaf) provides details of efficiency projects currently underway that have received funding under the National Water Infrastructure Development Fund (NWIDF), but does not include the broad portfolio of continuous improvement and maintenance measures that are routinely undertaken by bulk water providers.

Table 6: Bulk water supply efficiency projects

Project name	Proponent	Purpose	Status
Aquifer Recharge	Lockyer Valley Regional Council	The project will provide alternative water supplies to agricultural users in the Lockyer Valley.	NWIDF funded, feasibility progressing Investigation focused on options for alternative secure water supplies and innovative water delivery mechanisms Target feasibility completion—2018
Bundaberg Channel Capacity Upgrade	SunWater	The project will facilitate the use of available water from Paradise Dam by upgrading the Bundaberg Water Supply Scheme.	NWIDF funded, feasibility progressing Investigation focused on increasing the distribution of water from Paradise Dam through the existing channel/ pipeline system Target feasibility completion—2018
Burdekin Haughton Channel Capacity Upgrade	SunWater	The project will facilitate the use of available water allocations from the Burdekin Haughton Water Supply Scheme.	NWIDF funded, feasibility progressing Investigation focused on the distribution channel capacity limitations and augmentation options of the Burdekin Haughton Water Supply System to facilitate the use of available water allocations Target feasibility completion—2018
Utilising South East Queensland's Treated Effluent—NUWater	Queensland Farmers' Federation	The project will investigate making recycled water from the Western Corridor Recycled Water Scheme available to the Lockyer Valley and Darling Downs agricultural areas.	NWIDF funded, feasibility progressing Investigation focused on technical feasibility and economic viability Target feasibility completion—2018

4.4 Initiatives to support new infrastructure

While there are significant quantities of water currently available from bulk water supply infrastructure across the state, it may not be available in the right place or with the required reliability of supply to meet demand. The last two objectives (see Section 1.1) support infrastructure development that provides a commercial return and, if appropriate, consider projects that will provide regional economic benefits.

Across Queensland, new bulk water supply infrastructure projects (including significant new dams, dam upgrades and irrigation schemes) are actively being considered or developed to support a range of needs. The Queensland Government is also progressing investigations into selected infrastructure proposals identified through the *State infrastructure plan* consultation phase—the Maturing the Infrastructure Pipeline Program is a $20 million fund aimed at fast-tracking early stages of the infrastructure project pipeline by developing strategic assessments and preliminary evaluations for projects. The QBWOS includes relevant findings from all assessments completed to date, including the Maturing the Infrastructure Pipeline Program, and will continue to do so in future versions. More information is available on the Department of Infrastructure, Local Government and Planning website at www.dilgp.qld.gov.au.

Table 7 (overleaf) provides a summary of the potential bulk water supply infrastructure projects currently being considered or investigated to support infrastructure. This information will be updated in future versions of the QBWOS to reflect the outcomes of current and ongoing assessments.

Corella Dam

Table 7: Potential bulk water supply infrastructure projects

Project name	Proponent	Purpose	Status
Burdekin Falls Dam raising	SunWater (Department of State Development leading feasibility study)	Provide additional supplies for the Burdekin-Haughton Water Supply Scheme, Townsville urban use, mining and regional agricultural development Potential hydro-electric power generation from the dam	NWIDF funded, feasibility investigation Study focused on the economic viability of the proposed 2 metre raising of the Burdekin Falls Dam, assessing costs, demand and environmental impacts Business case for development of a hydro-electric power station progressing Target feasibility completion—2018
Clermont: Providing Water Security and Economic Growth	Isaac Regional Council	Secure reliable long-term water supply for Clermont and developments in the Galilee Basin	NWIDF funded, feasibility investigation progressing Study focused on new and upgraded major water infrastructure for Clermont and augmentation and remediation works on the Theresa Creek Dam Target feasibility completion—2017
Connors River Dam and Pipeline	SunWater	Primarily to supply coalmines near Moranbah (Bowen and Galilee basins) with some urban supply to associated communities	State and federal environmental approvals obtained and land acquired Currently insufficient demand to be viable
Emu Swamp Dam	Southern Downs Regional Council	Improve the security of Stanthorpe's urban water supplies and provide secure and affordable water to support regional growth in the Granite Belt area	State and federal approvals obtained Feasibility investigations under NWIDF progressing with a focus on the feasibility and economic viability of the proposed Emu Swamp Dam Target feasibility completion—2018
Fitzroy to Gladstone Pipeline	Gladstone Area Water Board	Provide contingency supply to Gladstone from Fitzroy River when required as a drought response or to meet increased demand	Environmental impact statement completed Awaiting completion of Rookwood Weir business case and decision
Gayndah Regional Irrigation Development Project	Isis Central Sugar Mill Company Limited	Water storage and supply options and irrigation development of up to 6800 hectares in the Gayndah region of the Burnett River catchment	NWIDF funded, feasibility investigation progressing Target feasibility completion—2018
Hells Gates Dam	Townsville Enterprise Ltd	Supply to mines and large-scale irrigated agriculture within the upper Burdekin River Potentially augment local urban water supplies for Townsville to improve security	Dam site identified but requires detailed investigation of viability A three-phase feasibility assessment has commenced with NWIDF funding Target feasibility completion—2018

Table 7 (continued)

Project name	Proponent	Purpose	Status
Lakeland Irrigation Area	Cape York Sustainable Futures Inc.	New water supply and storage options to support the expansion of irrigated agriculture in the Lakeland Irrigation Area	NWIDF funded, feasibility investigation progressing Target feasibility completion—2018
Lower Fitzroy River Infrastructure Project	SunWater/ Gladstone Area Water Board (Building Queensland leading feasibility study)	Augmentation of urban and industrial supplies for Rockhampton and Gladstone, as well as additional supply for agriculture	State environmental impact statement assessment process for Eden Bann and Rookwood complete NWIDF funded, business case development for Rookwood Weir is progressing, including assessment of potential demand and preferred water supply infrastructure Target feasibility completion—2018
Nathan Dam and Pipeline	SunWater	Mining, industrial, agricultural and urban supply to Dawson Valley and Surat Basin	Environmental impact statement complete Currently insufficient demand to be viable
Cloncurry River Dam	Mount Isa to Townsville Economic Development Zone Inc.	Augment Cloncurry urban water supply and for surrounding mines, and could support local irrigation	NWIDF funded (North West Queensland Strategic Water Storage Project), feasibility investigation progressing with a focus on the potential Cave Hill Dam Target feasibility completion—2019
Nullinga Dam	SunWater (Building Queensland leading feasibility study)	Expansion of irrigated production in the Mareeba-Dimbulah Irrigation Area—in the longer term, potential to augment Cairns urban supplies if required	NWIDF funded, feasibility investigation progressing with a focus on economic feasibility Target feasibility completion—2017
Tablelands Irrigation Project	Tablelands Regional Council	Multipurpose water use in the Upper Herbert River catchment to support expansion of the region's agricultural base and generate renewable power, and considering flood mitigation benefits for the Lower Herbert River catchment	NWIDF funded, feasibility investigation progressing with a focus on a preliminary business case analysis of options Target feasibility completion—2018
Urannah Dam	Initiative Capital Pty Ltd and Urannah Properties Association Inc, with Bowen Collinsville Enterprise Inc.	New water supply to support mines, agriculture and tourism development and could also increase local urban supplies	NWIDF funded, feasibility investigation progressing Target feasibility completion—2018

As part of future versions of the QBWOS, DEWS intends to undertake a review of historical and new water infrastructure projects. The review will consider regions where future demand is most likely to be realised, to ensure that assessment and advancement of new water infrastructure projects is appropriately focused. This review may lead to the identification of further projects for consideration. See Section 6.1 for more information on DEWS role in relation to project prioritisation.

It should be noted that the assessment of an infrastructure proposal may not result in development of that infrastructure. However, the assessment will seek to identify the key triggers or circumstances under which the project may progress. These may include increased certainty for demand, commitment to water products at a reflective cost, funding models and legislative matters. By defining some of these key triggers, stakeholders, government and markets will be better informed about opportunities and risks, while also providing a base for reassessment of proposals at a later date.

4.5 National Water Infrastructure Development Fund feasibility studies

There are 15 feasibility studies currently being administered by DEWS that are funded under the Australian Government's National Water Infrastructure Development Fund (NWIDF). These studies are being undertaken by a range of proponents, including SunWater, local governments and other organisations that support regional development. Some of these studies are detailed feasibility studies and others are high-level assessments.

The NWIDF studies will be completed at various times over the coming three years and the outcomes will be outlined in future versions of the QBWOS. Any projects that are shown to be commercially or economically viable will be considered further before any decision is made to invest or construct. The projects receiving funding under the NWIDF are noted in tables 6 and 7 (sections 4.3 and 4.4).

Building Queensland

Building Queensland, an independent statutory body, provides expert advice to Queensland Government agencies, government-owned corporations and selected statutory authorities on major infrastructure. Building Queensland assists with business case development for projects with potential government investment of between $50 million and $100 million, and leads the development of business cases for investment exceeding $100 million (e.g. Nullinga Dam and Lower Fitzroy River Infrastructure Project). Business Queensland also leads the procurement or delivery of projects if directed.

Lower Fitzroy River Infrastructure Project

The Lower Fitzroy River Infrastructure Project comprises construction and operation of weir infrastructure, upgrades to and construction of roads and bridges, and construction of other associated infrastructure in Central Queensland. The business case is being developed in partnership with the joint proponents (SunWater and the Gladstone Area Water Board) and will build on the work previously completed. Following initial assessment and feedback from the stakeholders, the business case is concentrating on the Rookwood Weir component. It considers a variety of matters, including water demand, water pricing, funding and financing models, delivery and operating models, and costs, risks and benefits associated with the proposed infrastructure.

The proposed Rookwood Weir would operate in concert with the existing Fitzroy Barrage located in Rockhampton. The project has the potential to provide water for urban, industrial and agricultural uses, and would be expected to be staged—with sequencing and timing dependent on a number of demand triggers, including existing and new consumers, drought conditions and security of supply requirements. Development of the project is currently limited to the 76 000 megalitre reserve for strategic water infrastructure on the Fitzroy River under the Water Plan (Fitzroy Basin) 2011.

The business case is being part funded by the NWIDF, with the balance of costs being met by the proponents. The Australian Government also made an election commitment to provide capital funding of $130 million for Rookwood Weir, subject to the outcomes of the business case, the project receiving required environmental approvals and a matching contribution of funds being secured from another source. The proponents have already undertaken significant work on the development of the project, including the preparation of an environmental impact statement. Completion of the business case will enable all levels of government and the proponents to make informed decisions on the future of the project.

Nullinga Dam

The location of the proposed Nullinga Dam is on the Walsh River in the Atherton Tableland. It has been proposed as a future water supply to serve growing urban water demand in Cairns and to support expansion of irrigated agriculture in the region by supplementing existing supplies.

A business case for the proposed dam is being developed in two stages by Building Queensland, in partnership with DEWS and SunWater, and is supported by funding from the NWIDF. The first stage will involve the development of a preliminary business case that will investigate the potential for Nullinga Dam and other options to address the identified future water supply shortfall in the region. The scope of work to be undertaken includes developing water demand assessments, preliminary analysis of costs, risks and benefits, consultation with key stakeholders and the provision of recommendations for the future of the project.

Subject to the outcomes of the preliminary business case and government approval to proceed, the second stage will involve Building Queensland developing a full business case that will assess in greater detail the likely costs of developing Nullinga Dam and enable all levels of government to make informed decisions on the future of the project.

4.6 Key agency roles

Several Queensland Government agencies have key roles in planning and administration of water resources, regulating the provision of water supply, management and operation of existing bulk water supply infrastructure and consideration of new infrastructure. The roles of these agencies are summarised below to provide clarity to customers, potential customers and those seeking more information on Queensland's water arrangements. The roles of the agencies should be read in conjunction with the roles of the state bulk entities (described earlier in Section 3.2).

Considering the range of issues associated with better use of existing infrastructure and developing new infrastructure where appropriate, it is acknowledged there can be improvements in the way relevant state government agencies work to better achieve beneficial economic outcomes for the state. Improvement is an ongoing process; however, specific opportunities have been identified and are outlined in Section 6.

Department of Energy and Water Supply

The Department of Energy and Water Supply (DEWS) provides coordinated advice on bulk water supply infrastructure, and partners with local governments in the provision of advice on urban water issues and the development of regional water supply security assessments. DEWS, together with Queensland Treasury, provides strong governance of government-owned corporations and statutory authorities, and regulates water service provision, drinking water, recycled water and dam safety. On behalf of the state government, DEWS manages the non-commercial asset portfolio of 21 dams and weirs, and associated land, plant and equipment. DEWS also administers the NWIDF projects for Queensland.

Department of Natural Resources and Mines

The Department of Natural Resources and Mines (DNRM) manages land, water, minerals and energy resources. DNRM provides a robust regulatory framework to manage security of rights (entitlements, allocations, licences etc.) to these natural resources, which involves both legal ownership and security to exercise those rights.

The management of water resources within Queensland is undertaken on a catchment-by-catchment basis using a water plan implemented by statutory instruments such as the water management protocol, resource operations licence and operations manual (previously a resource operations plan). These instruments are developed through technical and scientific assessment, as well as extensive community consultation, to determine the appropriate balance between the economic, social and environmental demands on the state's water resources. This balance is achieved through establishing rules for operating water supply schemes and water sharing within schemes and management areas.

Department of State Development

The Department of State Development (DSD) is responsible for leading the delivery of economic development outcomes for Queensland. With a focus on industry, regions and projects, DSD supports economic development by influencing the policy and the investment environment, supporting projects with funding and coordination, and supporting new and emerging industries and job creation.

In Queensland's regions, DSD actively works to deliver critical infrastructure through the Building Our Regions program, which supports jobs and economic development by addressing regional infrastructure needs (including water, sewerage and waste, roads, airports, flood mitigation and social infrastructure such as recreational facilities and community hubs).

Through the Office of the Coordinator-General, DSD also progresses assessment of coordinated projects, investigation of potential coordinated projects and facilitation of all approvals for construction-ready projects.

To support better use of Queensland's existing bulk water supply infrastructure and the development of new supply options where appropriate, DSD is developing a project to identify water infrastructure opportunities that will provide the greatest opportunity for regional economic development. The project builds on the CSIRO's research into expanding economic development opportunities in Northern Australia, including new and expanded industries that may require bulk water.

Department of Infrastructure, Local Government and Planning

The Department of Infrastructure, Local Government and Planning (DILGP) brings together the functions of infrastructure planning and policy, planning, local government, regional services and economic and regional development to create better cities, towns and communities.

DILGP leads the development of infrastructure policy, including the *State infrastructure plan*, regional plans and investment prioritisation for Queensland. DILGP also assists local governments with infrastructure funding proposals, such as those for water infrastructure, and provides some targeted funding and grants.

Department of Agriculture and Fisheries

The role of the Department of Agriculture and Fisheries (DAF) is to facilitate the growth and sustainable development of the agriculture, fishing and forestry sectors, and optimise their contribution to economic, environmental and social outcomes for Queensland (including developing export markets). With respect to bulk water infrastructure, DAF is an advocate for agriculturally important land, energy and water, and the sector's key role in regional economies and employment. It also actively advocates for leveraging changes in water and land use to develop new agricultural and aquaculture opportunities. DAF also has a role to protect fish habitat. Activities that disturb fish habitats (such as the construction or raising of waterway barriers, including weirs and dams) may require fisheries development approval under the *Sustainable Planning Act 2009*.

Department of Environment and Heritage Protection

The Department of Environment and Heritage Protection (DEHP) is Queensland's environmental regulator. DEHP has a number of roles relating to environmental impact assessment of development (including bulk water supply projects) depending on the type of development proposed, including:

- assessment manager or referral agency for development applications to undertake environmentally relevant activities that are listed and defined in the Environmental Protection Regulation 1998
- assessment manager or referral agency for assessable development regulated under the *Coastal Protection and Management Act 1995*
- advice agency as part of assessment processes managed by the Coordinator-General under the *State Development and Public Works Organisation Act 1971*
- coordinator of advice and statutory notices to the federal environment department related to assessments (including accredited environmental impact statement processes) under the federal *Environment Protection and Biodiversity Conservation Act 1999*.

Within DEHP, the Office of the Great Barrier Reef implements and coordinates reef management strategies and programs, including the Queensland Government's actions under the *Reef 2050 long-term sustainability plan* and the *Reef water quality protection plan 2013* (see Section 5.4).

The Bradfield Scheme—a project facing challenges

Over many decades, there have been numerous investigations into water supply infrastructure proposals across Queensland. Many of these investigations have found that the proposed infrastructure is not technically possible from an engineering perspective, or it is not economically viable—either due to prohibitive costs and/or insufficient demand.

The most notable of these proposals is the Bradfield Scheme. In 1938, Dr John Bradfield proposed a scheme where water would be extracted from one or more of the Tully, Herbert or Burdekin rivers, pumped over the Great Dividing Range and then distributed through a system of rivers, channels, pipelines and storages to water users across western areas of Queensland and other states. Although there were slight variations to the proposal, the general premise was to enable irrigation of vast areas of land, in the order of 15.5 million hectares, and support communities and other industries.

As early as the mid 1940s, the federal government was highlighting the technical issues, lack of knowledge and costs that would prohibit development of such a scheme. The Queensland Government regularly receives suggestions, proposals and general correspondence advocating the Bradfield Scheme or a similar arrangement to enhance water security.

Since investigations commenced in the 1940s, there have been occasional reviews of Bradfield Scheme–style proposals, as well as a number of reports prepared in the early 1980s. More recently in 2007, during the Millennium Drought, the state government commissioned consultants to investigate the option of piping water from Burdekin Falls Dam, inland of Townsville, to South East Queensland to provide a drought supply option.

The investigation found that construction costs ranged from $7 billion to $14 billion, with lower range water costs of more than $5000 per megalitre (if the scheme was in use permanently). This is well in excess of alternative supply options such as desalination (estimated at around $2500 to $3500 per megalitre for ‘ready to supply’ water). Consequently, the scheme was found not to be viable, which confirmed the findings of previous investigations.

Common findings from a range of investigations suggest Bradfield Scheme–type proposals are constrained by:

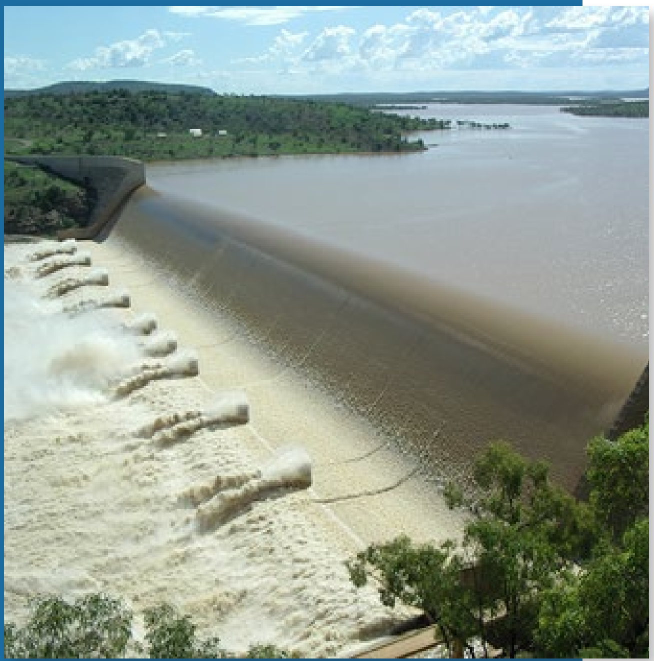
- availability of water according to water plans
- ability and willingness of potential users to pay for water
- availability of alternative water sources that have lower costs, in particular groundwater
- environmental impacts on flora and fauna due to changing flow regimes of watercourses
- impacts on groundwater recharge if water is redirected away from aquifer recharge areas
- variability of water availability across North Queensland year to year
- variability in the demand for water, especially during wet years
- losses of water due to seepage and evaporation in what is an arid area much of the time
- large storage requirements to maintain water availability during dry years
- access to energy to meet pumping requirements
- technical issues and costs for using onsite renewable energy generation to power pumps
- construction issues for channels, pipelines and storages, including locating suitable sites
- remoteness of much of the area presenting challenges during construction and operation.

Burdekin Falls Dam—complexity, risks and opportunities

Burdekin Falls Dam is currently Queensland's largest water supply dam, with a storage capacity of 1 860 000 megalitres (more than three times the capacity of Sydney Harbour). The dam is owned and operated by SunWater as part of the Burdekin Haughton Water Supply Scheme. It is the main water supply for the region, supporting a diverse mix of irrigated agriculture, grazing, mining, industry and urban population centres, including Townsville. The Burdekin Haughton Water Supply Scheme has about 1 080 000 megalitres of water entitlements associated with it, of which only 90 000 megalitres is uncommitted allocations.

There has been increasing demand for the water allocations. However, there are issues such as rising groundwater, salinity and potential impacts on agricultural production, in addition to environmental impacts (including on the Great Barrier Reef). These issues are being considered by Department of Natural Resources and Mines in developing a Lower Burdekin groundwater strategy project.

Raising Burdekin Falls Dam may create an opportunity for even further development in the region. A strategic reserve of 150 000 megalitres is identified in the Water Plan (Burdekin Basin) 2007 for this purpose. Raising the dam would require a business case that included a robust assessment of the demand for extra water, detailed discussion with potential customers and a full assessment of the risks and benefits (including an environmental impact statement).



The Department of State Development is undertaking a high-level assessment of demand for water and environmental limitations associated with the raising of Burdekin Falls Dam. At the same time, there are feasibility assessments underway for new dams at Hells Gate (upstream on the Burdekin River) and Urannah being undertaken by local organisations with an interest in water supply issues in the region.

Future growth in Townsville may lead to an increase in urban water demand from the Burdekin Haughton Water Supply Scheme. The Townsville Water Security Taskforce has been set up to investigate the short-, medium- and long-term options to secure water for the Townsville community. The interim report has been delivered and a final report is expected in 2018 to provide advice on Townsville's requirements for water from the Burdekin Haughton Water Supply Scheme. The government has committed $225 million over four years to invest in water security measures for Townsville. The funding is not allocated at this stage to any specific project. The Townsville Water Security Taskforce has released its report, which included a number of recommendations for immediate action, including infrastructure and non-infrastructure solutions. The Queensland Government is committed to working with Townsville City Council and the Australian Government to implement the report findings.

Burdekin Falls Dam (continued)

In addition, SunWater, through Building Queensland, are developing a detailed business case for some improvement works for Burdekin Falls Dam to ensure the dam continues to meet safety standards and requirements. The improvement works will be able to accommodate a possible future raising for supply purposes.

As well as water supply, the Queensland Government is committed to investigating the potential to develop hydroelectricity generation capacity at Burdekin Falls Dam. The government has set aside $100 million to invest in a renewable energy scheme if it proves feasible.

Given the scope and complexity of projects currently under consideration around the Burdekin Falls Dam, there are some significant risks but also great opportunities. The timing of project investigations is important, with real potential for significant cost savings and efficiencies if certain projects are progressed at or around the same time. To ensure the Queensland Government is best positioned to take advantage of the benefits that could accrue from these projects, asset owners, customers, stakeholders and state agencies are working collaboratively to manage the risks and maximise the benefits to the community.

Burdekin Dam

5. Addressing unique risks and uncertainty

5.1 Planning for an uncertain climate future

Queensland is a vast state with great variations in climate—from the temperate south to the tropical north and the arid west. Queensland also experiences high-impact extreme weather events, such as heatwaves, droughts, floods, tropical cyclones, bushfires and severe storms.

Most of Queensland's rainfall occurs in summer. Annual and seasonal average rainfall is variable, affected by local factors (such as topography and vegetation) and broader scale weather patterns (such as the El Niño–Southern Oscillation). Pacific south-easterly trade winds produce rainfall along the eastern coast throughout the year. Tropical cyclones bring significant rainfall to the north. However, the climate is changing across Queensland.

Increased climate variability will have an increasing influence on water security and availability from existing and potential bulk water supply sources. The majority of modelling results for Queensland, including Bureau of Meteorology and CSIRO studies, indicate that Queensland's future climate is expected to have higher temperatures, hotter and more frequent hot days, less frequent but more intense cyclones in the north, more intense downpours across the state, fewer frosts, reduced rainfall in the south-east and more time in drought in the south.[18] This suggests that climate change may impact on regional water supplies as less surface water is likely to be available for both the environment and water supply infrastructure, but with increased rainfall intensity there may also be more flooding events.[19]

With these changes expected to occur over the medium to long term, it is imperative that water security planners consider and manage the risks of climate variability and climate change. There will need to be sufficient flexibility in planning to accommodate and adapt to changing climate trends as they are established by ever-improving science.

Current initiatives

Incorporating the impacts of climate variability into water resource planning and regional water supply security assessments

The Queensland Government is committed to the development of a climate change adaptation strategy to improve opportunities and reduce risks to our communities, economy, infrastructure and environment from current and future climate impacts. The *Queensland climate adaptations directions statement* was released in 2016 to provide the broad direction for development of the strategy.

While there is uncertainty in climate predictions, particularly with respect to the timing and extent of impacts, the kind of weather-related phenomena and impacts that are likely to be seen are broadly agreed. Impacts of particular relevance to the functioning of a range of water supply infrastructure (including bulk water, drainage and sewerage) and for delivering water security into the future include:

- higher evaporation
- higher intensity rainfall compounded by reduced capacity for the ground to absorb run-off, resulting in larger floods, sea-level rise and storm surge (that may exceed current design criteria for events)
- extreme wind speed

18 Department of Environment and Heritage Protection 2016, *Draft Climate change in Queensland*, regional climate change impact summary, Queensland Government <https://www.qld.gov.au/environment/climate/projections/>.

19 Department of the Environment and Energy 2017, 'Climate change impacts in Queensland', Australian Government, <https://environment.gov.au/climate-change/climate-science/impacts/qld>.

- extremes of temperature (e.g. heatwaves)
- increased likelihood and severity of droughts and bushfires.

Climate change may also lead to a potential increase in water demand and changes to demand patterns.

Water security planning should consider the projected impacts of climate change on water supplies. The water planning framework under the *Water Act 2000* is used as a key adaptation tool to manage the effects of climate change on water resources. Climate variability and climate change forms part of the technical assessment process that supports water planning—but how this science informs water planning policy positions is not always transparent and direct, noting that climate change is not an explicit consideration required under the legislation.

DNRM are investigating initiatives to strengthen consideration of the water-related effects of climate change when making water planning instruments. These new considerations would inform the development of draft plans and influence the design of implementation instruments, so that strategies are adaptive to the prevailing climate conditions.

DEWS works with local governments across the state to develop regional water supply security assessments (RWSSAs), previously discussed in Section 2.4. The RWSSAs provide an overview of the capability of the existing water sources for projected population growth and water demands in discrete urban centres. Hydrologic modelling is used to assess the performance of the bulk water supply in meeting forecast demands, with consideration of a broad range of climate scenarios.

As the science around expected climate outcomes becomes more certain, new information will be factored into RWSSAs. There is a drive now to understand how climate change will affect rainfall and weather patterns and, in due course, to incorporate climate change impacts into hydrological assessments. This will improve the quality of RWSSAs and the accompanying planning and investment decision-making.

Designing new infrastructure and adapting existing infrastructure for a changing climate

Climate-adapted and disaster-resilient infrastructure can be more cost-effective in the long term, as it reduces the need for repairs or relocation due to environmental impacts. Accordingly, it is important to consider the effects of climate change when designing new infrastructure and adapting existing infrastructure.

New infrastructure

The Queensland Government recognises climate change as a challenge in its *State infrastructure plan.* This plan highlights the need for adaptation, in particular to build resilience within infrastructure networks and ensure the safety, reliability and connectivity of these networks are maximised during extreme events.

One *State infrastructure plan* implementation action is that, through the Building Queensland project assessment process, government projects greater than $100 million in value will include a sustainability assessment across the design, construction and operation of infrastructure. Assessments are also recommended for projects worth less than $100 million.

Existing infrastructure

Existing bulk water infrastructure is susceptible to the impacts of climate change. As discussed, climate change may reduce the performance of bulk water supply infrastructure, including reduced water supply yields and water quality. In addition, infrastructure can be affected directly by extreme weather events such as droughts, floods, storms and cyclones. The risk of damage to infrastructure escalates as it is exposed to increasingly extreme climate-related events (natural disasters).

Adaptation strategies for infrastructure can include:

- adjusting the capacity of infrastructure elements
- undertaking modifications, including retrofitting or replacing infrastructure components
- delaying action until new information is available
- relying on insurance to cover damage.

Each of these strategies depends on responsive management to achieve the best possible outcome.

In 2015, the Queensland Government committed to developing and implementing a Queensland Climate Adaptation Strategy to address risks to our economy, environment, infrastructure and communities from current and future climate impacts.

The Department of Environment and Heritage Protection is developing sectoral adaptation plans during 2017, including for human settlements and infrastructure. These plans will identify the climate adaptation needs, existing adaptation activities, major gaps in knowledge and practice, risks and barriers to adaptation, and response solutions. The Queensland Climate Adaptation Strategy will also facilitate partnerships with stakeholders from key sectors. Sectoral adaptation plans will provide a vehicle for sector participants to work with relevant Queensland Government agencies and local government to prioritise their adaptation activities and ensure they are complementary, mutually reinforcing and avoid unintended outcomes.

5.2 Flood mitigation

Flooding of urban areas across Queensland, in particular in 2011 and 2013, has put a focus on flood mitigation and operational strategies for managing dams (whether or not they have dedicated flood mitigation capacity). The 2011 flood events forced thousands of people to be evacuated from towns and cities across the state, much of the state was declared a disaster zone and a significant damage bill was incurred. The recent impacts of Cyclone Debbie also resulted in extensive evacuations and millions of dollars of damage, further emphasising the need for ongoing flood and emergency response management planning.

Reducing or mitigating the social, environmental and economic impacts of floods is likely to be an increasing driver for investment in bulk water storage infrastructure. All dams provide some mitigating effect on floods. However, only a small number of Queensland dams (such as Wivenhoe and Somerset dams in South East Queensland and Peter Faust Dam in the Whitsunday region) have been specifically designed to provide significant flood mitigation in addition to providing water supplies.

Following the flooding events of 2011, a number of recommendations were made (including reviewing operating strategies) to support increasing flood mitigation capacity, particularly in the heavily populated south-east corner. These included increasing flood mitigation capacities of existing storages, reviewing operating strategies and building new storages.

Flood mitigation solutions for a community might include development of specific infrastructure, such as dedicated flood mitigation compartments in dams, ‘dry’ dams or stormwater detention basins, or levees. Solutions could also include a combination of infrastructure development, changes to operational practices and investment in community resilience to flooding events.

Increasing the flood mitigation capacity of existing storages to better protect downstream properties, communities and major population centres is often not possible without affecting water supply security, unless major works are considered. It is often necessary to strike a balance between acceptable levels of flood mitigation and the provision of appropriate water supply security.

A conversation about this balance is occurring in a number of Queensland communities. For example, following a significant flooding event in the Callide Valley, the community, dam owner (SunWater) and Banana Shire Council are discussing whether the existing infrastructure can be operated in alternative ways to deliver more effective flood mitigation as well as water supply security. In addition, the *Wivenhoe and Somerset dams optimisation study* investigated alternative strategies for operating those dams during floods to achieve a more appropriate balance between flood mitigation and water supply security. Seqwater has implemented these changes to achieve an optimal outcome.

It should be noted that traditional project assessment techniques are difficult to apply to flood mitigation proposals. This type of infrastructure can have a significant gap between commercial and economic viability due to the broad economic benefits to multiple residents and businesses, with a limited ability to recover specific costs related to flood mitigation from these beneficiaries.

5.3 Dam safety upgrades

In Queensland, the responsibility for the safety of a dam rests with the dam owner. This includes dams owned by state and local governments, and other entities such as mining companies and farmers.

One of the critical drivers for capital spending by state-owned bulk water providers over the next few decades is the need to upgrade dams and spillways to meet state regulatory requirements for safety, which is linked to guidelines prepared by the Australian National Committee on Large Dams. These guidelines and standards are designed to ensure that dams and weirs are designed to appropriate standards.

The guidelines seek to ensure that, from a risk management perspective, the failure of a large dam is an exceedingly rare event. The assessments are very complex but, as an example, they set the target for each existing dam so the risk to any one person is lower than 1 in 10 000 annual exceedance probability—in other words, there is less than a 1 in 10 0000 chance of loss of life associated with dam failure in any given year. The standards get more stringent when more people downstream are at risk. By contrast, land-use planning on a flood plain is generally based on a 1 in 100 annual exceedance probability. The overall risk levels in the dam safety standards are consistent with similar standards around the world.

In 2003, the Bureau of Meteorology issued updated ‘probable maximum precipitation’ estimates, which had an impact on the calculation of the ‘probable maximum flood’. The changes to the probable maximum flood calculation mean that many of the large dams built before 2003 may no longer be compliant with current guidelines and will require upgrading. This is reflected in the program of projects described in Section 4.1.

The combination of updated rainfall information, downstream population growth and changes to the DEWS regulatory guidelines and Australian National Committee on Large Dams industry standard guidelines means that some dam owners (including SunWater and Seqwater) are required to upgrade applicable dams.

The Queensland Government *Guidelines on acceptable flood capacity for water dams: August 2016* provide a schedule for dam upgrades to reduce life safety risks and meet the minimum required standards by 2035. While a significant number of dams have already been upgraded, more work still needs to be done. Seqwater assessed its overall portfolio of dams in 2013 and found that improvements are needed at a number of dams, with program costs estimated at $570 million through to 2027. SunWater undertook a similar assessment of its dam portfolio in 2014. It has now estimated that their dam improvement program costs to 2027 will be in excess of $855 million.

5.4 Protecting the environment and the Great Barrier Reef

Bulk water supply infrastructure can provide many economic benefits to the community; however, there can be environmental impacts associated with their development and operation. Activities that make use of the water (such as agriculture, mining, industry and urban development) can also have significant and ongoing impacts on the environment that need to be assessed and managed through the relevant environmental assessment processes.

Challenges

There are many challenges associated with the supply of bulk water. Dams and weirs can have significant impacts on aquatic ecosystems if not planned and managed well. They create physical barriers to the passage of fish and other fauna, as well as manipulating in-stream flow velocities—both of which have significant impacts on breeding and population health. Bulk water supply for irrigation is also associated with potential environmental risks, such as irrigation salinity or nutrient run-off into waterways or other sensitive coastal environments.

The Great Barrier Reef is facing a number of challenges. Concern about the health of the Reef has heightened, with major bleaching events in 2016 and 2017. The *Great Barrier Reef outlook report 2014* stated that the highest risks to the health and resilience of the Reef are:

- climate change (i.e. stronger storms, flooding, thermal stress)
- land-based soil run-off (with the greatest impact on the inshore areas)
- coastal land-use change
- aspects of direct use (e.g. fishing, shipping, port activities).

The combined risks pose a significant threat to the Reef. That is, the impact that results from any one individual risk might be minor if considered alone, but collectively these risks are likely to (and have already) lead to a major impact on the Reef. In addition, risks considered low at the scale of the whole Reef, which extends 2300 kilometres along the Queensland coast, can still have significant local impacts.

The development of new water storages is usually associated with agricultural expansion or intensification that, by their nature, can also lead to significant land-use changes. Bulk water infrastructure, such as large dams, can have a direct impact on water quality downstream as they can alter the natural volumes of water flowing into a watercourse and change the chemical composition of its flow. However, it is the activities that benefit from bulk water supply, such as irrigation, that are a direct cause of land-based run-off of nutrients and sediment. Indeed, the main source of excess nutrients, fine sediments and pesticides from Reef catchments is diffuse source pollution from agriculture and grazing. As such, the Queensland Government's focus has been on working with farmers to improve the quality of water in the Reef by improving land management in Reef catchments.

Commitments

The Queensland and Australian governments have committed to delivering the *Reef 2050 long-term sustainability plan*, which provides an overarching framework for protecting and managing the Reef. Improving water quality in the Reef is a major theme under the 2050 plan, supported by the *Reef water quality protection plan 2013* to address water pollution from broadscale agriculture. The Reef water quality protection plan is currently undergoing a periodic review, with a new version to be released later in 2017. The new plan will have a broader scope, covering water pollution from all land-based activities.

The Queensland Government has committed to water quality targets for the Reef, with the key aim of reducing cumulative catchment pollution loads flowing into the Reef. These targets include reducing nitrogen run-off by up to 80% by 2025 and reducing total suspended sediment run-off by up to 50% by 2025 in key catchments such as the Wet Tropics and the Burdekin. The 2017 review of the *Reef water quality protection plan 2013* includes setting catchment-specific targets for the 35 river basins to provide more relevant detail for the above overarching targets that can be used to set pollution load limits.

Great Barrier Reef Water Science Taskforce and bulk water infrastructure

The Queensland Government has committed to invest an additional $90 million over five years to secure progress towards the targets through water quality initiatives, scientific research and helping primary production businesses to transition to better environmental practices. The Great Barrier Reef Water Science Taskforce was established in May 2015 to provide the Queensland Government with advice on the best possible approach to meeting its long-term water quality targets. The taskforce released its final report in May 2016. The Queensland Government agreed, or agreed in principle, with all of the recommendations, noting that some will require formal public consultation processes, further analysis or working with the Australian Government.

One of the recommendations was to implement staged regulations to reduce water pollution throughout Reef regions. Depending on how this recommendation is progressed, elements of it may impact on the operation or further development of water supply infrastructure in Reef catchments, including:

- setting reef catchment pollution load limits to drive load reductions to meet Reef water quality targets
- setting minimum standards for agricultural industries (sugar cane, grazing, bananas, horticulture and grains)
- managing impacts on water quality from intensification or expansion in the agricultural sector
- using water quality offsets across industry sectors (urban, industry and agriculture) if an increase in pollution load from new development cannot first be avoided or mitigated
- improving irrigation techniques to maximise water-use efficiency and reduce run-off
- extending protection of riparian areas and natural wetlands.

Implications

Over and above obtaining the standard environmental approvals required for new bulk water infrastructure, proponents seeking to expand existing infrastructure or develop new bulk water infrastructure will need to take into account policies and regulations to meet the Great Barrier Reef water quality improvement targets. This will include Queensland projects being assessed under the National Water Infrastructure Development Fund. Nine of the 15 proposals being assessed are based in catchments with inflows into the Reef.

Accordingly, when planning and assessing proposed bulk water infrastructure development in catchments that may impact the Reef, it will be important for both bulk water infrastructure proponents and decision-makers to consider current and emerging government policies and regulations.

5.5 Getting the balance right

Water infrastructure projects are typically long-life assets with demands developing over a significant period of time. It is sometimes many decades before the full supply potential is taken up. These projects are often not commercially viable on construction and the private sector is often reluctant to take the investment risk.

The Queensland Government has a role in driving sustainable regional economic development, and bulk water supply can be a significant enabler. There are many demands on the state's limited funds and the key issue is how the state government (with the involvement of its various stakeholders) prioritises expenditure for bulk water supply and invests in opportunities for the future of the community.

There is an imperative that governments spend ever more wisely on ideas and projects that provide quality economic and community outcomes, and this means planning for the best use of the existing water resources and bulk water infrastructure. At the same time, there is an imperative to consider the benefits of new infrastructure to grow Queensland's economy.

Is new bulk water supply infrastructure the solution?

Before a proposal for new bulk water supply infrastructure is developed, a range of factors need to be considered. These include identification of a need or water supply issue, the potential benefits, consideration of what water resources may be available, evaluation of options to service the need, and assessment of capacity to pay for development and ongoing operation and maintenance of new infrastructure.

Identifying the need and benefits

Identifying and clarifying the water supply need or issue is an important step prior to considering new bulk water supply development. Undertaking and completing this step will allow an understanding of factors such as the scale of demand, level of commitment from potential customers, type of water products required and areas where further work is required. This will inform subsequent actions and guide which water supply options, including non-infrastructure options, should be further investigated. Equally important is understanding what benefits could be realised by addressing the need or issue. Ultimately, a significant net commercial or economic benefit must be clearly demonstrated before a project has any chance of proceeding.

Availability of water in the relevant water plan

Not all areas of Queensland have water reserves identified in the water plans that could be accessed through development of new bulk water supply infrastructure. In some circumstances, the water reserves may be put aside for other uses or may not provide water products that will meet the identified need—for example, there may not be the right reliability of supply.

Water supply options

All potential water supply options should be assessed, including both infrastructure and non-infrastructure (such as market options). There may also be merit in considering demand management and efficiency initiatives such as improved irrigation practices or lining of irrigation channels.

When considering water supply options, it is important to understand the current use and products, as well as the additional requirements. Infrastructure and non-infrastructure options need to be considered in the long list of options, and only through evaluation against agreed criteria can options be shortlisted. In many circumstances, an approach centered around efficient and appropriate use of existing developed water resources can delay the need for expensive new infrastructure. See Section 6.6 on new technologies and approaches.

State government consideration

The state government will only consider investing in proposals for new bulk water infrastructure that are well supported with evidence and analysis that proves the need and the benefits, demonstrates alignment with water planning arrangements and justifies the preferred option. If a local government is the project proponent seeking state investment, they should also demonstrate that they have worked with the Queensland Treasury Corporation and considered all other funding avenues.

If it is determined that new bulk water infrastructure is required, a proposal will need to be assessed against Queensland Treasury's Project Assessment Framework (or Building Queensland's Business Case Development Framework as appropriate) and guided by principles of best practice assessment (see Section 6.5). Relevant state agencies, bulk water entities and the project proponent will work together to progress the project through the various decision gates and processes put in place to ensure state funds continue to be spent prudently and efficiently.

6. Key policy initiatives and opportunities

6.1 Prioritisation of bulk water supply infrastructure for government consideration (DEWS)

The opportunity

DEWS will have an oversight role to coordinate the prioritisation of bulk water supply infrastructure proposals that have significant economic benefits to the state and for which state government funding may be requested. Over 2017–2018, this role will be developed in consultation with stakeholders.

DEWS will be supported in this oversight role by bulk water entities and the Department of State Development (DSD), with input from Department of Agriculture and Fisheries (DAF), the Department of Infrastructure Local Government and Planning (DILGP) and other agencies to ensure projects support regional economic development. In particular, DSD identification of non-urban projects will provide a direct input into assessments, as will their existing role as the primary interface with proponents that bring forward potential projects and ideas for government consideration (e.g. through DSD regional offices).

The DEWS role includes a high-level evaluation of historic and new water bulk infrastructure proposals that are either unlikely to be commercial in nature or that are commercial but the net economic benefits to the state are uncertain. This evaluation will focus particularly in locations where water availability is the major constraint to economic growth. Assessments will include consideration of non-infrastructure options, environmental and social issues, and economic costs and benefits.

The result of DEWS assessments will be the ongoing production of an up-to-date list of infrastructure projects that are found to have the greatest economic and social benefit potential for the state, with the least risk and least potential environmental impacts. The list of projects will be presented to the government for consideration as part of QBWOS annual reporting and for submission to state infrastructure planning processes.

Queensland agencies with a key role in supporting economic development will use the priority list when preparing proposals for government consideration (including regional economic development).

6.2 Making information available (DNRM)

The opportunity

Making accurate information easily accessible has the potential to significantly contribute to increased use of our available water resources and better use of existing infrastructure. To support commercial decision-making, water resource information needs to be relevant, from a trusted source, current, accurate, timely and internally consistent.

The Queensland Government is committed to better servicing the water information needs of all stakeholders, including existing and potential water customers, bulk water entities and industry professionals. This will require relevant agencies to coordinate efforts to provide relevant, timely, accurate, consistent, current and understandable information, and clarify processes for accessing water.

Next steps

To assist small water customers and large-scale investors and project proponents, DNRM (together with other agencies and SunWater) will lead a long-term initiative to provide water customers with integrated advice about access to water through proactive assistance and/or online services.

This will include a review of the arrangements for provision of water information and data, and development of options and an implementation plan for improvements by 2018. In the meantime, DNRM will develop a water web page that provides links to relevant water information.

6.3 Markets, trading and product review (DNRM)

The management of surface water resources within Queensland is undertaken on a catchment-by-catchment basis via a water plan (previously water resource plan), a water management protocol (previously a resource operations plan) and, if required, resource operations licences or distribution operations licences and supporting operations manuals. A water plan sets the boundaries within which the water resources of that catchment must be managed and defines the specific way in which water management is to be achieved, including water trading zones and rules for the catchment.

The water plan may enable three water markets to operate within selected Queensland catchments:

- a water allocation market that deals in the permanent trade of registered water allocation titles
- a seasonal water assignment market in which seasonal assignment of water available under allocations and other entitlements are temporarily traded for up to 12 months
- a relocatable water licence market in which water licences may be relocated from one parcel of land to another on a permanent or seasonal basis.

More than 75% of the water in Queensland is held by entitlement holders as water allocations—the majority of which are surface water allocations. Permanent trading of surface water allocations involves the transfer of a water allocation title, similar to the sale of a land title. These dealings must be registered in the Water Allocations Register. While a permanent water allocation trade does not always have to be approved by DNRM, there may be other notification requirements.

Seasonal water assignments are temporary trades of water to meet short-term water needs—some or all of the water that may be taken under a water entitlement in a water year can be assigned to another person or place. Both supplemented and unsupplemented water can be seasonally assigned but different processes and rules apply. Temporary trades are approved by the resource operations licence holder for supplemented schemes and by DNRM for unsupplemented water. However, temporary trade prices are not currently required to be reported.

The opportunity

There are lower levels of permanent and seasonal trades in Queensland water markets compared with the levels of trade in southern Australian water markets. However, Queensland's hydrology and climate are significantly different from other states and the market arrangements are tailored to these differences, which translates into less market liquidity. For example, Queensland has disconnected catchments with smaller numbers of market participants and less regulated water infrastructure.

As identified in Section 3.3, there is significant latent capacity in existing bulk water supply systems. Facilitating an increase in water market activity, including by removing any unneccessary constraints, could potentially increase the uptake of supplemented water, unsupplemented water and groundwater resources that are under-utilised, not used, uncommitted or unallocated across Queensland.

Even in highly utilised schemes there is an opportunity for water trading to continue, driving efficient water use and delivering economic benefits (including if users are holding more allocation than they need as a risk mitigation measure). Furthermore, a water market that is perceived as well functioning may result in risk-averse entitlement holders being more confident/comfortable with trading. This may increase water use or offer surplus water for sale, facilitating the movement of water to customers that need it most or are willing to pay a premium.

Trading activity could be supported through actions that improve price declaration and market formation; however, improvements are likely to need both process and regulatory changes. In 2017–2018, DNRM will work with stakeholders to review trading arrangements and the function of water markets in Queensland.

Next steps

This initiative will specifically include a review of the legislative framework for temporary trading to identify options for improvement. In addition, it will be followed by the development of an implementation plan for improved water market access. This is expected to include a prioritised program for conversion of existing water licences to tradeable water allocations based on demand for water, and a prioritised program for reviewing trading rules to provide additional flexibility where possible and where required. In a parallel process, DNRM will identify options for improving the way market information is currently provided.

Furthermore, DNRM will assess processes to achieve greater and more effective movement of water within a water supply scheme. They will work with resource operations licence holders to review the current framework for regulating water trading to allow scheme operators greater flexibility to manage trade.

6.4 Improving access to unallocated water (DNRM)

The opportunity

As part of using existing bulk water supply infrastructure better, DNRM has a role in reducing constraints. One of the constraints to increased supply of available water from existing bulk water supply infrastructure is the process of unallocated water releases. There is an opportunity to review the process and improve efficiency in identifying available unallocated water in water plans.

Next steps

DNRM have committed to reviewing the program for the release of unallocated water with a view to improving uptake of existing unallocated water reserves, particularly in areas where identified demand cannot be met through improvements in water-use efficiency and/or trading of existing under-utilised entitlements. This includes a review of how decisions about the release of unallocated water could better align with other government priorities (such as Great Barrier Reef protection, vegetation management and regional development objectives), while delivering social, economic and environmental outcomes in accordance with the objectives of the *Water Act 2000* and the principles of the National Water Initiative. In addition, DNRM is proposing to investigate short-term options for beneficially using water that has been reserved for strategic infrastructure needs.

6.5 Best practice project assessment (DEWS and Queensland Treasury)

Investment decision-making should be a logical, phased process that takes account of all relevant information and clearly addresses the identified and inherent uncertainties of long-lived assets such as large water supply infrastructure. The process must also be flexible enough to incorporate new information as it becomes available. Queensland has a well-established project assessment framework in place, including guidance on investment decision-making provided by Queensland Treasury, Building Queensland and other entities. Figure 8 (overleaf) presents the alignment of some of these key processes.

Figure 8: Alignment of key project assessment processes (source: Building Queensland, *Business case development framework: strategic business case—template and guide: April 2016)*

The opportunity

To complement the current process for assessing proposed bulk water supply infrastructure proposals, the government has committed to considering some additional requirements for bulk water providers. This is critical to ensure that limited government funds are focused on the investigation of water infrastructure projects that have the best chance of delivering a net public benefit to Queensland.

These additional requirements will be developed in consultation with all stakeholders and will be complementary to the existing frameworks administered by Business Queensland, Queensland Treasury and Infrastructure Australia. The requirements under consideration will be based on the following principles:

1. Analysis of water demand is informed by direct engagement with potential customers, who have been provided with estimates of the availability and security of water to be supplied and the potential charges likely to be associated with water delivery.
2. Estimates for water charges that are presented to potential customers as part of demand analysis are underpinned by preliminary strategic and technical assessment of infrastructure options.
3. There should be secure customer commitment (through formal arrangements between the proponent and the customers) prior to any state government funding of bulk water supply infrastructure projects.
4. If a government contribution is necessary to enable a project to proceed, the government should be presented with a business case that addresses the above matters prior to the commencement of more detailed and costly assessments (including environmental impact assessments and any potential environmental impact statement).

Appendix 3 provides a summary of current arrangements for project assessment.

Next steps

DEWS intends to bring its recommendations to government as part of a wider suite of QBWOS reforms by the end of 2018.

DEWS will work with key stakeholders (SunWater, Seqwater, Gladstone Area Water Board, Mount Isa Water Board and other agencies) to further develop the proposed approach, consider options and make recommendations to define:

- the changes that may be required in more detail
- how these changes fit within the existing frameworks
- the size and type of project to which these additions apply
- the appropriate mechanism to ensure adoption by relevant entities (noting that the initiative to consider options for SunWater to take a greater role in regional economic development explained in section 6.7 will help to inform this definition).

6.6 New technologies and approaches for the future (DEWS)

The construction of traditional new bulk water supply infrastructure, such as dams and weirs, is one of a number of options for delivering water security solutions to a community or region. This option can require significant capital and ongoing expenditure, and there may often be a more cost-effective solution to meet demand. Across the state there is ageing bulk water infrastructure that needs ongoing maintenance and much of it requires costly upgrades (e.g. dam safety spillway upgrades to meet acceptable flood capacity guidelines). Any new infrastructure will come with the same liability.

The opportunity

There are a range of technologies and alternative approaches (including efficiency measures) that may help to meet or manage demand for water that should be considered as an alternative to traditional infrastructure.

Potentially viable alternatives to traditional large-scale infrastructure (such as dams, weirs and transfer pipelines) typically have features that may be suitable/available for varied water needs. Suitable (technological or efficiency) options will involve evaluation against the following criteria:

- suitability for Queensland's climatic conditions, including resilience to climate change
- readily deployable to a range of location types, such as remote, urban, coastal or inland
- cost-effectiveness, including relative ease of maintenance
- ability to scale the solution up or down (or apply in stages)
- flexibility in quality of water produced
- ability to supplement existing water supply systems or be employed as standalone solutions
- social acceptability, cultural heritage, environmental footprint and optimal use of energy
- minimal conflicts with policies and regulations, and other constraints such as power supply and waste by-product disposal
- water-use efficiency
- energy efficiency.

Considering the evaluation criteria above, a selection of technologies and efficiency measures that may warrant consideration are summarised in Table 8 (overleaf). It is recognised that many of these measures are not suitable for all situations. It should be noted that, as with any development, new technologies and approaches need to satisfy all requirements for environmental and other approvals.

Table 8: Potential new technologies and approaches

Measure	Description	Benefits and constraints
Aquifer recharge	Introduce additional water by pumping into aquifer for withdrawal later (less evaporation than surface storage and can be employed for either storing seasonal peaks from run-of-river flows or reclaimed wastewater)	✓ Increased storage ✓ Less evaporation losses ✓ Scalable ✓ Well-known technology × Requires suitable geology × Less social acceptance if reclaimed wastewater is the source
Evaporation covers	Solid or fluid materials can be placed over the water surfaces to minimise evaporation	✓ Less evaporation losses ✓ Scalable × May require special consideration of maintenance
Irrigation mosaics	Smaller discrete patches of irrigated land are dispersed across the landscape, offering a potentially more water-efficient alternative to traditional large-scale contiguous irrigation systems	✓ Less evaporation losses ✓ Scalable ✓ Well-known application × Not suitable for all types of agriculture
Irrigation scheduling	Tensiometers give estimates of soil moisture content and indicate when irrigation is required, reducing the volume of irrigation	✓ Low cost ($100–$500 per hectare) ✓ More effective use of available water × Not suitable for agriculture in paddy fields or hydroponic installations
Leakage prevention	Same-day repairs, early detection and pipe material developments in order to reduce possible resulting damage, including subsidence of roads and muddying of water	✓ Scalable ✓ Employed by most urban water service providers, with technology advances providing better insights × Not suitable for very small systems or remote locations
Sand dams	Simple, low-cost and low-maintenance impermeable weir constructed across a seasonal sandy river that captures rain and suspended sand (the sand matrix significantly reduces evaporation)	✓ Low cost ✓ Easy to build and maintain × Requires a sandy river × Vulnerable to flood damage
Smart technology	Instantaneous feedback is provided to residents on daily water and energy use through an in-home device or smart phone/tablet app (can include incentive program and gamification)	✓ Scalable ✓ Emerging trend with documented success stories × Not trialled in non-urban locations

Table 8 (continued)

Measure	Description	Benefits and constraints
Solar desalination	Direct or indirect type plants where the solar array is either coupled with or separate from the distillation mechanism (these plants are typically provided as a package installation of varying scales)	✓ Can be cost-effective compared to traditional desalination ✓ Scalable ✓ Mobile × May be complex to maintain
Solar pumping	Solar-powered bulk water pumping used in conjunction with balancing storage and more power-efficient, soft-start pumps	✓ Suitable for remote locations ✓ Scalable ✓ Cost-effective over the long term × May be complex to maintain
Subsurface irrigation	Subsurface drip or textile system for direct application of water or reclaimed wastewater to plant roots, minimising evaporation	✓ Less evaporation losses ✓ Nutrient benefits to crop if effluent is used ✓ Well-known application × Not suitable for all types of agriculture
Underground weirs	Impermeable barrier down to the clay lens, creating water storage	✓ Increased storage ✓ Less evaporation losses × Requires suitable geology × Not well known

Next steps

Queensland may benefit from increased uptake of new technologies and approaches to better using existing bulk water supply infrastructure and as potential alternatives to new infrastructure. Planning to meet water demand now and into the future requires active consideration of all supply and demand options. The solution may be traditional bulk water infrastructure or it may be a technological solution or an efficiency measure, or a combination of options. Water supply infrastructure of any kind should be part of a holistic solution with multiple benefits.

As new opportunities for high-performing traditional infrastructure are exhausted, and climate change impacts such as evaporation and rainfall intensity increase, development of water security solutions will need to consider all available options, including new technologies and approaches.

Solar desalination

Solar desalination of seawater or brackish water is one of a number of promising technologies to meet urban and/or agricultural water user demand on a range of scales, in diverse geographical locations. Both solar energy and desalination are established, well-understood and broadly used technologies. As the desalination process (which uses a distillation or filtration method to treat saline water) is energy-intensive, combining it with solar energy technology will ideally reduce the energy costs associated with producing fresh water using desalination and increase the affordability of using the technology.

Solar desalination works by either thermal distillation or membrane separation—some solar desalination utilises both processes. Thermal distillation uses thermal systems powered by solar energy. The energy is used to heat saline water to separate the pure vapour for subsequent condensation and use. Heat released in the condensation phase can be reused in other processes, making the system more energy-efficient. Membrane separation systems generally utilise high-pressure pumps powered by solar-generated electricity to produce electric fields or overcome osmotic pressure differentials. These electric fields or pressure differentials cause electromigration of ions in the saline water. Solar electricity can then be produced by either direct solar–electric conversion or by a solar-driven thermal power cycle.

The number of successful case studies for solar desalination is increasing due to its ability to operate as a closed loop system, with the opportunity to harness energy during the treatment process to feed back into the system. However, solar desalination does have a number of constraints and considerations:

- complexity of the water treatment technology may require specialist operators to install and maintain
- disposal of the brine by-product from the process according to environmental regulation
- associated capital expenditure of both initial and ongoing costs (though this is offset by using its own power)
- large area of land required for panel infrastructure, which needs to receive a consistent amount of solar energy
- unlike unlimited quantities of seawater, the quantity of brackish water available at specific rural locations that is easily pumped to the plant inherently limits supply.

Solar desalination projects may be considered for investment under the Emissions Reduction Fund administered by the federal Clean Energy Regulator. In addition, the federal Clean Energy Finance Corporation has a range of funding options to support investment in projects like solar desalination, which help reduce Australia’s emissions, improve energy efficiency and lower operating costs.

The Queensland Government’s rural water use efficiency–irrigation futures initiative is another source of potential funding for solar desalination as, amongst other things, it may assist irrigators reduce the energy consumption associated with their pumping applications. This initiative is a partnership between the Queensland Government and major rural industries—the government provides financial support to industry groups to provide services to irrigators.

Underground weirs

An underground weir is a 'below stream bed' storage created by a barrier constructed within the bed sands of a watercourse. Sometimes called a subterranean weir and similar to an 'upside-down' weir, these are all forms of managed aquifer recharge. The barrier obstructs the flow of water through the bed sands, allowing for continued access to water that would otherwise drain downstream. It is important to note that such a barrier should only be developed to a level within the bed sands that provides adequate storage for the identified water supply need, and that flows above the level of the barrier would continue unimpeded.

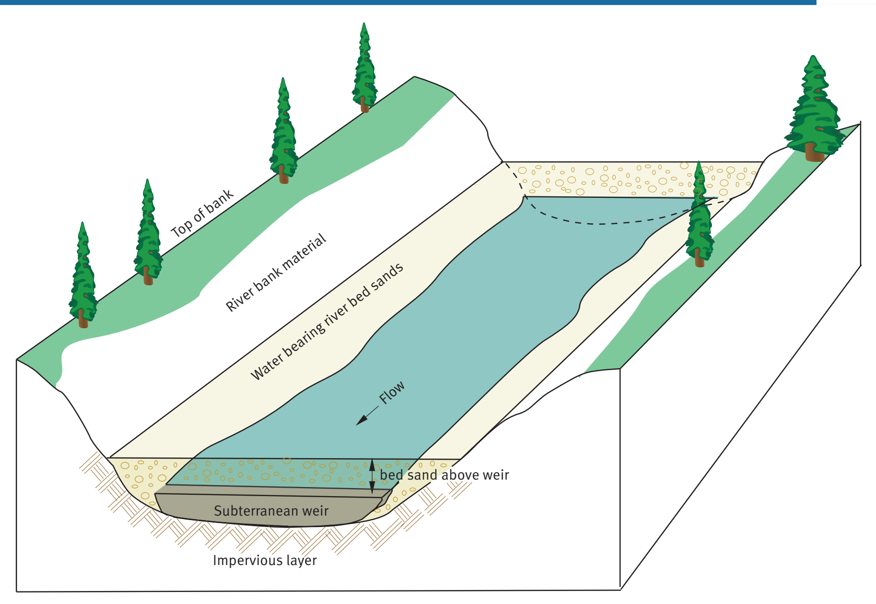
A large part of Queensland experiences short periods of high rainfall intensity, resulting in large but short-duration streamflow events. These short-lived (ephemeral) river systems are usually wide with well-defined beds and banks, and typically have a considerable depth of pervious sand and gravel material in the beds. While the visible streamflow in the river may only last a few months, water can continue to flow within the bed sands for a much longer period. In many places, water users (including communities) access this valuable water resource as their main supply source. The performance and security of such water supplies can be improved by increasing the volume of water stored in the bed sands and the length of time it is retained. In locations that experience infrequent periods of surface water flows but have access to supplies from bed sands through bores and river wells, the development of a subterranean weir to store water could be considered as an option for improving supply.

Water held in the bed sands may also have a number of benefits, such as being pre-filtered to some degree (which may reduce treatment costs) and not being susceptible to evaporative losses (which can exceed 3 metres per year for surface water storages in many parts of Queensland). In addition, the construction of infrastructure below normal river bed level may alleviate the need for associated infrastructure, such as fish transfer devices and outlet works typically associated with instream infrastructure that creates a waterway barrier. As such, the environmental impacts of small-scale developments within the bed sands may be less than the environmental impacts typically associated with surface water storages. The cost of developing appropriately sized infrastructure within the bed sands of suitable watercourses is also likely to be considerably lower than that to develop a comparable above bed level storage structure.

The development of underground weirs needs to consider the flow characteristics of the river, rainfall characteristics (ideally high rainfall intensity in short duration events), geomorphology (including type and depth of bed sands), hydraulic-grade profile within the watercourse and movement of the bed sand during large floods. This could require investigations similar to those required to 'prove up' a conventional surface storage structure.

Once the potential storage size available is understood, the suitability of a subterranean weir can be evaluated against the water supply need (or required performance improvement) and the interaction with other users of the water resource to understand whether this option is feasible.

Figure 9: Profile of a subterranean weir



6.7 SunWater initiatives

Current approach to support economic development

Water pricing arrangements

There are two key components to SunWater's pricing framework:

1. **The prices to recover the ongoing cost of infrastructure associated with supplemented water allocations owned or leased by SunWater's customers**

   SunWater's prices to recover the ongoing cost of infrastructure for water allocations held for rural/irrigation purposes are set by SunWater's shareholding ministers (the Treasurer and the Minister for Energy and Water Supply) based on advice from the Queensland Competition Authority. This advice is based on the government policy that these prices should be set to recover SunWater's efficient operational, maintenance and administrative costs (known as 'lower bound' costs) associated with the supply of water for rural/irrigation purposes. Where these prices are still transitioning to lower bound cost recovery, the government compensates SunWater with a transparent Community Service Obligation payment. For more information about irrigation water pricing, visit the DEWS website at www.dews.qld.gov.au.

   SunWater sets its own commercial policies and negotiates prices to recover the ongoing costs of infrastructure associated with water allocations used for other purposes, including mining, urban water supply or industrial. In line with its commercial mandate under the *Government Owned Corporations Act 1993*, these prices are generally commercial contracts based on recovering its operating, maintenance, refurbishment and administration costs, plus a return on capital.

2. **The prices charged by SunWater to sell or lease supplemented water allocations**

   In line with its commercial mandate under the *Government Owned Corporations Act 1993*, SunWater's policy when selling available water allocations to new customers is generally to negotiate a sale or lease price reflective of the market's 'preparedness to pay'. SunWater applies commercial pricing principles and potential buyers could expect to participate in a bidding process (i.e. request for offers) if there is strong demand.

New infrastructure proposals

If a proposed bulk water supply infrastructure project to support economic development requires state government funding and is to be owned and operated by SunWater, there is currently a provision for SunWater to assess whether the proposal is in its commercial interests. If it is assessed that a proposal is not in SunWater's commercial interests (i.e. that the project is unlikely to provide a commercial return), the project will not proceed.

The opportunity

The government has committed to exploring options to better consider and evaluate the economic benefits offered by bulk water supply infrastructure projects. If net economic benefit is demonstrated for the state, the government may consider supporting the project (e.g. contributions to capital and ongoing costs) within the context of existing budget constraints. Consistent with current arrangements, Building Queensland will lead development of business cases for projects that exceed $100 million in value, and support development of business cases for projects between $50 million and $100 million.

The government has recognised that there may be potential for SunWater to take a greater role in supporting projects that may not provide a full commercial return to SunWater but may be economically beneficial to the state.[20]

20 This initiative relates predominantly to regional Queensland; however, the same principles could apply to Seqwater in relation to new, non-urban infrastructure in South East Queensland.

The state government will consult with SunWater to assess:

- options for SunWater to help the government achieve its objectives for regional economic development
- options for incorporating this new role into SunWater's governance framework.

Options for SunWater to support better use of existing infrastructure, and new infrastructure if appropriate, that supports regional economic development may include:

- SunWater providing advice (including technical advice) to assist government's consideration of the economic benefits of infrastructure proposals
- SunWater modifying its charging regime to encourage greater demand take-up—options might include initial pricing at less than full commercial upper bound prices that ramp up towards full commercial pricing over time, or the introduction of an ongoing support arrangement between SunWater and the state government based on the net economic benefits to the state.

As part of a new approach to supporting economic development, SunWater has committed to prioritising opportunities to increase use of its latent capacity. In support of this review, SunWater has commenced an audit to identify spare capacity and supply constraints. Following the capacity audit, SunWater will develop an integrated strategy that includes recommendations for the shareholding ministers in early 2018. The strategy will include:

- an audit of latent capacity and development of initiatives to unleash the potential of existing assets
- development of initiatives to remove constraints such as barriers to moving water to new demand locations (e.g. expanded/new schemes, or pipelines), and opportunities to improve distribution and peak flow capacity
- development of new or amended water products to better suit the business needs of a range of existing and potential customers
- a review of economic pricing arrangements associated with existing latent capacity, with options to encourage demand and support regional economic development.

Proponent and owner-operator arrangements

With Queensland's administration of the National Water Infrastructure Development Fund, it has become necessary to clarify proponent and ownership arrangements for new water infrastructure. If the Queensland Government is the major investor in a project (either directly or acting through SunWater), then the government reserves the right to establish SunWater as the default proponent for the project and owner-operator of any resulting infrastructure. This means that for the bulk of projects (for which the state is to be the majority investor) outside South East Queensland and the Gladstone and Mount Isa areas, SunWater is to be the proponent and infrastructure owner-operator.

An example of when an entity other than SunWater may be a proponent is Rookwood Weir. The Rookwood Weir project is currently the subject of a detailed business case in development by Building Queensland, for which SunWater and the Gladstone Area Water Board are joint proponents.

Next steps

The Queensland Government will investigate and consider:

- ways for SunWater to help the government achieve its regional economic development objectives
- how any changes to SunWater's role fits within existing frameworks
- appropriate mechanisms to facilitate adoption of role changes by SunWater.

The government will consult with SunWater and all relevant stakeholders as it develops options and recommendations for implementation, as part of a wider suite of QBWOS reforms during 2017–2018.

6.8 Improved state subsidy programs for local government (DSD and DILGP)

In Queensland, local governments are established by the *Local Government Act 2009* and the *City of Brisbane Act 2010*, which drive the councils to be accountable, effective, efficient and sustainable. Local governments are responsible for the sustainable development and management of assets and infrastructure, and the delivery of effective services (including some water supply services).

It is the state government's expectation that all councils will move toward fiscal sustainability. To support this progression, the government supports councils in the delivery of community, economic and social infrastructure projects. It provides support in many ways, including planning assistance (such as the regional water supply security assessments discussed in Section 2.4) and direct financial subsidies and grants.

Current arrangements

Outside South East Queensland, water and sewerage services are predominantly delivered by local councils or council-owned water businesses in Queensland. There are a number of programs administered by the state government aimed at funding local government infrastructure (including water infrastructure such as water treatment plants, sewerage treatment plants, pipelines and water reservoirs), which include the following:

- The Community Resilience Fund aims to make communities more resilient to natural disasters and provides funding for infrastructure, including flood mitigation.
- The Natural Disaster Resilience Program seeks to reduce communities' vulnerability to natural hazards.
- The Works for Queensland program is another program that supports local governments to undertake job-creating maintenance and minor infrastructure projects, including those for sewer, water and stormwater networks and systems.
- The Local Government Grants and Subsidies Program provides grants and subsidies for the purposes of providing essential public infrastructure. This includes, but is not limited to, capital infrastructure projects that are new constructions or expansions, renovations or replacements of existing facilities, water and sewerage infrastructure, and community safety infrastructure.
- The Building our Regions program is divided into four streams, three of which cover water infrastructure. The primary purpose is to provide funding for critical infrastructure in regional areas while supporting jobs and economic development, and improving the liveability of regional communities.

To date, Building our Regions and the Local Government Grants and Subsidies Program have provided funding for permanent, traditional infrastructure solutions—such as upgrades to water treatment plants, reservoirs, pipelines, trunk mains and upgrades to sewerage treatment plants or networks.

However, these funding programs do not provide financial support to initiatives that are:

- non-infrastructure solutions, such as demand management or efficiency programs
- non-permanent solutions, such as modular water and sewerage treatment programs
- alternative solutions, such as vegetation swales or floating wetlands.

Similarly, there is no requirement for applicants seeking funding under these programs to consider alternative solutions as part of any options analysis. This limitation creates a lost opportunity to look at innovative and/or low-cost solutions that may address the problem at hand. Alternative solutions may require relatively modest funding compared to building new water supply infrastructure. Possible options that could be considered include demand management and leakage prevention programs.

The opportunity

Given the costs and long life span of water supply infrastructure, it is important to look at all types of solutions along the water supply chain (i.e. beyond the dam) that may help with water security. This may include non-infrastructure solutions such as water-use efficiency programs, management of leakage and pressure, and market mechanisms. These types of options can help defer bulk water supply infrastructure investment, with accompanying long-term cost savings.

The Queensland Government has recognised that only hard infrastructure solutions are considered under existing state funding programs. The government is exploring avenues to enhance these funding programs to ensure:

- funding initiatives are fit for purpose
- funding decisions are based on prioritising the needs of the community
- funding consideration is given to non-traditional options.

Next steps

DEWS will work with DILGP, DSD and key industry stakeholders (such as the Local Government Association of Queensland) during 2017 to encourage consideration of alternative solutions in state government funding programs.


Charters Towers Weir

QBWOS next steps

The Queensland Government has invested heavily in bulk water supply infrastructure over many years. Much of this infrastructure is part of water supply systems that are supporting prosperous Queensland regions. New water infrastructure can bring growth opportunities and attract investment into communities; however, it can also require significant capital and ongoing expenditure. The development of new greenfield irrigation areas will also require major expenditure to establish the essential supporting and enabling infrastructure and services to support agricultural development.

The QBWOS reinforces the importance of prioritising development of new infrastructure along with options to maximise the benefits of existing infrastructure and managing the costs of continuing to keep dams safe for the future.

The QBWOS contains principles and actions that target more efficient use of the significant quantity of water currently available from existing infrastructure across Queensland, and it focuses on reducing the barriers to using this water for generating regional economic growth. There are opportunities for using existing available water, building new infrastructure if it is demonstrated to be economically viable, and using new technologies and approaches to promote growth across Queensland. All of these options have been considered in this document. The initiatives will be further developed to support the objectives, and subsequent versions of the QBWOS will contain implementation progress updates.

The QBWOS identifies the need to bolster the project assessment process for new bulk water supply infrastructure. This is to make sure the right infrastructure is built at the right times, in the right places to boost economic development while protecting Queensland's natural environment (including the Great Barrier Reef). It also acknowledges the need to consider the risks associated with an increasingly changing climate. There are many factors to consider in order to better use our existing infrastructure and investigate new water infrastructure proposals (if appropriate). The QBWOS is an important step towards achieving this goal.

The QBWOS will be updated annually to reflect advances in project assessment, new policies and streamlined processes and approaches to supply planning. The first review will consider and utilise the findings of investigations and studies currently in progress, as they become available. This includes feasibility studies supported through the National Water Infrastructure Development Fund, or those being led by Building Queensland or other state entities. It will incorporate feedback from the public and community groups. Importantly, the review process will also provide an opportunity to regularly update the community on the progress of proposed initiatives and projects under consideration.

It is expected the first review will provide more detail on the DEWS role in project prioritisation and the processes to support the role, as well as the assessment approach to be used by state water entities to understand the economic merit of project proposals. It is acknowledged that there is also an opportunity to broaden the scope of the QBWOS in future versions to include more explicit consideration of alternative bulk water supplies—such as water from coal seam gas generation, recycled wastewater and manufactured water.

Please email any questions or comments about this QBWOS document to **QBWOS@dews.qld.gov.au**.

Appendix 1: Available water in major bulk water supply systems

Table A1: Available water in major bulk water supply systems across Queensland

QBWOS region	Bulk water supply system	Total water storage capacity	Total water entitlements	Operational losses entitlement	Total water available to customers	Total water committed to customers	Uncommitted water available for contract, sale or lease	Reported 2015–2016 water use
Central	Awoonga Water Supply Scheme	777 000	78 000		78 000	~64 000 [19]	~14 000 [20]	49 837
Central	Lower Fitzroy Water Supply Scheme	35 900	28 621	1 275	27 346	27 346		19 879
Central	Fitzroy Barrage Water Supply Scheme	81 300	62 093		62 093	62 093		27 008
Central	Eton Water Supply Scheme	62 800	62 563	9 384	53 179	53 179		33 913
Central	Nogoa Mackenzie Water Supply Scheme	1 340 213	230 518	28 697	201 821	201 821		192 025
Central	Callide Valley Water Supply Scheme	151 406	19 449		19 449	19 449		14 442
Central	Dawson Valley Water Supply Scheme	66 266	61 737	4 005	57 732	57 732		39 818
Far North	Cairns Water Supply	37 100	46 685		46 685	46 685		22 893
Far North	Mareeba Dimbulah Water Supply Scheme	441 610	204 425	45 000	159 425	159 425		162 062

21 All 78 000 ML from the scheme is owned by the Gladstone Area Water Board, with approximately 64 000 ML contracted as supply to customers over 2015–2016.

22 The Gladstone Area Water Board operates the Awoonga Water Supply Scheme under a contract model. As such, no water is available for lease or sale, but the board enters into supply contracts with customers.

Table A1 (continued)

QBWOS region	Bulk water supply system	Total water storage capacity	Total water entitlements	Operational losses entitlement	Total water available to customers	Total water committed to customers	Uncommitted water available for contract, sale or lease	Reported 2015–2016 water use
North	Burdekin Haughton Water Supply Scheme	1 890 455	1 079 593	197 074	882 519	792 552	89 967	680 593
North	Paluma-Crystal Water Supply	11 800	21 571		21 571	21 571		6 924
North	Townsville Water Supply	236 047	75 000		75 000	75 000		51 408
North	Bowen Broken Water Supply Scheme	118 573	38 929	494	38 435	38 435		16 963
North	Pioneer River Water Supply Scheme	160 318	78 110		78 110	67 110	11 000	27 894
North	Proserpine River Water Supply Scheme	491 400	62 876		62 876	60 324	2 552	30 747
North West	Cloncurry Water Supply	2 750	2 700		2 700	2 700		1 187
North West	Croydon Water Supply	5 200	4 360		4 360	4 360		89
North West	Julius Water Supply Scheme	107 500	48 850	1 250	47 600	36 750	10 850	5 003
North West	Moondarra Water Supply Scheme	106 833	26 300	1 250	25 050	25 050		14 734
South East	Logan River Water Supply Scheme	148 890	23 411		23 411	23 411		5 991
South East	Central Brisbane and Stanley River Water Supply Schemes	1 547 250	286 041		286 041	286 041		165 284
South East	Pine Valleys Water Supply Scheme	215 000	66 000		66 000	66 000		37 687

Table A1 (continued)

QBWOS region	Bulk water supply system	Total water storage capacity	Total water entitlements	Operational losses entitlement	Total water available to customers	Total water committed to customers	Uncommitted water available for contract, sale or lease	Reported 2015–2016 water use
South East	Warrill Valley Water Supply Scheme	84 152	29 834	3 714	26 120	26 120		7 699
South East	Central Lockyer Valley Water Supply Scheme	32 125	16 541	184	16 357	16 357		9 176
South East	Nerang Water Supply Scheme	317 435	84 000		84 000	84 000		47 020
South East	Lower Lockyer Valley Water Supply Scheme	31 534	12 620	1 500	11 120	11 120		2 947
South West	MacIntyre Brook Water Supply Scheme	70 576	24 997		24 997	24 997		9 290
South West	Chinchilla Weir Water Supply Scheme	9 780	4 049		4 049	4 049		2 171
South West	Stanthorpe's Water Supply	2 180	1 150		1 150	1 150		656
South West	Maranoa River Water Supply Scheme	1 470	805		805	805		40
South West	Cressbrook Creek Water Supply Scheme	111 982	10 110		10 110	10 110		9 340
South West	Border Rivers Water Supply Scheme	264 043	183 854		183 854	183 854		6 878
South West	St George Water Supply Scheme	99 670	84 575	9 701	74 874	74 874		81 931
South West	Upper Condamine Water Supply Scheme	108 780	33 960	25	33 935	33 935		8 473

Table A1 (continued)

QBWOS region	Bulk water supply system	Total water storage capacity	Total water entitlements	Operational losses entitlement	Total water available to customers	Total water committed to customers	Uncommitted water available for contract, sale or lease	Reported 2015–2016 water use
West	Cunnamulla Water Supply Scheme	4 770	2 612		2 612	2 612		1 882
Wide Bay Burnett	Barker Barambah Water Supply Scheme	136 190	34 315		34 315	34 315		15 187
Wide Bay Burnett	Baroon Pocket Water Supply Scheme	61 000	36 500		36 500	36 500		28 866
Wide Bay Burnett	Boyne River and Tarong Water Supply Scheme	204 200	43 525	1 620	41 905	41 905		32 362
Wide Bay Burnett	Bundaberg Water Supply Scheme	937 420	380 329	41 520	338 809	212 809	126 000	137 249
Wide Bay Burnett	Cedar Pocket Water Supply Scheme	730	495		495	495		361
Wide Bay Burnett	Upper Burnett Water Supply Scheme	188 439	48 550		48 550	44 550	4 000	17 293
Wide Bay Burnett	Teddington Weir Water Supply Scheme	4 095	10 869		10 869	10 869		4 180
Wide Bay Burnett	Lower Mary River Water Supply Scheme	16 750	30 409	4 912	25 497	15 497	10 000	12 713
Wide Bay Burnett	Mary Valley Water Supply Scheme	44 841	32 093	486	31 607	28 607	3000	8 720
Wide Bay Burnett	Three Moon Creek Water Supply Scheme	89 328	14 734		14 734	14 734		6 697
Wide Bay Burnett	Wide Bay Water Supply Scheme	32 357	14 473		14 473	14 473		6 628

Appendix 2: Major bulk water supply systems

Table A2: Major bulk water supply systems across Queensland

Bulk water supply system	Associated infrastructure	Total storage capacity (ML)	Total volume of entitlements (ML)	Primary water users
Awoonga Water Supply Scheme	• Awoonga Dam • Pipelines, pump stations, reservoirs	777 000	78 000	Large industry and urban water supply for Gladstone
Barker Barambah Water Supply Scheme	• Bjelke-Petersen Dam, Joe Sippel Weir, Silverleaf Weir	136 190	34 315	Agricultural, community and industrial water supply
Baroon Pocket Water Supply Scheme	• Baroon Pocket Dam • Tunnel and pipeline	61 000	36 500	Urban water supply for Caloundra and Maroochy areas
Border Rivers Water Supply Scheme	• Glenlyon Dam, Goondiwindi Weir, Glenarbon Weir, Mungindi Weir, Boggabilla Weir, Bonshaw Weir, Boomi Weir, Cunningham Weir	264 043	183 854	Agricultural, industry and community water supply
Bowen Broken Water Supply Scheme	• Bowen River Weir (Collinsville Weir), Gattonvale offstream Storage, Eungella Dam • Channels	118 573	38 929	Mining industry in the Bowen Coal Basin, agricultural and community water supply
Boyne River and Tarong Water Supply Scheme	• Boondooma Dam • Pipeline	204 200	43 525	Industry, agricultural and community water supply
Bundaberg Water Supply Scheme	• Paradise Dam, Ned Churchward Weir, Ben Anderson Barrage, Fred Haigh Dam, Bucca Weir, Kolan Barrage • Channels and pipelines	937 420	380 329	Large agricultural, industry and urban water supplies, including for Bundaberg

Table A2 (continued)

Bulk water supply system	Associated infrastructure	Total storage capacity (ML)	Total volume of entitlements (ML)	Primary water users
Burdekin Haughton Water Supply Scheme	• Burdekin Falls Dam, Gorge Weir, Blue Valley Weir, Val Bird Weir, Giru Weir, Clare Weir • Haughton, Elliot and Barratta main channels • Pipelines and pump stations	1 890 455	1 079 593	Large agricultural and mining industry in the Bowen Coal Basin and urban water supplies, including for Townsville
Cairns Water Supply	• Copperlode Falls Dam, Behana Creek	37 100	46 685	Urban water supply for Cairns
Callide Valley Water Supply Scheme	• Callide Dam, Kroombit Dam, Callide Creek Weir • Pipelines	151 406	19 449	Agricultural, industry and community water supply, including for Biloela
Cedar Pocket Water Supply Scheme	• Cedar Pocket Dam	730	495	Agricultural
Central Brisbane and Stanley River Water Supply Schemes	• Wivenhoe Dam, Somerset Dam, Mount Crosby Weir	1 547 250	286 041	Urban water supply for South East Queensland
Central Lockyer Valley Water Supply Scheme	• Bill Gunn Dam, Lake Clarendon, Kentville Weir, Jordan I and II Weirs, Wilson Weir, Clarendon Weir, Glenore Grove Weir, Laidley Creek Diversion Weir, Showgrounds Weir, Crowley Vale Weir • Pipeline and channels	32 125	16 541	Agricultural, industrial and community water supply
Chinchilla Weir Water Supply Scheme	• Chinchilla Weir • Pipeline	9 780	4 049	Agricultural, industrial and community water supply
Cloncurry Water Supply	• Chinaman Creek Dam, River Wells • Weir	2 750	2 700	Urban water supply for Cloncurry
Cressbrook Creek Water Supply Scheme	• Cressbrook Creek Dam, Perseverance Creek Dam • Pipeline connection from Wivenhoe Dam	111 982	10 110	Urban water supply for Toowoomba and agriculture
Croydon Town Water Supply	• Belmore Creek Dam, Butterfly North Pit	5 200	4 360	Urban water supply for Croydon

Table A2 (continued)

Bulk water supply system	Associated infrastructure	Total storage capacity (ML)	Total volume of entitlements (ML)	Primary water users
Cunnamulla Water Supply Scheme	• Allan Tannock Weir	4 770	2 612	Agricultural and community water supply
Dawson Valley Water Supply Scheme	• Glebe Weir, Gyranda Weir, Orange Creek Weir, Theodore Weir, Moura Weir, Moura Offstream Storage, Neville Hewitt Weir, Selma Weir • Channels	66 266	61 737	Agricultural, industrial and community water supply, including Theodore, Moura and Baralabla
Eton Water Supply Scheme	• Kinchant Dam • Channels and pipelines	62 800	62 563	Agricultural, industrial and community water supply
Fitzroy Barrage Water Supply Scheme	• Fitzroy Barrage	81 300	62 093	Urban water supply for Rockhampton and the Capricorn Coast, and agriculture
Julius Water Supply Scheme	• Julius Dam • Pipelines	107 500	48 850	Mining industry and urban water supply for Mount Isa and Cloncurry
Logan River Water Supply Scheme	• Maroon Dam, Wyaralong Dam, Cedar Grove Weir, Bromelton Weir, South Maclean Weir, Bromelton Offstream Storage	148 890	23 411	Agricultural, industrial and community water supply, including Beaudesert
Lower Fitzroy Water Supply Scheme	• Eden Bann Weir	35 900	28 621	Industrial water supply for Stanwell Power Station and agriculture
Lower Lockyer Valley Water Supply Scheme	• Atkinson Dam, Buaraba Creek Diversion Weir, Brightview Weir, Sippels Weir, Potters Weir, O'Reillys Weir • Pipeline and channels	31 534	12 620	Agricultural, industrial and community water supply
Lower Mary River Water Supply Scheme	• Mary River Barrage, Tinana Barrage • Pipeline, channel	16 750	30 409	Agricultural, industrial and community water supply, including Maryborough
Macintyre Brook Water Supply Scheme	• Coolmunda Dam, Greenup Weir, Whetstone Weir, Ben Dor Weir	70 576	24 997	Agricultural, industrial and community water supply
Maranoa River Water Supply Scheme	• Neil Turner Weir	1 470	805	Agricultural

Table A2 (continued)

Bulk water supply system	Associated infrastructure	Total storage capacity (ML)	Total volume of entitlements (ML)	Primary water users
Mareeba Dimbulah Water Supply Scheme	• Tinaroo Falls Dam, Granite Creek Weir, Bruce Weir, Leafgold Weir, Solanum Weir, Collins Weir, Dulbil Weir • Channels and pipelines	441 610	204 425	Agricultural, industrial and community water supply
Mary Valley Water Supply Scheme	• Borumba Dam, Imbil Weir • Pipeline, Channels	44 841	32 093	Agricultural, industrial and community water supply
Moondarra Water Supply Scheme	• Moondarra Dam • Pipelines	106 833	26 300	Mining industry and urban water supply for Mount Isa
Nerang Water Supply Scheme	• Hinze Dam, Little Nerang Dam	317 435	84 000	Urban water supply for South East Queensland
Nogoa Mckenzie Water Supply Scheme	• Fairbairn Dam, Bedford Weir, Bingegang Weir, Tartus Weir • Pipelines and channels	1 340 213	230 518	Agricultural, industrial and community water supply, including Emerald
Paluma–Crystal Water Supply	• Paluma Dam, Crystal Creek Dam • Pipelines	11 800	21 571	Urban water supply for Townsville and local communities
Pine Valleys Water Supply Scheme	• North Pine Dam	215 000	66 000	Urban water supply for South East Queensland
Pioneer River Water Supply Scheme	• Teemburra Dam, Kinchant Dam, Mirani Weir, Marian Weir, Dumbleton Rocks Weir • Channels	160 318	78 110	Agricultural, industrial and community water supply, including for Mackay
Proserpine River Water Supply Scheme	• Peter Faust Dam	491 400	62 876	Agricultural, industrial and community water supply, including for Bowen
St George Water Supply Scheme	• E J Beardmore Dam, Moolabah Weir, Jack Taylor Weir, Buckinbah Weir • Channels	99 670	84 575	Agricultural, industrial and community water supply, including for St George
Stanthorpe Water Supply	• Storm King Dam	2 180	1 150	Urban water supply for Stanthorpe

Table A2 (continued)

Bulk water supply system	Associated infrastructure	Total storage capacity (ML)	Total volume of entitlements (ML)	Primary water users
Teddington Weir Water Supply Scheme	• Teddington Weir, Tallegalla Weir • Teddington Diversion Pipeline	4 095	10 869	Urban water supply for Maryborough and agriculture
Three Moon Creek Water Supply Scheme	• Cania Dam, Youlambie Weir, Monto Weir, Bazley Weir, Avis Weir, Mulgildie Weir • Pipeline	89 328	14 734	Agricultural and community water supply
Townsville Water Supply	• Ross River Dam Haughton pipeline • Black School Weir Pipeline	236 047	75 000	Urban water supply for Townsville
Upper Burnett Water Supply Scheme	• Wuruma Dam, John Goleby Weir, Kirar Weir, Jones Weir, Claude Wharton Weir	188 439	48 550	Agricultural, industrial and community water supply
Upper Condamine Water Supply Scheme	• Leslie Dam, Talgai Weir, Yarramalong Weir, Lemon Tree Weir, Melrose Weir, Wando Weir, Nangwee Weir, Cecil Plains Weir • Pipeline	108 780	33 960	Agricultural, industrial and community water supply, including for Warwick
Warrill Valley Water Supply Scheme	• Moogerah Dam, Upper Warrill Diversion Weir, Kents Lagoon Diversion Weir, Aratula Weir, Warrill Creek Diversion Weir, Warroolaba Creek Diversion Weir, Churchbank Weir, West Branch Warrill Diversion Weir, Railway Weir • Channels	84 125	29 834	Agricultural, industrial and community water supply
Wide Bay Water Supply Scheme	• Lenthalls Dam, Burrum Weir No, 1, Burrum Weir No. 2	32 357	14 473	Urban water supply for Hervey Bay and agriculture

Appendix 3: Project assessment arrangements

Table A3: Current project assessment arrangements

	SunWater (government-owned corporation)	Seqwater, Gladstone Area Water Board and Mount Isa Water Board (statutory authorities)
The Queensland Government provides comprehensive assessment frameworks	Business Case Development Framework (BCDF), administered by Building Queensland—for an overview of the BCDF visit **www.buildingqueensland.qld.gov.au** **Note:** For any proposal being assessed for funding under the National Water Infrastructure Development Fund, all proponents would be required to address Infrastructure Australia's Assessment Framework. For an overview of this framework, visit **www.infrastructureaustralia.gov.au**	Project Assessment Framework (PAF), administered by Queensland Treasury For an overview of the PAF, visit **www.treasury.qld.gov.au**
Application of the frameworks varies depending on the estimated capital cost	For proposals with an estimated capital cost of $100 million or more, the assessment must be led by Building Queensland and the BCDF must be used. For proposals with an estimated capital cost of $50 million to $100 million, Building Queensland assists in the preparation of business cases and use of the templates and guidance provided under the BCDF is encouraged. **Note:** In practice, SunWater will also consider the PAF and use it where necessary.	For proposals with an estimated capital cost of $100 million or more, the PAF must be applied. For proposals with an estimated capital cost of $50 million to $100 million, the PAF must be applied unless the authority's chief executive officer has approved use of an assessment methodology other than the PAF. **Note:** For proposals over $100 million, the assessment must be led by Building Queensland and the BCDF must also be used. Building Queensland will use the PAF as the base project assessment tool.
The frameworks involve various stages of assessment	1. Strategic business case—aims to ensure the service need is substantiated and effectively articulated, and the benefits sought are achieved through the proposed initiatives 2. Preliminary business case—aims to progress the concept documented in the strategic business case through an options generation and assessment process, which culminates in preferred option/s for analysis within the detailed business case 3. Detailed business case—aims to provide evidence for investing in the project **Note:** In practice, government-owned corporations would be expected to assess whether completed projects have delivered outcomes.	1. Pre-project stage (strategic assessment of service requirement) 2. Preliminary evaluation 3. Business case development 4. Supply strategy development 5. Source supplier/s 6. Establish service capability 7. Deliver service 8. Post-project stage (benefits realisation)
Government reviews	Consistent with the PAF	

Acronyms

BCDF	Business Case Development Framework
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF	Department of Agriculture and Fisheries
DEHP	Department of Environment and Heritage Protection
DEWS	Department of Energy and Water Supply
DILGP	Department of Infrastructure, Local Government and Planning
DNRM	Department of Natural Resources and Mines
DSD	Department of State Development
GAWB	Gladstone Area Water Board
MIWB	Mount Isa Water Board
ML	megalitre
NWIDF	National Water Infrastructure Development Fund
PAF	Project Assessment Framework
QBWOS	*Queensland bulk water opportunities statement*
RWSSAs	Regional water supply security assessments

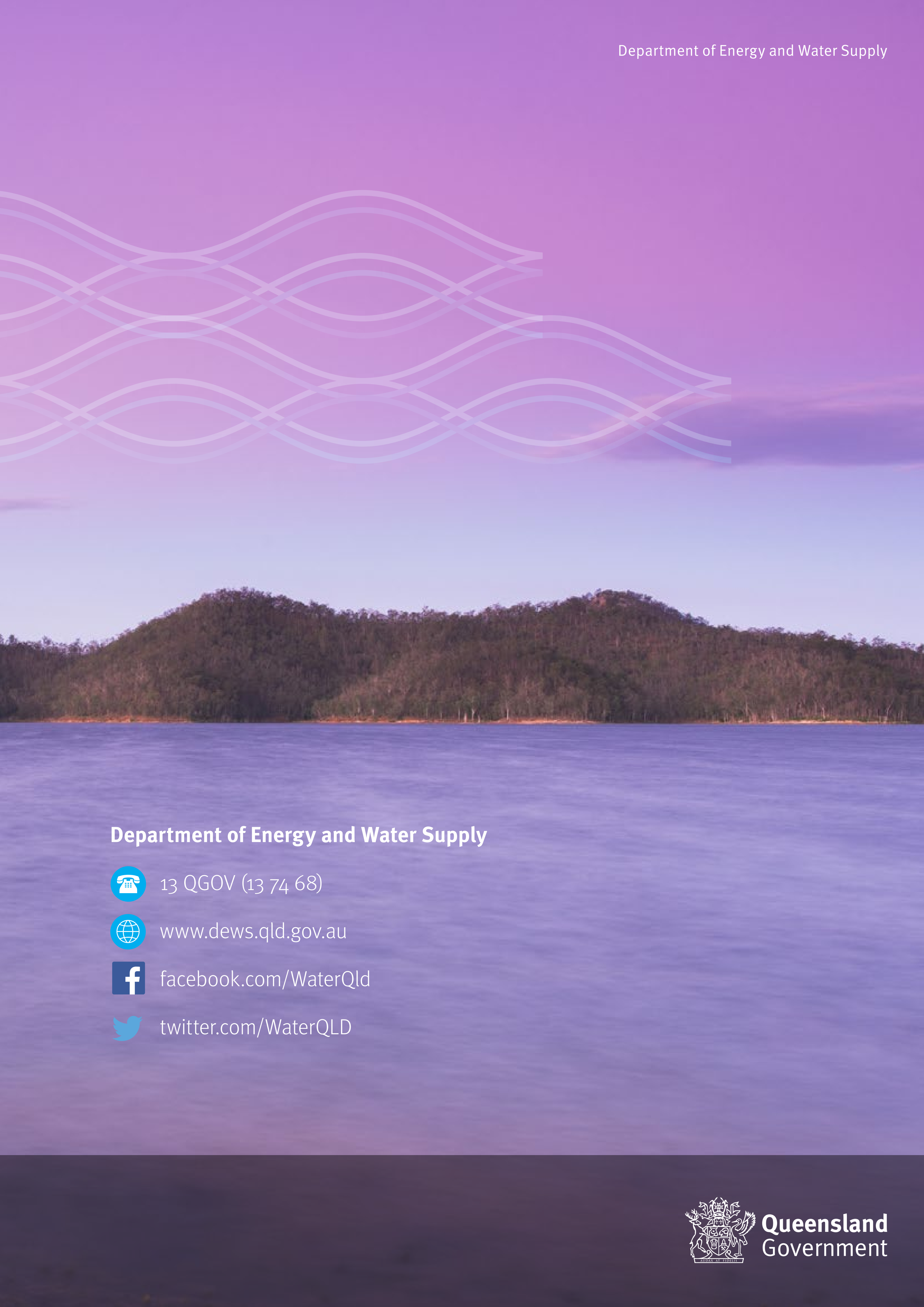
Glossary

Water-related terms	
Allocation (water)	A water allocation is an entitlement created under the *Water Act 2000*. The granting of allocations now occurs through water entitlement notices. Water allocations are assets that are separate to land and may be owned and traded by non-landholders. All water allocations are registered in the Water Allocation Register. The register records ownership information on water allocations in a similar way to which details of land ownership are recorded in the Freehold Land Registry.
Bulk water	Raw water that is supplied from a bulk water supply system, in accordance with a water entitlement, either directly to an end-user customer or to a customer that provides treatment services and/or distribution services to end-user customers.
Bulk water entity	Bulk water providers generally provide water to local councils as the source of their drinking water supplies. DEWS oversees four bulk water entities in Queensland: • Queensland Bulk Water Supply Authority (trading as Seqwater) • SunWater • Gladstone Area Water Board • Mount Isa Water Board.
Bulk water supply system	Consist of either a dam or a weir or other man made improvements. In South East Queensland, Seqwater is the bulk water supply authority and owns and operates the bulk water supply system infrastructure. Outside South East Queensland, the infrastructure within the bulk water supply systems is typically owned by the state entities of SunWater, Gladstone Area Water Board and Mount Isa Water Board, or councils or council-owned entities.
Committed water	Water allocations that have been sold or traded to a customer for the customer's use.
Millennium Drought	From late 1996 to mid 2010, much of southern Australia (except parts of central Western Australia) experienced a prolonged period of dry conditions, known as the Millennium Drought. The drought conditions were particularly severe in the more densely populated south-east and south-west. South East Queensland was affected from 2001 to 2009.
Priority group	Water allocations in a supply scheme that have the reliability as defined by the relevant water plan. Determined with consideration of the water security objectives and environmental flow objectives.
Supplemented water	Surface water supplied under an interim resource operations licence, resource operations licence or other authority to operate infrastructure. Usually supplied from either a dam or a weir or other manufactured improvements to supplement natural stream flows or groundwater supplies, and generally has higher reliability than unsupplemented water according to the priority group.
Unallocated water reserve	Water allocations that have been set aside in a water plan for future use or to facilitate construction of storage. It can be either supplemented or unsupplemented. Includes general, strategic, town water supply or state reserve, Indigenous reserve and strategic infrastructure (water that may be granted to facilitate the development of particular water infrastructure projects).
Uncommitted water	Water allocations that have not been committed. These allocations are usually available for lease, sale or contract subject to transportation infrastructure constraints or may be held for future business purposes.
Unsupplemented water	Water that is not supplemented water. Water that is available for use from a non-regulated source where no instream improvements or transportation assets are present to supplement natural water supplies.

Water-related terms	
Water service	Under the *Water Supply (Safety and Reliability) Act 2008*, a water service includes: • water harvesting or collection, such as dams, weirs, bores and direct extraction from watercourses • the transmission of water • the reticulation of water • drainage infrastructure other than for stormwater drainage • water treatment and recycling.
Water service provider	An entity registered as a service provider for a water service. In Queensland, water service providers include: • drinking water service providers (primarily local governments) • recycled water providers (who are not required to register as a service provider unless they also provide another water or sewerage service) • bulk water service providers and water authorities.
Water supply scheme	Combinations of dams, weirs, pipelines, channels and other storage or transport infrastructure, operated in a water plan area in accordance with a resource operations licence or interim resource operations licence.

Economic and financial terms	
Commercially viable	Projects demonstrated to achieve a commercial rate of return on invested funds.
Economically viable	There is a net economic benefit, that is, the economic benefits outweigh the economic costs following economic analysis (an economic analysis is a comprehensive analysis of all the costs and benefits associated with each proposed project option, including financial, environmental and social matters (typically employing cost–benefit analysis) with the objective determining the most economic use of resources).
Financial analysis	A financial analysis, conducted on a cash basis, determines whether projected revenues will be sufficient to cover costs, including an appropriate return on the capital invested.
Regional economic development	This is considered to include economic development that occurs in, or impacts on, metropolitan areas, regional urban centres, and rural and remote communities.

Infrastructure-related terms	
Feasibility assessment	An analysis and evaluation of a proposed project to determine if it is feasible, with consideration of financial, commercial, legal, regulatory, technical, environmental and social impacts, project demand and practicality of the proposal.
Optimism bias	A cognitive bias that causes a person to believe that they are less at risk of experiencing a negative event compared to others. Optimism bias is quite common and transcends gender, race, nationality and age.
Project proponent	An individual, group or organisation that submits or proposes a project for review and acceptance.



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