Initiatives currently being implemented

ecoBiz

ecoBiz is a partnership program that helps businesses to achieve cost savings through reduced energy and water consumption, and more productive use of materials.

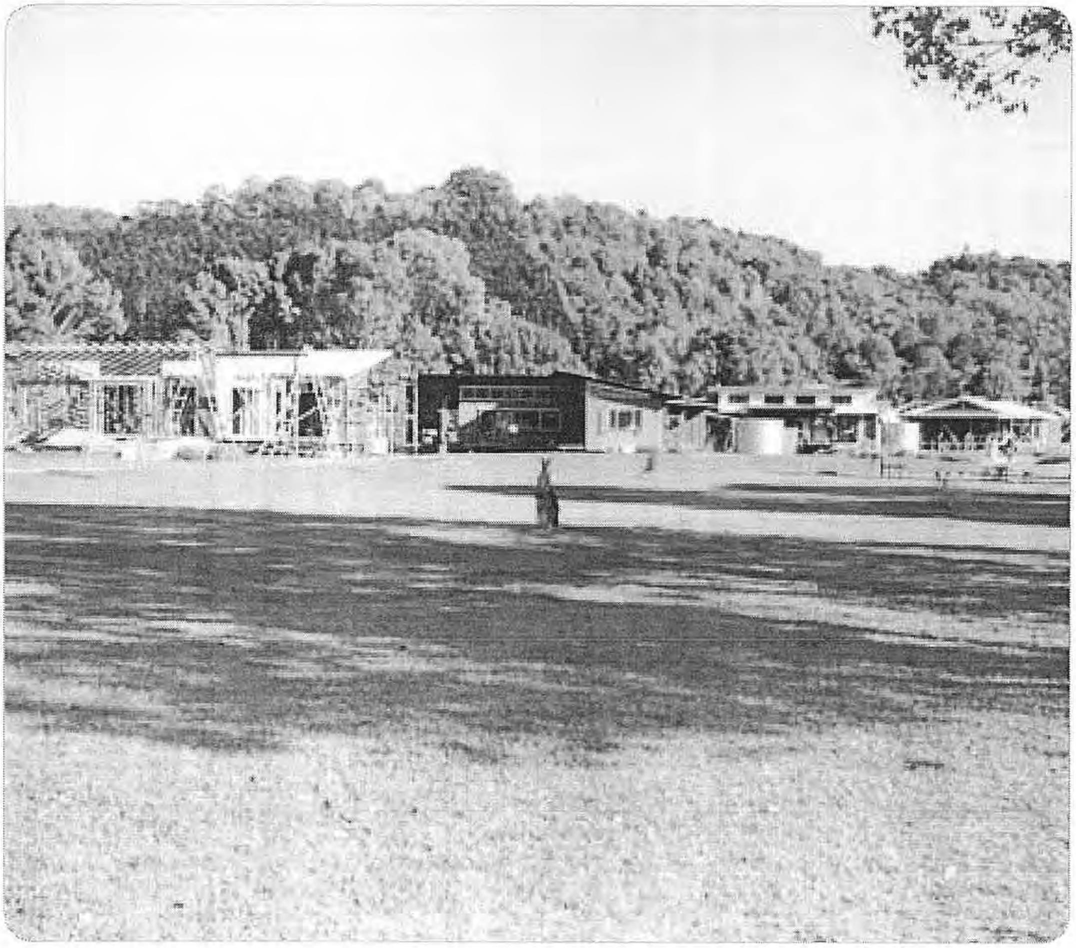
Local government rebate schemes

A number of local governments provide rebates for the installation of rainwater tanks and water efficient devices, including dual flush toilets, showerheads, washing machines and swimming pool covers. In some instances, increased rebates are offered for rainwater tanks that have been plumbed to internal fixtures.

Pricing and tariff design

Water use information to residential tenants

This measure requires water service providers to provide water use information to occupiers of residential rental properties. The advice will state the amount of water supplied to the premises during each billing period so residents can monitor their use.



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4.4 Urban demand targets

The Strategy sets a series of targets for efficient water use beyond the Millennium Drought. The initiatives to achieve this are explained below.

Section 6.1 of Chapter 6 contains a recommended demand management program to achieve the targets. Ongoing monitoring and review of water usage will be required to determine the effectiveness of the program, including the potential to further reduce the water saving target without significantly impacting upon our current lifestyle.

4.4.1 Residential demand

The average residential consumption target is 230 litres of Grid Water per person per day. This target will apply from immediately after the Millennium Drought.

The Regional Plan, released in 2005, contained a policy for all urban water providers to adopt residential reticulated water consumption targets (excluding leakage and other system losses) of:

- 270 litres per person per day by 2010;
- 250 litres per person per day by 2015; and
- 230 litres per person per day by 2020.

These targets were reviewed to incorporate measures implemented as part of the drought response and to consider the lifestyle impacts. Three approaches were used:

- Scenario based – establishing a regional demand profile based on cost-efficient potential demand management options;
- Building block – establishing a typical residential demand profile based on efficient use but without significant lifestyle impacts; and
- Historical – assessing the target against past water saving achievements in the region.

Based on this analysis, the target of 230 litres of Grid Water per person per day is considered to represent an appropriate balance between regaining the outdoor amenity and lifestyle that characterised SEQ before the Millennium Drought, and the increased costs of additional water supplies.

Scenario based approach

Three savings scenarios were prepared, based on the preliminary analysis of potential demand management measures. These scenarios summarised four potential combinations of measures, including the forecast based on pre-drought trends.

The high savings scenario comprised:

- The top 15 potential demand management measures, ranked on annualised cost;
- The pressure and leakage management project;
- Dual reticulation recycled water schemes in major new residential and industrial development;

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- Rainwater tanks on all new dwellings for use in toilets, laundries and outdoors, outside of dual reticulation recycled water areas; and
- Rainwater tanks retrofitted on 10% of existing accounts.

The high saving scenario achieved the average residential consumption target of 230 litres of Grid Water per person per day.

Building block approach

The building block approach was used to test the lifestyle impacts of the proposed combination of measures.

The Millennium Drought has shown that residents can reduce average residential consumption to below 140 litres per person per day under Level 5 and 6 water restrictions, compared to about 300 litres per person per day in 2005. However, these levels have had substantial lifestyle impacts that would be unacceptable over the longer term.

Figure 4.6 illustrates the changes in average personal water use prior to the drought (300 L/p/d) and Levels 5 and 6 water restrictions (140 L/p/d). Before the drought, outdoor consumption was about 120 litres per person per day or 40% of typical household use. This use has reduced to almost zero during the drought, due to the outdoor water restrictions. Indoor usage has reduced by 18%, reflecting a successful behavioural campaign and efficient fixture retrofit program.

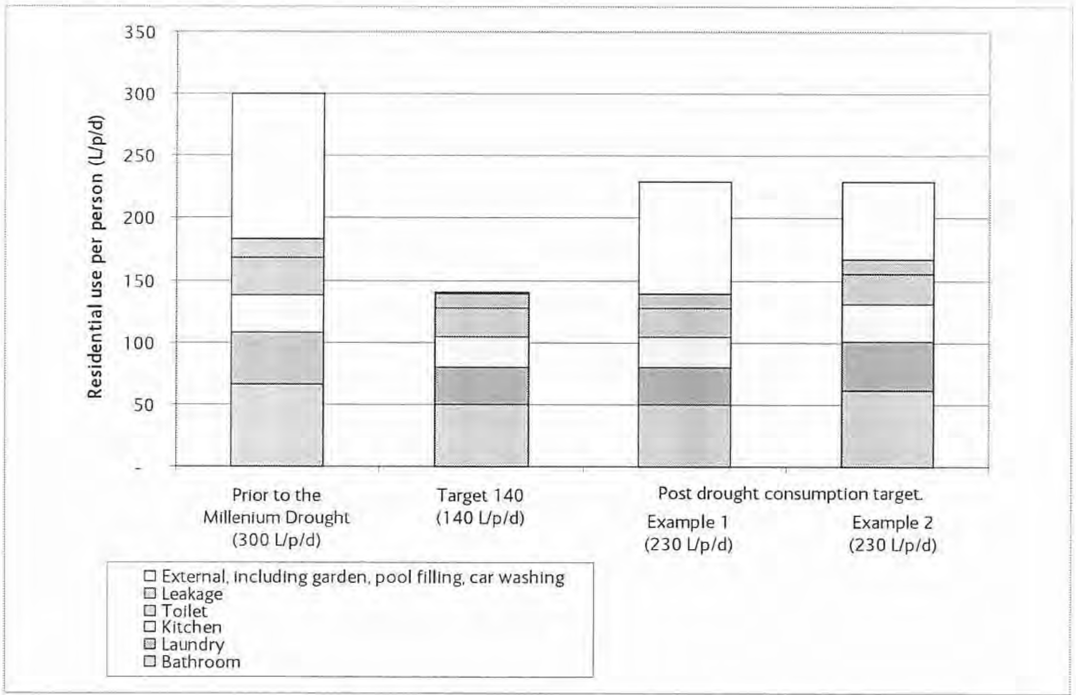

Figure 4.6 Typical residential water use in SEQ

Residential water use during the drought provides a unique opportunity to use a building block approach to derive a new residential water consumption target.

The new residential water consumption target of 230 litres per person per day represents an increase of more than 90 litres per person per day over average consumption rates during Levels 5 and 6 water restrictions. It is

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equivalent to an increase in indoor water use of about 25 litres per person per day and an allowance of 65 litres per person per day for efficient outdoor use, excluding water from rainwater tanks or other local supplies.

At about 165 litres per person per day, average indoor use would be about 10% less than prior to the Millennium Drought. This saving can be achieved immediately and without significant lifestyle impacts by continuing water saving behaviours developed during the Millennium Drought, such as turning off the tap while brushing teeth or shaving and using the correct settings on the dishwasher or washing machine.

Efficient appliances fixtures and fittings are also being installed in an increasing number of households. These fixtures and fittings will reduce water use with minimal impacts on lifestyle. The Home WaterWise Service is scheduled to install water efficient devices in 200,000 of 950,000 existing homes by mid 2008. In addition, new houses and buildings are also required to meet minimum water efficiency standards, as outlined in Table 4.3.

The average allowance of 65 litres per person per day for outdoor use has been based on 400 to 500 millimetres of watering per square meter of garden or turf per year, and has been adjusted to take into account the increased supply from rainwater tanks. By late 2007, rainwater tanks had been installed on more than 130,000 dwellings in SEQ. Efficient outdoor watering practices include using a trigger nozzle on hoses and other efficient garden irrigation technology.

In practice, the residential consumption target will not be prescriptive in terms of proportion of indoor or outdoor water use. Figure 4.6 contains two examples of how a resident may achieve the target. For example 1, the amount of water used in the bathroom has been maintained at a similar level to that achieved, on average, during the Target 140 campaign. Example 2 illustrates the effect of an increase in bathroom usage to a level similar to the pre-drought average. The difference in outdoor water use is about 20 litres per person per day.

It is expected that actual consumption will vary between households and across the region. On average, residents of new dwellings will use less water than residents of existing dwellings, due to water efficient devices, rainwater tanks or other alternatives. Likewise, residents of units will, on average, use less water than residents of detached dwellings with gardens. Large households will tend to use less water per person than small households, and use will vary marginally across the region due to climatic differences, such as lower rainfall.

Historical approach

The target of 230 litres per person per day is similar to the average consumption level during 2005 when Level 1 water restrictions were enforced. The restrictions allowed for unattended outdoor watering, filling and topping up pools, and washing cars. Residents were not asked to shorten their showers or install water efficient appliances. During this period SEQ residents used on average 227 litres per person per day.

4.4.2 Non-residential demand

Business and industry, government and other large users of water need to conserve water supplies by using less and being more efficient water users. As part of the response to the Millennium Drought, the QWC has implemented a package of measures that will deliver efficiencies and savings for businesses while minimising risks to economic production and employment.

Through these permanent measures, business and industry will continue to move towards best practice water efficiency. Regular review and updating of WEMPs will assist in this process.

Businesses using more than 10 ML/a have been required to prepare, submit and comply with a WEMP which must set out how the business can either reduce their water consumption by at least 25% or achieve best industry practice.

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All businesses must ensure their urinals and cooling towers are efficient, and businesses using 1 ML/a or more must ensure that all internal water fittings on the premises are water efficient.

4.4.3 Power generation

Power stations will be required to use recycled water where the appropriate quality is available. Most of the water used in power stations is for cooling and much of this is lost to the atmosphere as evaporation. Over time, impurities in the water become concentrated which can lead to scaling and fouling. It is routine practice in a power station to 'blow down' cooling water when the impurities become too high. For power stations that are able to access high purity recycled water, they will not need to blow down as often and hence their overall demand for water will be reduced.

The Western Corridor Recycled Water Project will provide the capacity to supply recycled water directly to the Swanbank, Tarong and Tarong North power stations. The System Operating Plan will direct the supply of water to power stations.

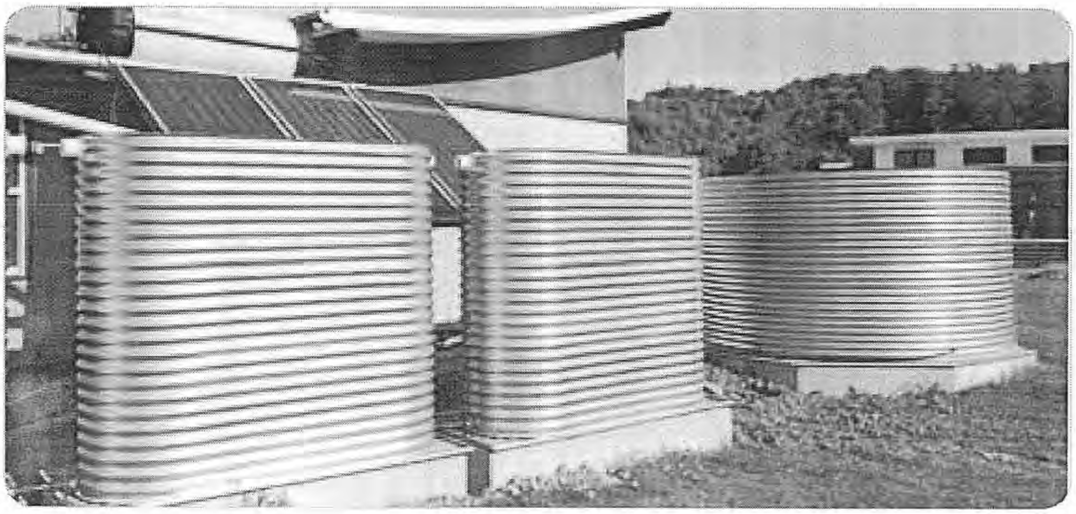
4.4.4 System losses

Bulk transport and network distribution system loss targets have been set at no more than 8% of total urban water use. This target will be achieved through the pressure and leakage reduction project and the design and management of new distribution infrastructure.

System losses comprised 14% of urban demand in 2005. System losses include losses from authorised uses such as fire fighting, unauthorised uses such as theft, and other losses from inaccurate meter readings and leakage.

Commenced in 2006, the pressure and leakage reduction project has a target of achieving a saving of about 22,000 ML/a in the short-term. System leakage targets have been set at the economic break-even point for each District Metered Area, with over 400 areas having been targeted, comprising a substantial length of the regional distribution network. Once completed, the project is forecast to reduce system losses to less than 10%.

Ongoing management of the distribution infrastructure will continue following the pressure and leakage reduction project, including active leakage detection and the design of new infrastructure. Over the medium- to long-term, this management should seek to further reduce system losses to 8% of total urban use. This target represents best practice based on industry benchmarking for system losses.



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Examples of current non-residential programs

Water Sensitive Urban Design – Pimpama Coomera WaterFutures Master Plan

The suburbs of Pimpama and Coomera at the northern end of the Gold Coast are expected to grow from approximately 15,000 people to around 120,000 people by 2056. The Pimpama Coomera WaterFuture Master Plan has been developed by Gold Coast City Council and is the largest integrated water cycle management program ever undertaken in Australia. The Master Plan aims to reduce the use of drinking water in new homes by up to 84%. A recycled water system is a key part of the Master Plan.

Industrial water recycling – BP and Caltex refineries

Since 2000, the BP Amoco Refinery at Bulwer Island in Brisbane has been using an average of 3,650 ML/a of recycled water. In a similar project currently under construction, the Caltex refinery at Lytton will soon be receiving wastewater from the nearby Wynnum Wastewater Treatment Plant at a rate of 1,600 ML/a. Both these projects are examples of recycled water substitution that will directly reduce the demand on drinking water supplies.

Industrial water management – Dairy Farmers Booval, Ipswich

Dairy Farmers is one of the largest dairy manufacturers in Australia. Recent improvements at the Booval Dairy Farmers plant have led to greater recovery and reuse of water, allowing the plant to reduce water consumption by 18%. An additional benefit is that effluent discharge from the plant has been reduced by 48%. Dairy Farmers plans to increase water use efficiency further with the installation of a new reverse osmosis plant for concentrating milk products. The high quality water obtained from this process will be used in other processes within the plant.

Commercial water management – Logan Hyperdome

The Hyperdome Shopping Centre in Logan City serves more than 10 million shopper visits each year. Centre management have implemented a number of water savings programs since 2005, including converting existing urinals to waterless technology and fitting water restrictors to taps. These measures are estimated to have saved 24 ML/a. A new program to recycle cooling tower water for use in toilets and garden watering is underway. The program aims to save another 30 ML/a.

Government buildings – Water SMART Buildings

This program aims to reduce water consumption in Queensland Government owned commercial buildings, facilities and parks. High water use facilities have been targeted with a program of works to improve their water efficiency. Projects are also underway to replace single flush toilets and install water efficient tapware, showerheads and flow restrictors.

Rural water use efficiency – SEQ Irrigation Futures

The SEQ Irrigation Futures project was established to improve the efficiency and off-farm impacts of irrigation. Participating industries include horticulture, dairy and fodder, turf, flora, and nursery and garden. A key objective is to provide research and development that will underpin a 10% improvement in water use efficiency by 2009. Technologies and management practices for improved irrigation practice have been developed, trialled and evaluated through water balance models, spatial variability assessments, zonal irrigation management and tool kit support for industry consultants.

4.5 Rainwater and local recycling

4.5.1 Rainwater tanks and stormwater harvesting

A large proportion of development in SEQ is located in coastal areas that receive higher rainfall than existing major dam catchments. Rainwater tanks and stormwater harvesting provide a means of capturing some of this rainfall. Rainwater tanks are able to collect inflows from light rainfall, whereas dams may require 50 mm or more of rainfall in the catchment area before runoff commences.

Installing rainwater tanks on existing and new houses and commercial premises potentially provides an additional source of water suitable for outdoor irrigation, topping up pools and some indoor uses, such as toilet flushing and laundry.

Since 1 January 2007, all building development applications lodged for the construction of new homes in SEQ must meet mandatory water saving targets. Detached houses must target savings of 70,000 litres per year, while terrace houses and townhouses must aim to achieve savings of 42,000 litres per year. Rainwater tanks are one option to achieve the water saving target. Alternative solutions to achieve the water saving target include communal rainwater tanks, stormwater harvesting and dual reticulation recycled water systems.

The water saving target is forecast to apply to about 500,000 new houses by 2026 and about 800,000 houses by 2056. At this rate, rainwater tanks and stormwater harvesting are forecast to comprise about 7% of supply at 2056. The actual number of new houses depends on a range of factors including population growth and household size. The forecast takes into account variations in the yield of rainwater tanks across the region.

In new dwellings, rainwater tanks are cost effective compared to desalination and PRW. This cost effectiveness is due to:

- Cost being minimised by installing the tank and internal plumbing connections during construction; and
- Yield being maximised through minimum regulated requirements regarding the size of the tank, connected roof area and plumbing into toilets and washing machines.

The savings that could be achieved for similar costs in existing homes are estimated to be considerably lower. Retrofitted rainwater tanks are generally less cost effective due to smaller tanks, smaller connected roof area and fewer, if any, internal connections such as to toilets or washing machines.

Stormwater harvesting is currently a boutique solution and must be considered on its merits, case by case. Stormwater is generated when rainwater falls on hard or impervious surfaces and is collected in stormwater drains and pipes. Stormwater harvesting involves the collection and storage of stormwater, followed by treatment and reuse at a later time. The appropriate use depends upon the quality of treatment. Stormwater may be stored in a small dam or reservoir or used to recharge a groundwater aquifer (there are a limited number of suitable aquifers in SEQ).

Following treatment, water is distributed from the storage or treatment plant to the point of use. The extent of the distribution system depends on the scale of the system, the intended uses and the location of storages and treatment systems relative to the point of use.

The scale of stormwater harvesting can vary from lot scale, such as a shopping centre or industrial development, to a regional scale. At the lot scale, stormwater harvesting may involve the capture and reuse of water for use in toilets and for outdoor irrigation. Storage could be provided in underground tanks under car parks or internal roads.

At the suburb scale, runoff from a new development area might be collected in a wetland for treatment and used for outdoor irrigation or through a dual reticulation system. At the regional scale, stormwater harvesting might involve collecting runoff from a large catchment area that includes urban and rural areas. The water may be treated to a high standard and used to supplement drinking water supplies.

Stormwater quality varies greatly between locations and over time. Stormwater use involves health risks that must be appropriately managed. Stormwater use will be regulated under the same legislation as recycled water schemes. The cost of regulating stormwater use will be a considerable factor in determining the viability of such schemes.

Stormwater harvesting is generally not cost effective compared to rainwater tanks or new sources of supply, such as PRW as illustrated in Figure 4.4. The high cost of such schemes is generally due to the cost of the land required for the small dam or reservoir. The cost of constructing the collection, storage, treatment and distribution infrastructure can also be substantial. The high cost may also be due to the infrastructure only being used intermittently, due to the dam or reservoir running dry.

The Queensland Government is undertaking more detailed research to assess opportunities for stormwater harvesting in SEQ, as explained in Section 6.7.1, Chapter 6.

4.5.2 Other types of recycling

Apart from PRW, other types of water recycling may provide additional water supplies for the region. Such recycling opportunities may involve:

- Effluent from a wastewater treatment plant that is not part of a PRW scheme;
- Excess effluent from a wastewater treatment plant that is surplus to the requirements for the local PRW scheme;
- Raw sewage that is extracted from the sewerage system and treated using sewer mining technologies; and
- Greywater.

A feature of recycled water is that the treatment process and water quality can be tailored to suit the use, optimising the capital and operating costs. Where treated wastewater effluent is not fully upgraded to PRW, it might still be of a suitable quality to be used for:

- Agricultural applications such as irrigation;
- Parkland irrigation;
- Industry activities; and
- Toilet flushing and outdoor irrigation in residential developments, through a dual reticulation system.

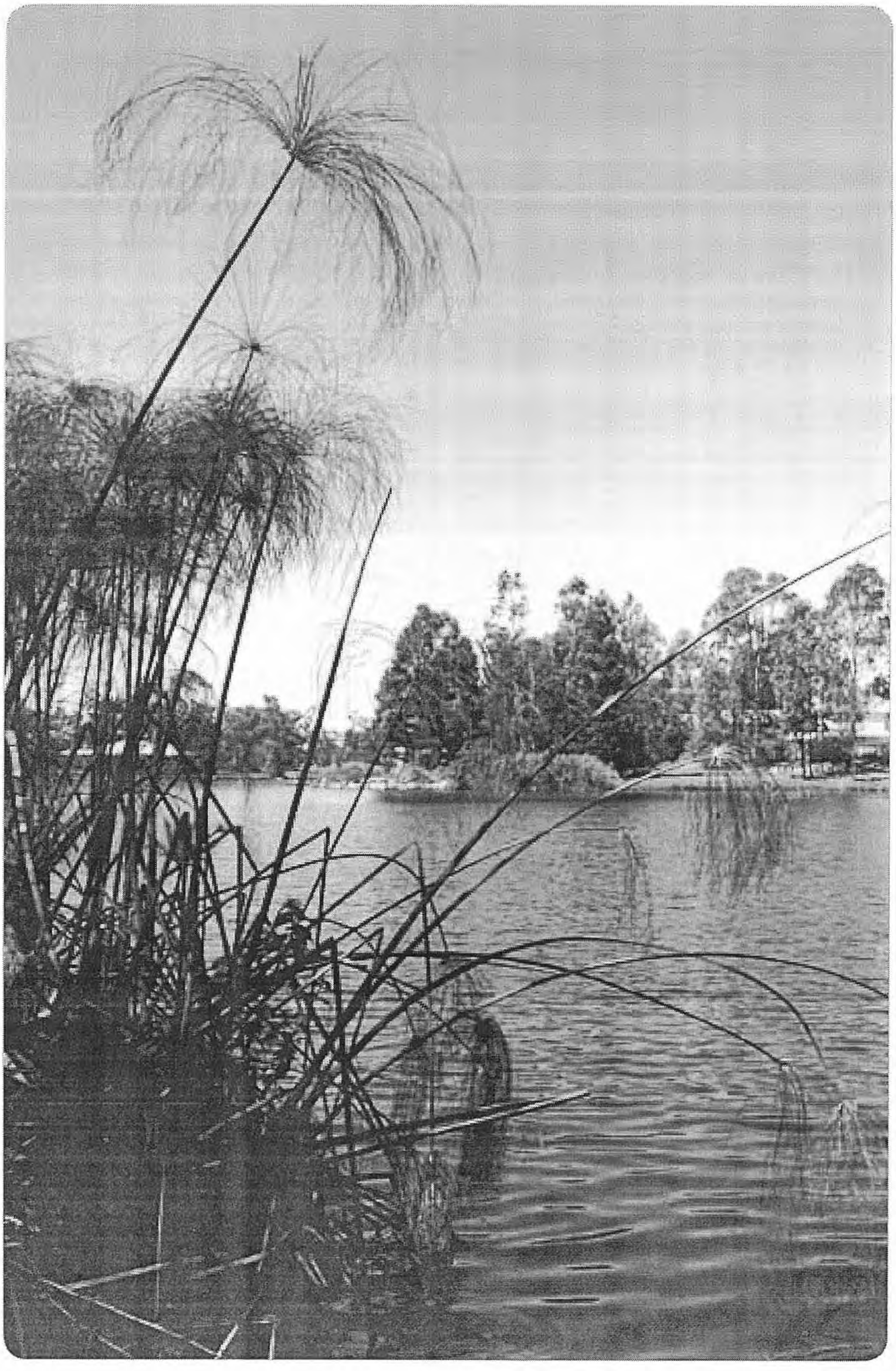

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Table 4.4 provides a summary of wastewater discharges by Local Government Area and provides a summary of the existing use of these wastewater discharges. Significant volumes of wastewater are currently available to feed both local and bulk recycling schemes in the future. In total, about 17,000 ML of wastewater was recycled in 2006, predominantly for use on sports grounds and golf courses.

Table 4.4 Wastewater volumes from regional treatment plants.

Local Government Area	Wastewater (ML/a)				Type of recycled water use as a proportion of total recycled (2006)					
	Available 2006	Available 2026	Available 2051	Recycled 2006	Industrial	Rural	Parks & gardens	Environ-mental flow	Sports grounds	Tanker stand pipe
Beaudesert	700	6,000	17,300	250				67%	33%	
Boonah	300	400	500	150		53%			47%	
Brisbane	100,000	116,700	130,000	1,950	80%				20%	
Caboolture	6,400	11,300	13,900	150	50%		50%			
Caloundra	8,600	13,100	22,800	700					100%	
Esk	400	600	1,000	100		100%				
Gatton	500	1,300	1,700	150		60%	10%		30%	
Gold Coast	51,000	65,500	76,700	6,550	2%		15%		80%	3%
Ipswich	10,700	24,600	41,000	800					100%	
Kilcoy	100	200	300	50					100%	
Laidley	200	1,000	2,700	100		100%				
Logan	15,700	16,600	19,200	50		85%	15%			
Maroochy	14,000	19,900	21,600	800		14%	2%		82%	2%
Noosa	3,800	4,100	4,100	850					100%	
Pine Rivers	8,900	12,900	17,300	250			10%		90%	
Redcliffe	5,400	5,500	5,900	150					100%	
Redlands	10,100	12,800	12,900	2,750					100%	
Toowoomba	8,500	8,900	10,400	850	100%					
Total	245,300	321,400	399,300	17,200						

Dual reticulation recycled water schemes

Dual reticulation recycled water schemes involve the construction of separate distribution systems for drinking water and recycled water. In residential areas, the recycled water is plumbed to homes for flushing toilets and outdoor irrigation. Dual reticulation recycled water schemes can result in a high percentage of recycled water reuse and potentially reduce the impact of any future water restrictions.

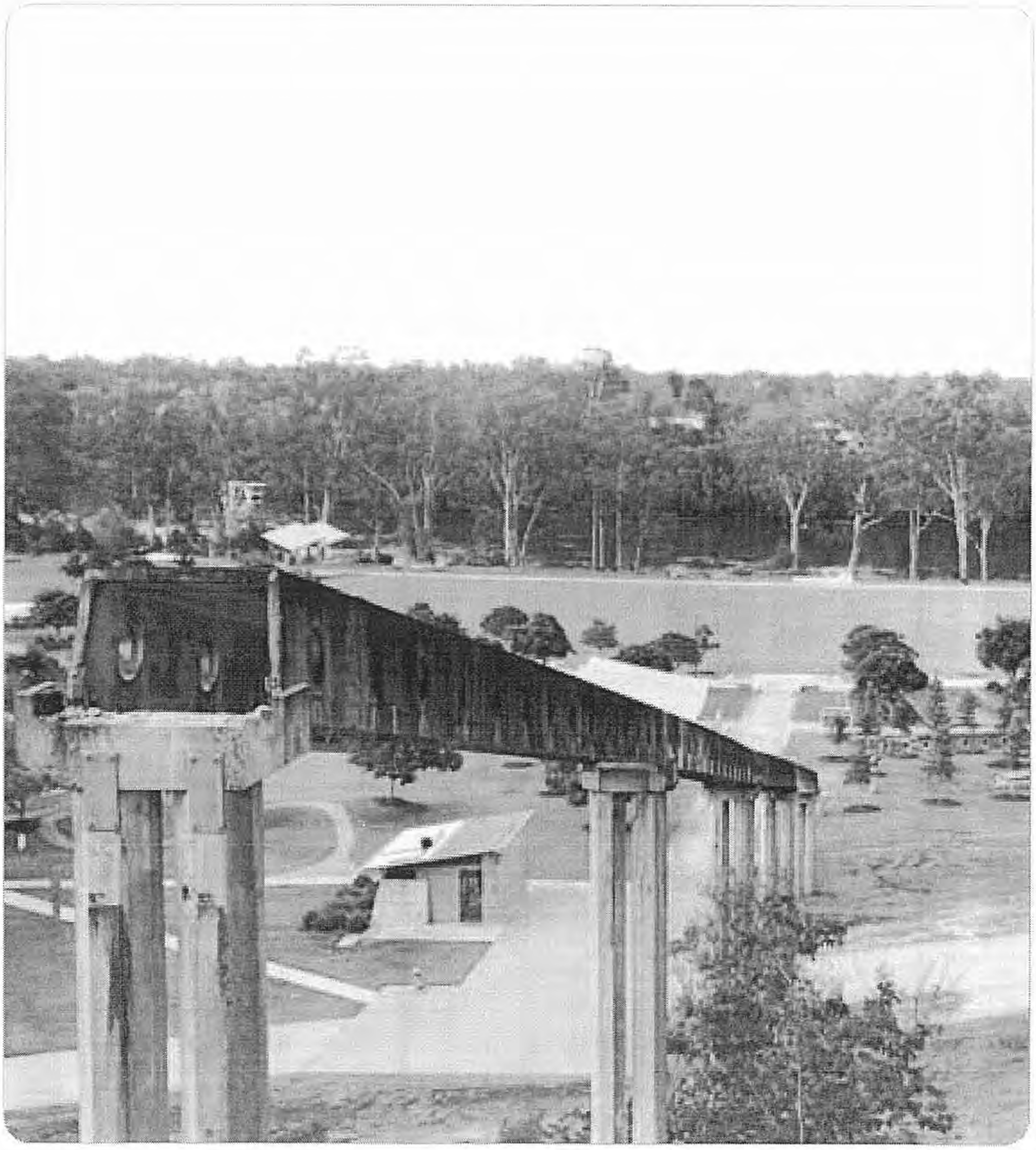
These schemes have a secondary benefit of dispersing nutrients that would otherwise have been discharged from wastewater treatment plants into waterways and Moreton Bay. However, the schemes need to be strictly regulated to minimise health risks due to cross connections.

In SEQ, dual reticulation recycled water schemes are one option to achieve the mandatory water saving targets for new homes, as outlined in Section 4.5.1.

Greywater systems and sewer mining

Greywater systems can assist in reducing demand for potable supplies. These must be carefully managed, due to potential health risks. The Queensland Government introduced new laws in March 2006 to broaden the use of greywater. Under this legislation, anybody is allowed to manually bucket greywater from the laundry and bathroom (not black water), or to connect a flexible hose to divert it from the washing machine to the garden. An application to the local Council is required for more sophisticated systems, such as a diverter unit or treatment plant. Such systems must be installed by a plumber licensed in Queensland and must meet Australian standards.

Sewer mining (where sewage is pumped directly from the sewer, treated and used on site) is a minor element of the Strategy, due to cost and a preference for PRW. With advances in technology, sewer mining may become more economically viable and schemes may be developed where treated effluent is available.



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4.6 Forecast demand

Based on pre-drought trends, demand for water for urban uses and power generation would increase from around 478,000 ML/a in 2005 to approximately 985,000 ML/a in 2056. With high series population growth, demand would increase to around 1,196,000 ML/a.

These forecasts include an allowance for continuing increases in per capita water use. For the Strategy, total urban demand was forecast to increase from 468 litres per person per day in 2005 to around 500 litres per person per day by 2056. This compares with the residential water consumption target of 230 litres per person per day.

Based on projects and initiatives currently being implemented, the demand management program described in Section 6.1 of Chapter 6, and medium series population growth, regional demand is predicted to increase to 535,000 ML/a in 2026 and 749,000 ML/a in 2056. With high series population growth, demand is forecast to increase to approximately 907,000 ML/a in 2056. Table 4.5 presents a summary of these forecasts, together with the savings compared to pre-drought trends.

Table 4.5 Forecast urban demand excluding existing rural allocations

	2005 estimated water consumption (ML/a)	2026 forecast demand (ML/a)	2056 forecast demand (ML/a)
Medium series population projections			
Pre-drought trends	472,396	690,000	985,000
Strategy demand management program	–	535,000	749,000
% saving	–	22.4%	23.9%
High series population projections			
Pre-drought trends	472,396	749,000	1,196,000
Strategy demand management program	–	580,000	907,000
% saving	–	22.5%	24.1%

Note: Forecasts include demand for power stations and rural communities and include parts of Cooloola Shire Council that are likely to be supplied from Burumba Dam.

Table 4.5 presents the forecasts for water demands ranging from most likely to likely highest demand. This range has been used to ensure that planning is sufficiently flexible to be able to respond to changes in population growth or consumption trends. Cases where savings initiatives within the high savings projections are slower to come into effect or do not fully materialise, will be within the envelope of the two scenarios. For example, the higher demand estimates may eventuate if the water saving target for residential use is not achieved. Also presented in the table is the pre-drought trend, as a point of comparison.

Figure 4.7 shows how urban demand for bulk water will increase from 2005 to 2056 using medium series population growth with measures currently being implemented and the demand management program. Also shown is the distribution of demand amongst the major sectors, as well as system losses and the water saved.

Achieving these savings requires average targets of 230 litres per person per day of residential use and 375 litres per person per day of total water usage, excluding water for rural production.

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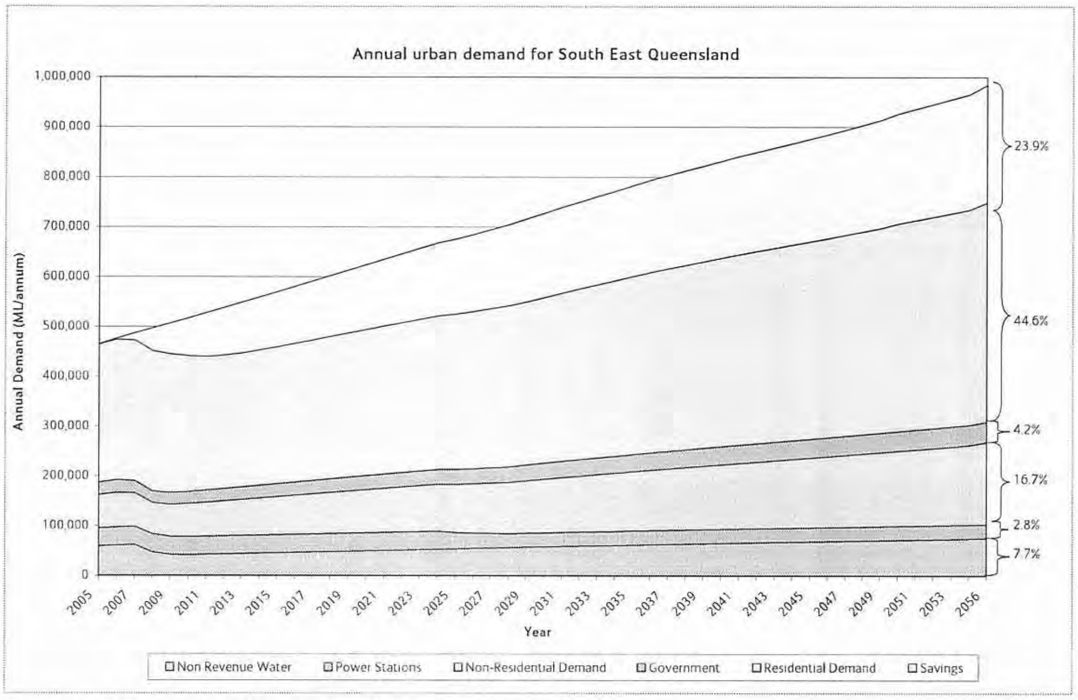

Figure 4.7 Forecast total demand excluding water for rural production

Demand reductions need to be achieved by all sectors of the urban community. Figure 4.8 shows demand forecasts by sector, together with the expected savings in each sector over time.

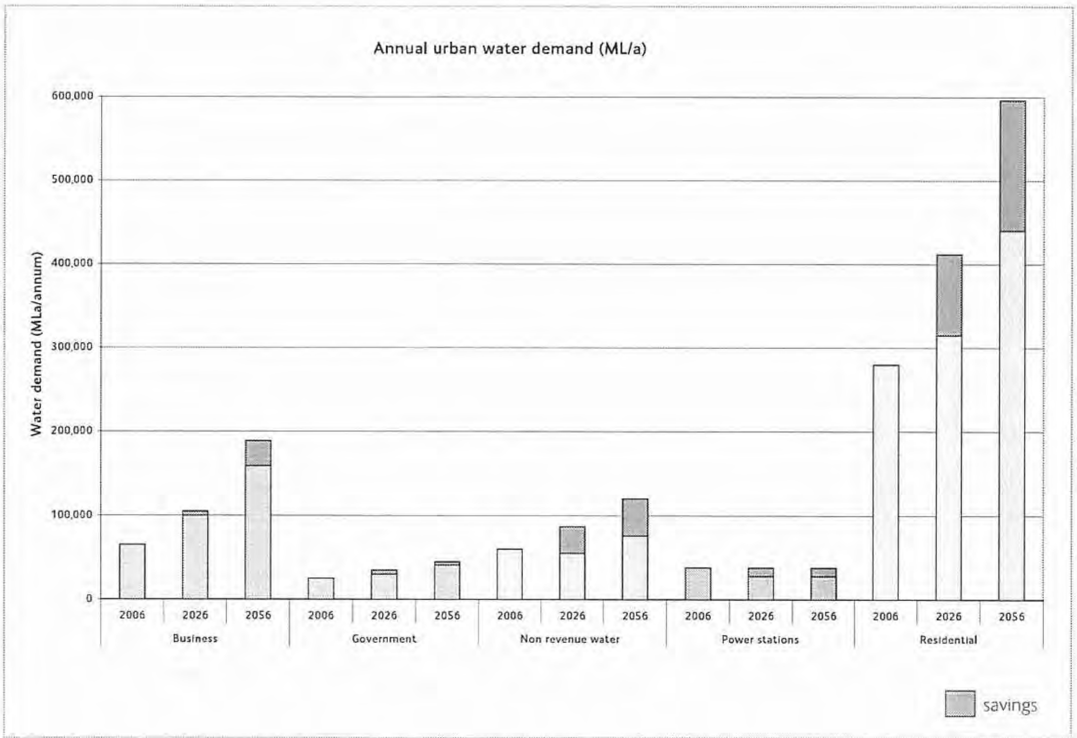

Figure 4.8 Forecast urban water savings by customer group

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4.6.1 Forecast urban demand

Prior to the drought, residential use accounted for around 65% of urban demand. Figure 4.7 shows the relative proportion of residential water use is projected to decline to about 44% of urban water use by 2056.

Non-residential water use represented approximately 21% of total urban water use in 2005. An estimate of the breakdown of water use by sector is provided in Figure 4.9. This data is for 2005, prior to the implementation of WEMPs and BWEP.

Non-residential demand is forecast to increase from 91,426 ML/a in 2005 to about 130,000 ML/a in 2026 and about 200,000 ML/a in 2056, based on medium series population growth. At these rates, non-residential water use is forecast to comprise about 27% of urban demand at 2056.

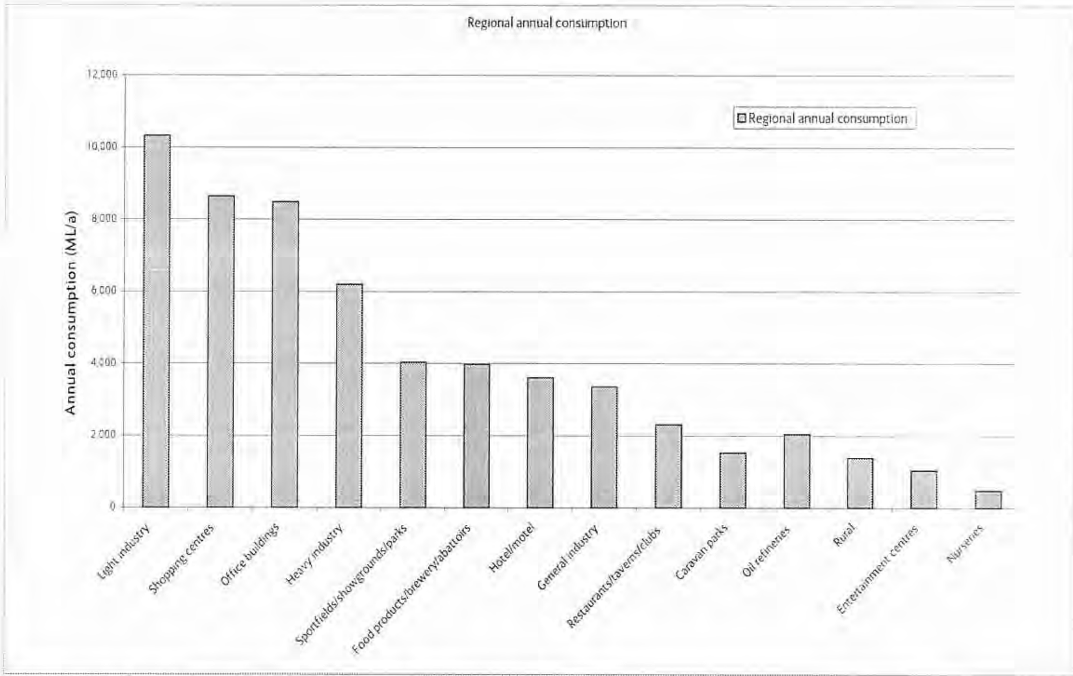

Figure 4.9 Breakdown of water use in business sector (2005)

4.6.2 Forecast power generation demand

In 2005, about 38,000 ML was used for power generation in SEQ, equivalent to 6% of total consumption. Most usage occurred in coal fired power stations which require a significant amount of water for coal washing, steam generation and cooling. SEQ power stations have implemented a range of responses to the current drought. These measures will continue beyond the drought, and include:

- The Swanbank, Tarong and Tarong North power stations will use PRW from the Western Corridor Recycled Water Project;
- The Swanbank B and E power stations have implemented a range of water saving measures including stormwater collection to supplement cooling water; and
- The Tarong and Tarong North power stations have implemented a range of water saving measures including installation of a reverse osmosis plant to recycle stormwater, boiler blowdown water and ash dam water.

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Increasing the energy and water efficiency of power stations takes time, investment and planning. Over time, power generation in SEQ is expected to become less water intensive through the penetration of alternative technologies such as gas-fired electricity generation, and renewable energy technologies.

These savings may be partially offset by demand for water for new power stations. Alternatively, an increasing proportion of electricity may be transported into SEQ via transmission networks.

Power generation is forecast to continue to use about 36,500 ML/a of Grid Water up to 2026, taking into account increases in water use efficiency and the possible construction of new power stations. Beyond 2026, improved water use efficiency is forecast to reduce demand to about 28,000 ML/a.

4.6.3 Forecast rural communities' demand

Demand forecasts for rural communities with stand alone sources of system are described in Section 6.4.1, Chapter 6. Demand is expected to remain at approximately 1% of total demand.

These demand forecasts have been derived from the October 2006 population growth forecasts from the then Department of Local Government, Planning, Sport and Recreation. An assumption has been made regarding the proportion of connected and unconnected properties in each council area in the future.

4.6.4 Forecast rural production demand

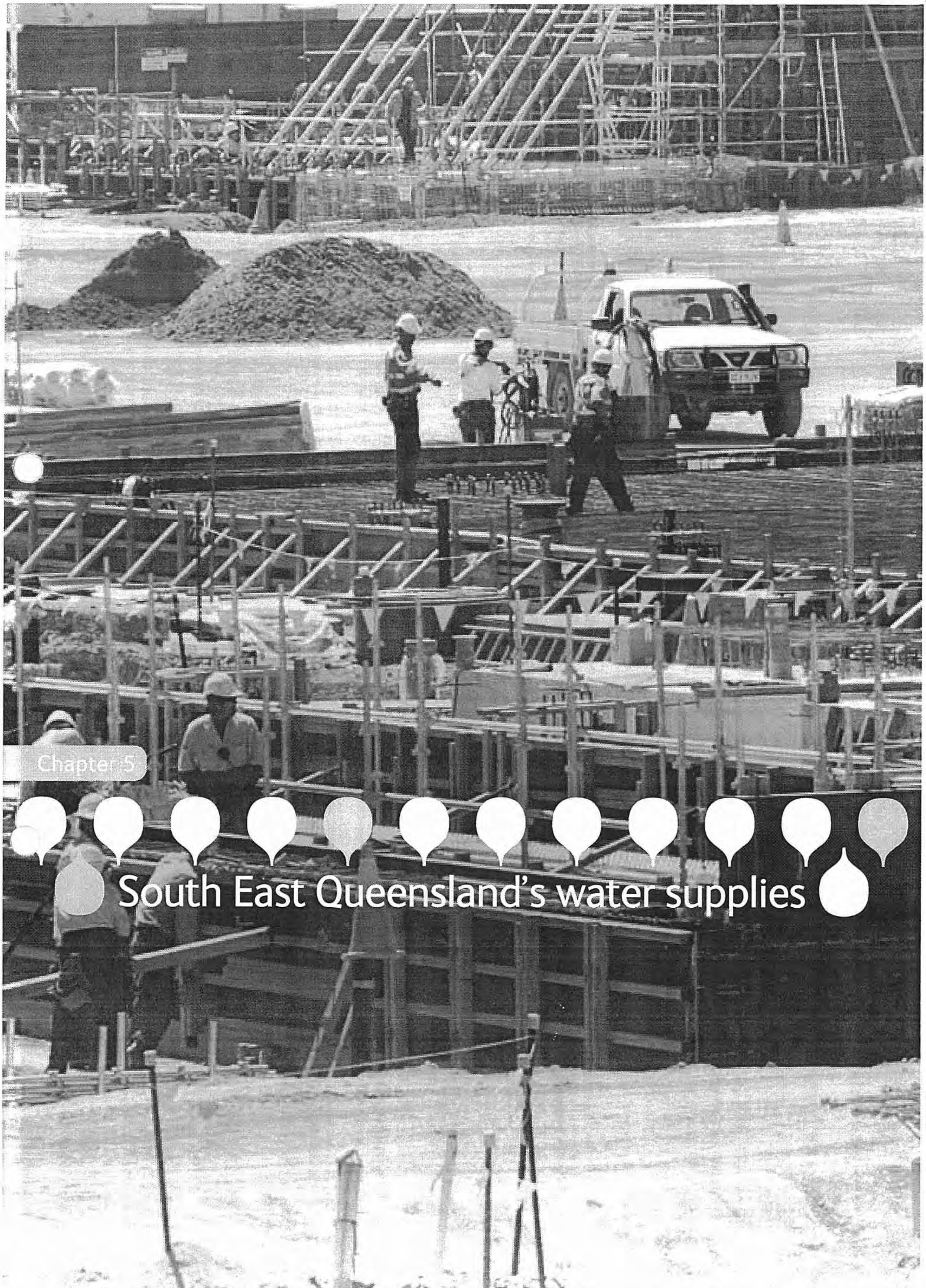
The growth in rural activities in SEQ is limited by the availability of water, with some restrictions on land use. With the current allocations of water available under the Water Resource Plans, there are only limited opportunities for growth in the rural sector in terms of hectares under irrigation. Within this area, there may be changes to the types of crops and rural activities driven by the national water reforms and other initiatives in progress.

Section 6.5 of Chapter 6 explains commitments made regarding additional water for rural production. Apart from this water, it can be expected that rural water consumption will remain at around 24% of total demand, which is similar to 2005, as summarised in Table 4.1.

4.7 Monitoring and updating

Whilst the overall demand can be accurately measured, it has not been possible to accurately measure specific sub-sectoral water consumption across all council areas due to the different methods of categorising land use in existing water billing databases. To improve reporting and ensure consistency across the region, a best practice data management system is in development. The South East Queensland Water Accounting Framework (SEQWAF) will deliver consistent and accurate data across the region, providing a sound basis for future program development and performance monitoring.

Assumptions underpinning the demand projections for the Strategy will continue to be reassessed and refined by the QWC on an ongoing basis. This will ensure that demand forecasts continue to be relevant. Relevant variables include market penetration of water efficient technologies, changes to population growth forecasts, and behavioural change.



Chapter 5

South East Queensland's water supplies

5. South East Queensland's water supplies

This chapter describes existing and committed supply sources. It explains the yield of these sources using the LOS approach outlined in Chapter 3, including the benefits of the Water Grid and the potential impact of climate change. It also recommends a series of projects for detailed investigation, including potential desalination and PRW schemes.

Key messages

- The Strategy indicates that additional sources of water will not be required before 2028, unless brought forward as part of a response to a drought as severe as the Millennium Drought.
- If assessed under a LOS approach, the system yield of existing surface and groundwater supplies is estimated at 416,000 ML/a. This is 20% less than the existing urban allocation as at 2007.
- For the purposes of preliminary analysis, a scenario accounting for climate change has been assessed which would result in a further 10% reduction in the yield of existing storages. This scenario would reduce system yield to about 374,000 ML/a.
- The Strategy will be revised as information on the likely impacts of climate change improves.
- A range of actions are currently underway to ensure that adequate water supplies can be maintained during the Millennium Drought.
- Constructing interconnections and operating the Water Grid as a single system will increase the LOS system yield by about 14% above the existing supply arrangement.
- By 2012, the combined benefit of committed infrastructure projects and the interconnected system will increase the LOS system yield to about 684,000 ML/a. This yield would reduce to about 631,000 ML/a under the climate change scenario.
- Reliance on water from dams and weirs will reduce from 95% of the total regional supply in 2006 to about 75% in 2012.
- There are limited opportunities to substantially increase supply by developing new dams in SEQ beyond those already committed.
- Groundwater in the SEQ region is considered to be almost fully utilised.
- Potential future desalination and PRW projects have been identified for detailed investigation.

5.1 Existing water sources

SEQ currently relies almost exclusively on water from dams and weirs. Only about 5% of the drinking water supply comes from groundwater, although groundwater is an important resource for the rural sector. As explained in Chapter 2, the manner in which these water supplies are allocated for consumptive purposes is determined by the *Water Act 2000* through Water Resource Plans and Resource Operations Plans.

Figure 5.1 illustrates existing sources of urban supplies in SEQ. The following major sources comprise most of the available supply:

- Brisbane River system, comprising the Wivenhoe and Somerset dams, Lake Manchester and the Mt Crosby Weir;

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- North Pine Dam;
- Hinze and Little Nerang dams;
- Baroon Pocket Dam;
- North Stradbroke Island groundwater system; and
- Cressbrook, Perseverance and Cooby dams in Toowoomba.

Borumba, Moogerah and Maroon dams supply significant quantities of irrigation water. Lake Dyer, Lake Clarendon and Atkinson Dam are small dams that have been constructed specifically to deliver irrigation supplies.

Groundwater aquifers generally provide relatively high-quality water that, under the right circumstances, requires little treatment before use. In SEQ, water from groundwater aquifers is currently used for:

- Supplying significant quantities of drinking water to Redlands Shire, Toowoomba City and some southern suburbs of Brisbane;
- Supplying drinking water to small communities such as those at Mt Tamborine and on North Stradbroke Island; and
- Irrigation supplies to the Lockyer and the Warrill Valleys.

Private bores in coastal sands and backyard bores on the mainland provide small unregulated quantities of water, mainly for garden irrigation.

5.1.1 Existing water supply zones

SEQ is currently supplied from a series of largely discrete water supply zones, as illustrated in Figure 5.1. These supply zones are:

- Brisbane and surrounding shires and cities, which are supplied from the Brisbane River system and North Pine Dam;
- The Gold Coast, which is supplied from the Hinze and Little Nerang Dams;
- Caloundra and Maroochy, obtaining water from Baroon Pocket Dam, the South Maroochy system and Ewen Maddock Dam;
- Noosa and Cooloola, obtaining water from Borumba Dam on the Mary River and Lake MacDonald;
- Redlands, obtaining supplies from Leslie Harrison Dam and North Stradbroke Island groundwater;
- Toowoomba, obtaining supplies from Cressbrook, Perseverance, and Cooby Dams and local groundwater;
- Beaudesert, obtaining supply from Maroon Dam; and
- Boonah, obtaining water from Moogerah Dam.

Some connectivity exists between the Brisbane zone and the Gold Coast and Beaudesert zones.

The Tarong Power Station obtains supplies from the Brisbane River system as well as Boondooma Dam. Recycled water has been the main supply for the Swanbank Power Station since the end of August 2007, when it was connected to Bundamba Advanced Water Treatment Plant. If insufficient recycled water is available, backup supplies can be sourced from the Moogerah system or the Brisbane River system.

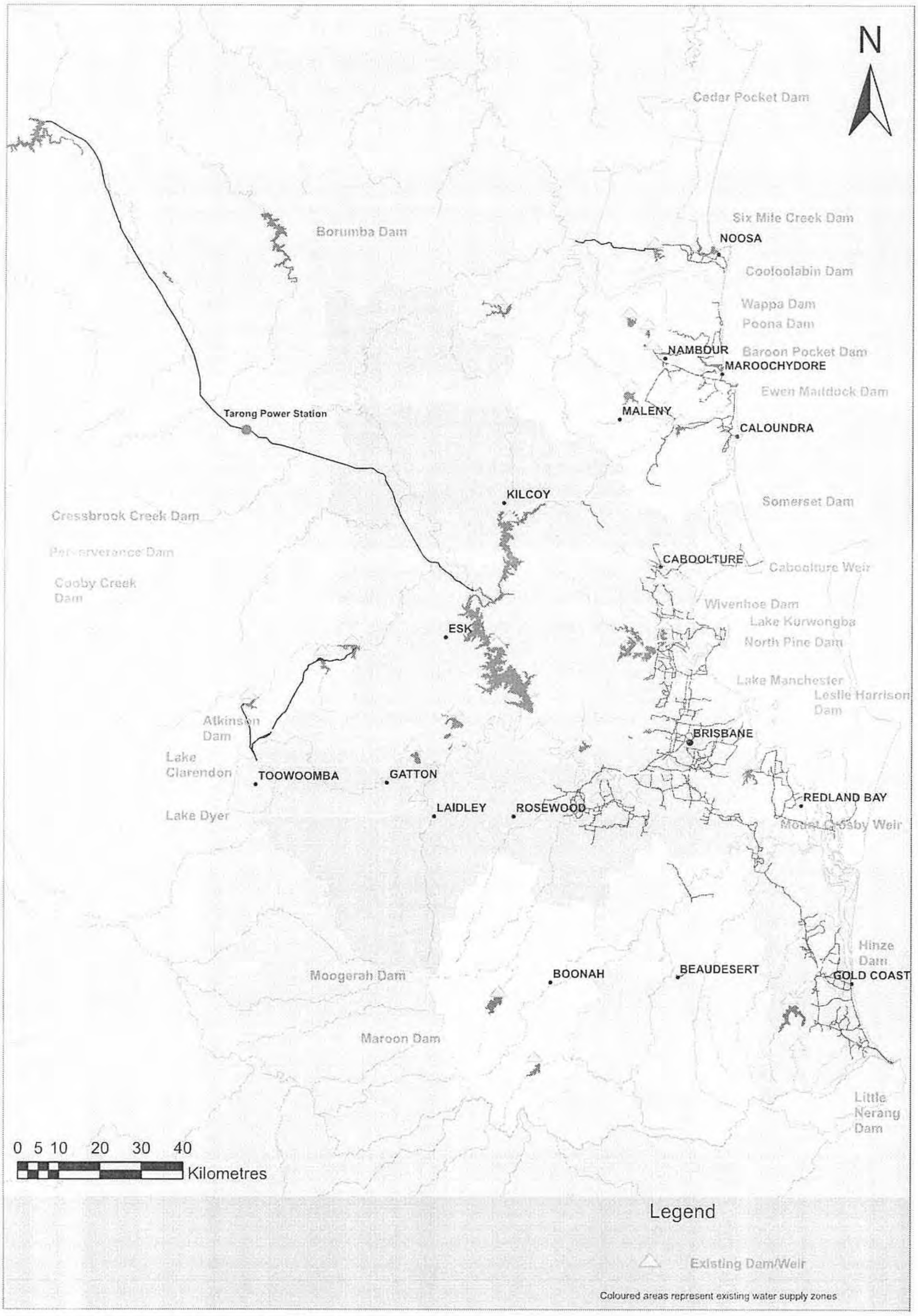

Figure 5.1 Existing bulk water supply and transport infrastructure

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5.2 Committed projects

A range of actions are underway to ensure that adequate water supplies can be maintained during the current drought in SEQ. These actions are set out in the Drought Regulation, which was introduced by the Minister for Water in August 2006. The actions are being undertaken by a number of service providers, including the Queensland Government, local government entities and special purpose vehicles such as the Western Corridor Recycled Water Company. For each project, the Drought Regulation specifies the service provider responsible for delivering the project, timelines and target water volumes to be achieved.

Table 5.1 and Figure 5.2 describe the regulated actions and the expected supply volumes. In practice, these projects will be interdependent and the overall increase in LOS system yield is not comparable to the sum of the expected supply volumes.

Table 5.1 Drought Regulation projects

Bulk water supply and transport projects	Pipeline capacity (ML/a)[1]	Forecast supply capacity (ML/a)[1]
Bribie Island Groundwater Project	–	1,800
Brisbane Aquifer project	–	7,300
Hinze Dam Stage 3 [2]	–	5,800
South East Queensland (Gold Coast) Desalination Facility	–	45,600
Traveston Crossing Dam Stage 1	–	70,000
Western Corridor Recycled Water Project [3]	–	84,700
Wyaralong Dam, Cedar Grove Weir and Bromelton Offstream Storage [4]	–	26,000
Eastern Pipeline Interconnector [5, 6]	8,000	3,600
Gold Coast to Logan Interconnector [5]	7,300	7,300
Northern Pipeline Interconnector [5, 7]	76,700	23,700
Southern Regional Water Pipeline	47,500	

[1] Rounded to nearest hundred.

[2] Forecast increase in Historical No Failure Yield

[3] Forecast production flows for the Western Corridor Recycled Water Project have been reduced to 131 ML/d (47,800 ML/a) during the Millennium Drought. This is a result of the effectiveness of high-level water restrictions and demand management measures, resulting in reduced sewer flows.

[4] Incremental LOS system yield. The Drought Regulation does not include a regulated volume for this project. Project capacity may be increased with additional infrastructure, including water treatment and pipeline works.

[5] Surplus supplies transferred into the Brisbane supply zone during the Millennium Drought. Supply is at maximum during drought conditions and restricted demand, but will reduce under normal demand.

[6] Work in relation to North Stradbroke Island is on hold, with alternative water source options being investigated. Supply of about 3,600 ML/a may be achieved through the mainland section of Eastern Pipeline Inter-connector, if current levels of supply from North Stradbroke Island continue and supply to Redlands from Leslie Harrison Dam is maximised.

[7] Potential initial supply of 23,700 ML/a, increasing to a total supply to 76,700 ML/a including Traveston Crossing Dam Stage 1.

The Queensland Government has also announced that supply to Toowoomba will be secured by connection to the Water Grid through a new pipeline from Wivenhoe Dam to a Toowoomba water storage.

These projects will significantly increase the diversity of supply sources. As depicted in Figure 5.3, the reliance on water from dams and weirs will be reduced from 95% of the total regional supply in 2006 to about 75% in 2012.

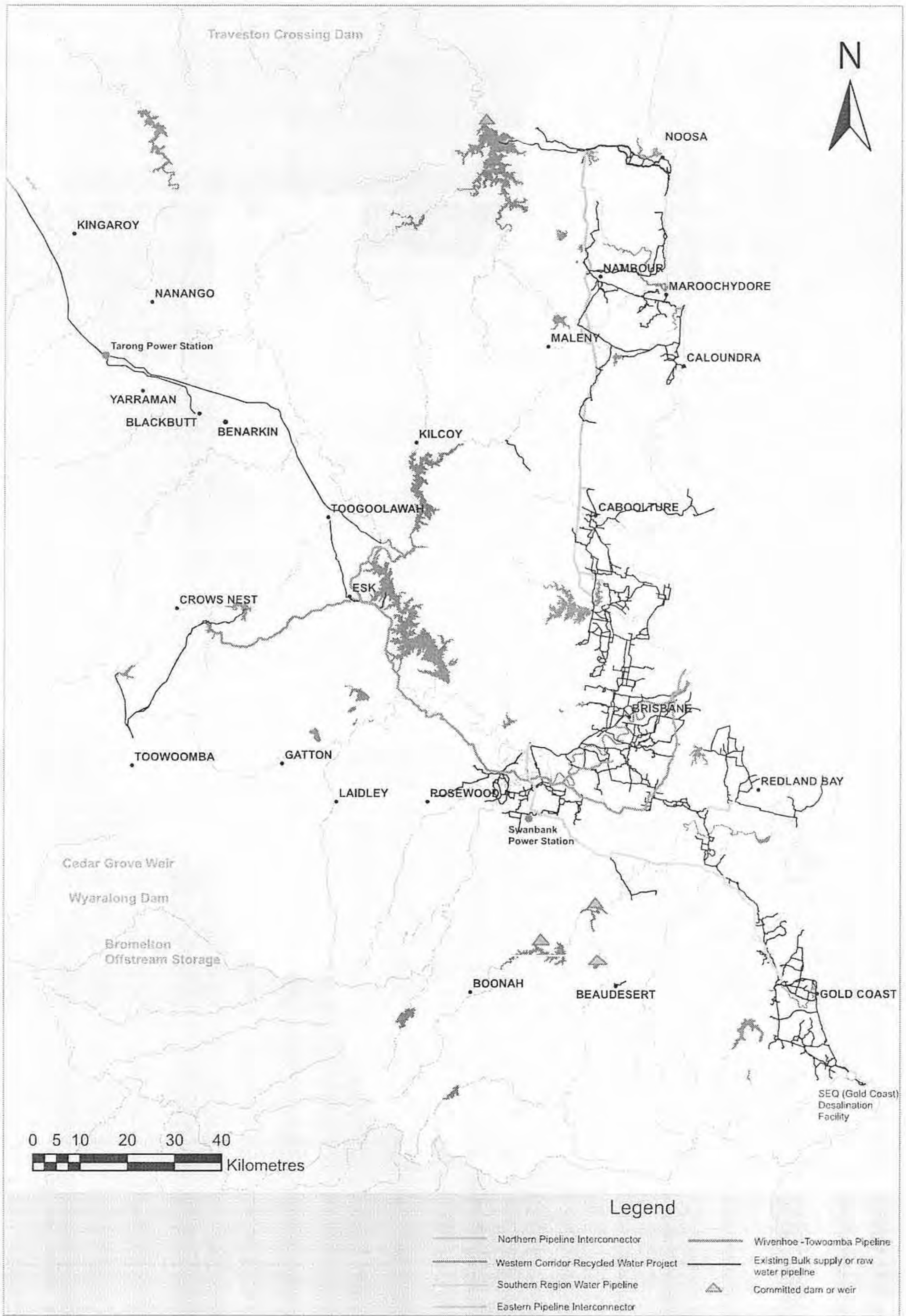

Figure 5.2 Committed projects

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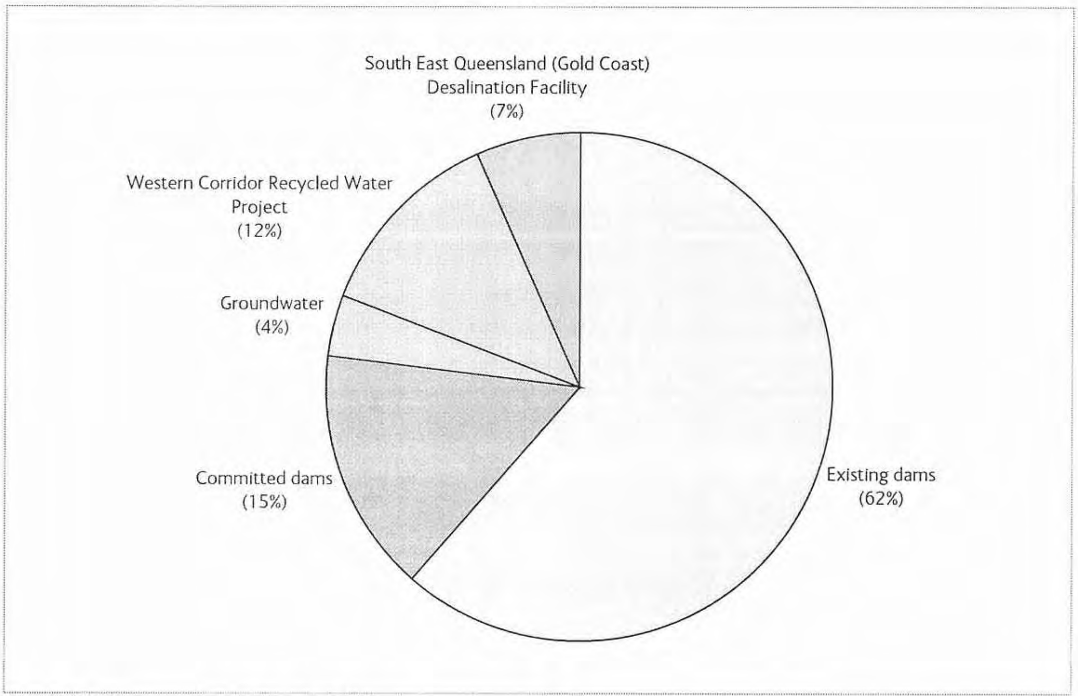

Figure 5.3 Supply capacity at 2012

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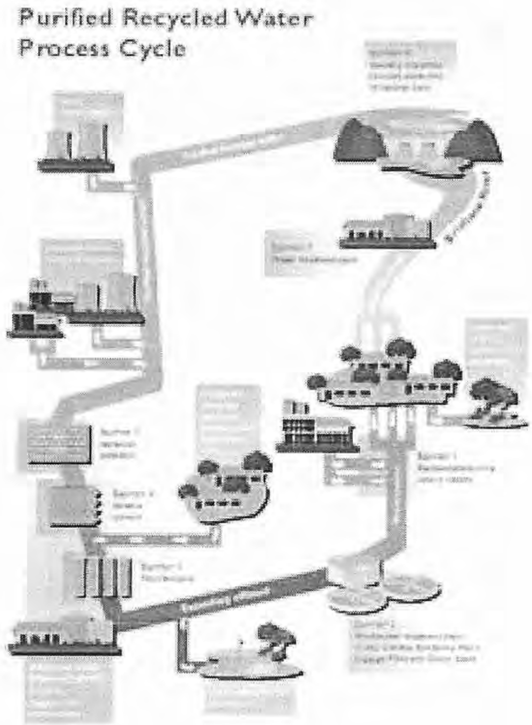
Major project commitments

Western Corridor Recycled Water Project

The Western Corridor Recycled Water Project (WCRWP) will be one of the largest PRW schemes in the world. From the end of 2008, it will have the capacity to supply up to 84,700 ML/a to power stations and industry, and to replenish Wivenhoe Dam. In normal conditions, water will also be available for supply to the Lockyer Valley for irrigation.

The WCRWP comprises three advanced water treatment plants at Luggage Point, Gibson Island and Bundamba that will treat effluent from six wastewater treatment plants. The first stage was commissioned in August 2007. The remainder of the project will be brought into operation during 2008.



South East Queensland (Gold Coast) Desalination Facility

The South East Queensland (Gold Coast) Desalination Facility is under construction at Tugun on the Gold Coast. The project will have the capacity to supply 45,600 ML/a of water and is on schedule for completion and delivery of first water by the end of 2008. The inlet tunnel and outlet structure are being constructed with a capacity of 62,000 ML/a as a provision for future expansion.

South East Queensland (Gold Coast) Desalination Facility under construction, September 2007

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Traveston Crossing Dam Stage 1

In mid 2006 the Queensland Government announced its intention to construct the Traveston Crossing Dam on the Mary River. Traveston Crossing Dam will diversify the sources of supply across SEQ and bolster the supply from smaller dams on the Sunshine Coast. Operating in accordance with the Mary Water Resources Plan, Traveston Crossing Dam Stage 1 will supply 70,000 ML/a.

Traveston Crossing Dam is located in the only catchment in or adjoining SEQ that has sufficient water available for urban use to establish a dam on this scale. The Mary Water Resource Plan includes a strategic reserve of 150,000 ML/a of additional high priority entitlement. The next largest strategic reserve, estimated at about 50,000 ML/a, is in the Logan catchment. The Traveston Crossing Dam Stage 1 is currently awaiting final approval by the Federal Government.

Logan River system

The Queensland Government is committed to the construction of the Wyaralong Dam, an off-stream storage at Bromelton and a weir at Cedar Grove. The three storages are all located in the Logan River catchment. When operated conjunctively, the projects will supply at least 26,000 ML/a in normal conditions. Cedar Grove Weir commenced storing water in late 2007, the Bromelton Off-stream Storage is scheduled for completion by mid 2008 and the Wyaralong Dam is scheduled for completion at the end of 2011.The Environmental Impact Statement for the Wyaralong Dam is currently awaiting final approval by the Federal Government.

Connections

The Water Grid is a made up of a group of water supply sources joined by a series of large interconnected water pipelines. The key interconnecting pipelines are the: Northern Pipeline Interconnector between the Sunshine Coast and Brisbane; Southern Regional Pipeline between the desalination plant at Tugun and Wivenhoe Dam; and Toowoomba connector between Wivenhoe Dam and Perseverance Dam. All these pipes are due for completion between late 2008 and mid 2009, with the exception of the Toowoomba connector.

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5.3 System yield

5.3.1 Yield of existing sources

The maximum amount of water permitted to be extracted from existing surface and groundwater supplies in SEQ has been established through recently completed water resource planning processes. These processes are explained in Chapter 2. The impact of climate change is addressed in Chapter 3 and below in Section 5.3.3.

Under these regulations, about 550,500 ML/a is allocated from existing supplies for urban use. Of this, 541,500 ML/a has been allocated for communities attached to the Water Grid and communities with stand-alone sources of supply. The remainder is allocated for industries obtaining supplies directly from water supply schemes.

The Strategy seeks to improve the security of supply in SEQ. One of the means of achieving this has been to reduce the estimated yield of dams and weirs using the LOS approach, as described in Chapter 4.

Based on the LOS approach, the LOS system yield of existing supplies would have been 416,000 ML/a in 2006. Table 5.2 lists the estimated LOS yield of each supply zone in 2006, compared to actual consumption in that year. The data indicates that, respectively applying the LOS objectives, additional sources of supply were required for Brisbane, the Gold Coast and Toowoomba prior to the Millennium Drought. Supplies for Beaudesert and Boonah also need to be enhanced and Redlands Shire will require augmentation in the near future. These requirements are being addressed by committed infrastructure and the proposed infrastructure outlined in Chapter 6. Planning for most of these projects had commenced prior to 2006, such as for the Southern Regional Water Pipeline. In addition, amendments to the *Water Act 2000*, passed in 2006, required the adoption of the LOS approach in SEQ.

Table 5.2 also illustrates some of the constraints of existing dams. Dynamic smaller coastal storages, such as Baroon Pocket Dam, are potentially vulnerable to severe drought, particularly as the demand approaches the LOS system yield. These dams have high yield to storage volume ratios, meaning that the time available to respond to a water crisis is short without connection to the Water Grid. As demand approached supply, it would become increasingly important for these coastal supplies to have Drought Response Plans either in place or able to be implemented at short notice.

Larger dams, such as Wivenhoe, fill less frequently and have much lower yield to storage ratios. This highlights the high reliance on stored water both now and for the medium-term, and the importance of having relatively large volumes of drought storage reserve. In comparison, Traveston Crossing Dam would benefit from being a relatively large dam located in a catchment near the coast that receives more rainfall, on average, than the Wivenhoe Dam catchment.

The LOS objectives were selected to minimise the frequency and severity of future restrictions, avoiding the economic and social impacts of the current high-level water restrictions. Retrospectively applying these objectives to the Millennium Drought, Table 5.2 indicates that about 247,000 ML/a of additional climate resilient supply would have been required to avoid severe restrictions and maintain supply in extreme circumstances, once Drought Storage Reserves were depleted. The projects contained in Table 5.1 will increase climate resilient supplies by more than 200,000 ML/a.

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Table 5.2 Existing sources of supply at 2006 as stand-alone systems, retrospectively applying LOS objectives (exclusive of climate change impacts)

Supply zone	Dams	Storage volume [2] (ML)	Urban allocation (ML/a) (2007)[3] Does not include Annual Volumetric Limits	LOS yield in Normal Operating Mode			Drought resilient supply		
				LOS yield (ML/a)	2006 estimated unre-stricted demand[8] (ML)	Surplus LOS yield (ML/a)	System drought resilient supply (ML/a)	2006 esti-mated restricted demand[8] (ML)	Surplus drought resilient supply (ML/a)
Brisbane and surrounding shires and cities	Brisbane River system[9]	1,572,000		241,500			84,000		
	North Pine Dam and Lake Kurwongbah	230,500		38,500			13,500		
	Enoggera Dam and Gold Creek Reservoir	4,500		1,500			800		
	Bribie Island groundwater			1,400					
	Total	1,807,000	345,000[4]	282,900	326,500	-43,600	98,000	277,500	-179,800
Gold Coast	Hinze and Little Nerang dams	167,700	76,300[5]	52,000	79,600	-27,600	32,000	67,700	-35,700
Caloundra and Maroochy	Baroon Pocket Dam	61,000		27,000					
	South Maroochy system (Cooloolabin, Poona and Wappa dams)	18,800		9,100					
	Total	79,800	57,300	37,500	30,700	6,800	29,500	26,100	3,400
Noosa and Cooloola	Borumba	46,000		7,500					
	Lake MacDonald	8,000		3,500					
	Total	54,000	13,500	11,000	9,100	1,900	7,500	7,700	-200
Redlands	Leslie Harrison Dam	24,800		5,500					
	North Stradbroke Island			9,000					
	Total	24,800	34,300[6]	14,500	18,800	-4,300	13,000	16,000	-3,000
Toowoomba	Cressbrook, Perseverance and Cooby Dams	215,000		9,000					
	Groundwater			4,000					
	Total	215,000	16,800	13,000	17,200	-4,200	4,900	14,600	-9,700
Beaudesert	Maroon Dam	44,300	9,900	6,000	3,200	2,800	2,500	2,700	-200
Boonah	Moogerah Dam	83,800	2,500[7]	500	700	-200	300	600	-300
SEQ total		2,475,400	555,600	416,000	485,800	-69,800	187,700	412,900	-225,200

[1] All numbers rounded to the nearest 100 ML
[2] Includes minimum operating volume
[3] Includes allocations only to all High Priority users, including Water Grid customers, other reticulated communities and industries who are obtaining supply from water supply schemes. Does not include Annual Volumetric Limits (e.g. Brisbane does not include Lake Manchester, Lake Kurwongbah, Enoggera Dam and Gold Creek Reservoir)
[4] Includes 7,000 ML/a allowance for Mid-Brisbane irrigators and 250 ML/a for Glamorgan Vale Water Board
[5] The Gold Coast City Council have adopted 69,900 ML/a as their yield for the existing infrastructure, however the allocation is still listed as 76,300 ML/a
[6] HNFY yield has been downgraded to 7,600 ML/a however, Leslie Harrison Dam still holds an allocation of 11,800 ML/a
[7] Does not include 7,000 ML/a allocation for Swanbank power station
[8] Consistent with LOS objectives, 85% of estimated unrestricted demand.
[9] Includes Wivenhoe and Somerset Dams, Lake Manchester and Mt Crosby Weir

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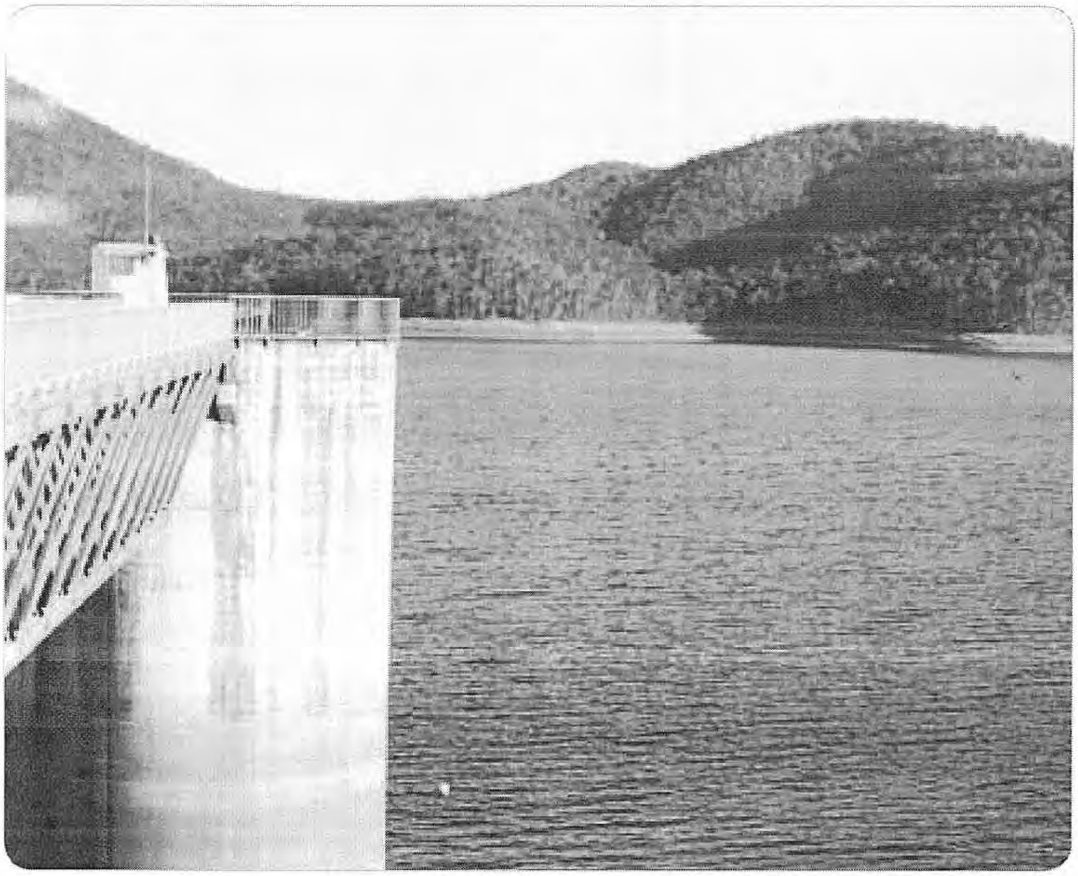

5.3.2 Yield of committed sources

The LOS system yield will increase to about 684,000 ML/a including committed infrastructure and the benefits of the Water Grid. This excludes the 9,000 ML/a allocated directly to isolated industries, as explained in Section 5.3.1.

Operating at this yield, in just over 100 years of recorded inflows, only once would restrictions have been triggered and preparations for construction of new infrastructure commenced. Some early preparations may also have occurred during the Federation Drought. Figure 5.4 illustrates the impact of the LOS system yield on combined regional storage levels, using recorded inflows. The analysis is for existing and committed infrastructure, where demand equals the LOS system yield. This is expected to occur in 2042 based on median series population projections without an allowance for climate change. Implementation of a Drought Response Plan would only have been required in response to the Millennium Drought.

The T1 trigger for implementation of the Drought Response Plan level will be set in the System Operating Plan, which is explained in Chapter 7. It will change over time based on forecast demand and other factors. Figure 5.5 illustrates the forecast changes in the T1 trigger level, based on medium series population growth and without allowance for climate change. The reduction in the T1 trigger level between 2006 and 2012 is due to the completion of committed projects, including desalination, PRW and the major interconnections. In total, climate resilient supplies are forecast to increase from 165,700 ML/a in 2006 to approximately 390,000 ML/a in 2012. At 390,000 ML/a, climate resilient supplies comprise about 57% of LOS system yield, compared with 40% at 2006.

The trigger level is lowest at 2012, due to demand being less than LOS system yield, and will increase over time until new infrastructure is constructed.

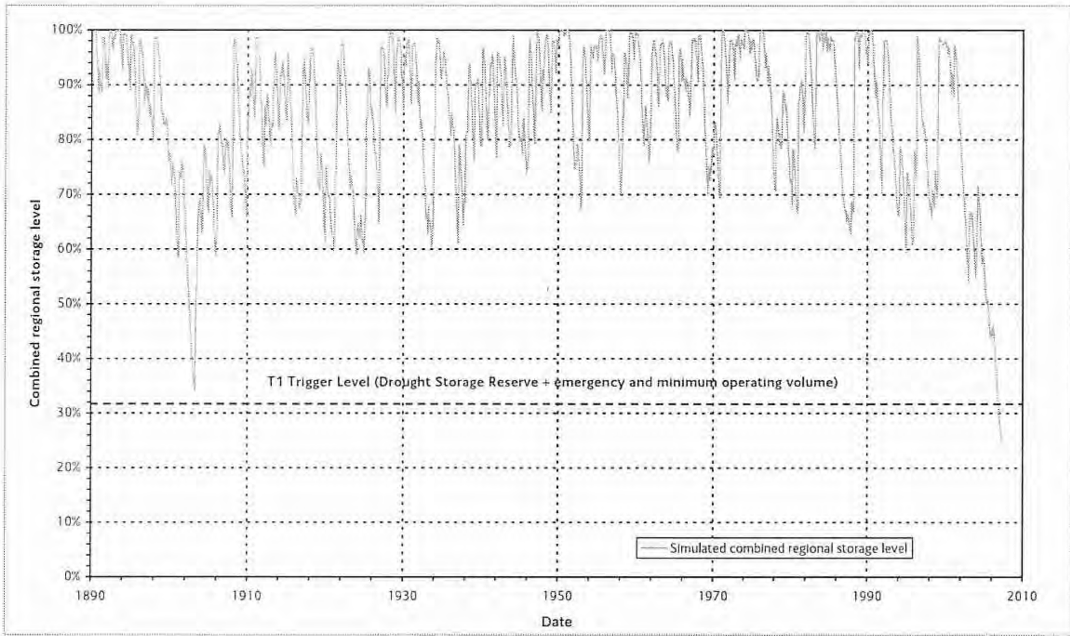

Figure 5.4 Simulated combined regional dam level based on LOS system yield and historically recorded inflows (existing and committed infrastructure)

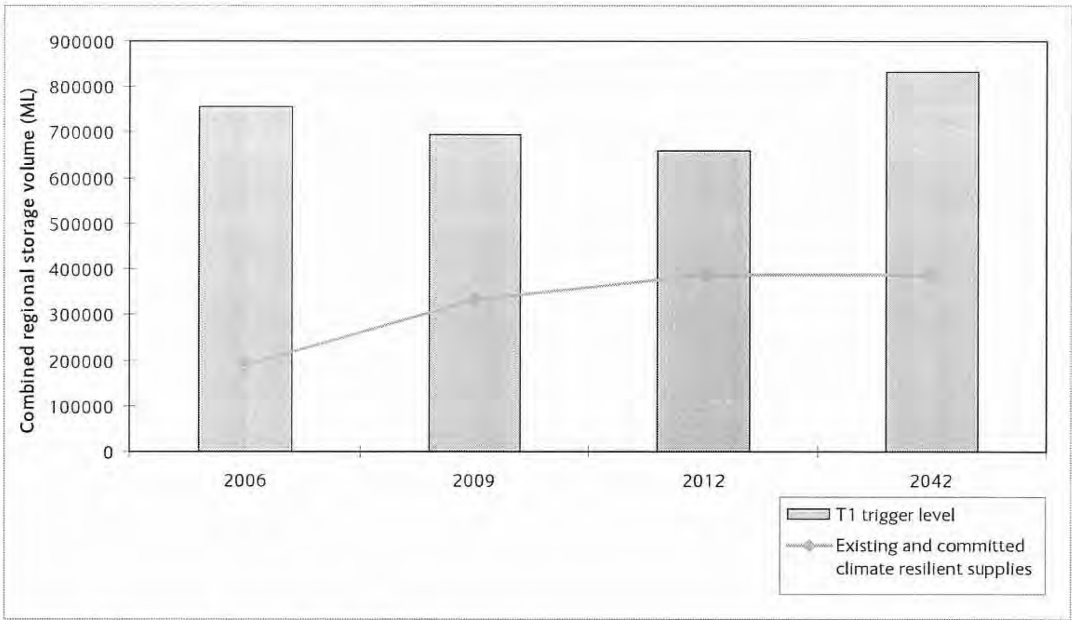

Figure 5.5 Forecast T1 trigger levels

The actual amount extracted from any specific dam will vary from year to year, as explained in Section 3.6 of Chapter 3. Among other factors, the supply from each dam will depend upon the location of the regional Drought Storage Reserve. Supplies from a dam will reduce when a significant proportion of the storage capacity is allocated for Drought Storage Reserve.

Table 5.3 lists the supply from each source, based on one scenario of allocating drought storage reserves. It includes the benefit of operating the Water Grid as a system. Analysis indicates that there are several alternative scenarios that can also obtain the LOS system yield.

Table 5.3 Supply from existing and committed sources to obtain SEQ LOS system yield

System	Supply (ML/a)[2]	Drought Storage Reserve (ML)	Emergency and minimum operating volumes (ML)
Baroon Pocket Dam	33,000	700	7,300
Brisbane River system[4]	263,300	381,000	96,300
Cressbrook, Perseverance and Cooby Dams	9,000	32,500	12,400
Enoggera Dam	1,100	0	200
Ewen Maddock Dam	2,500	7,500	2,400
Hinze and Little Nerang Dams	58,200	116,000	10,600
Lake McDonald	3,500	800	1,200
Leslie Harrison Dam	5,300	0	3,500
Logan River system[4]	29,500	20,000	19,500
Mary River system[5]	70,000	7,200	14,300
North Pine Dam, Lake Kurwongbah and Caboolture Weir	43,300	69,100	13,400
South Maroochy system	7,000	9,200	1,500
Total dam supplies	**525,700**	**644,000**	**182,600**
Groundwater (Bribie Island, Brisbane, North Stadbroke Island and Toowoomba)	28,000		
SEQ (Gold Coast) Desalination Facility	45,600		
Western Corridor Recycled Water Project	84,700		
LOS system yield	**684,000**		

[1] All numbers rounded to the nearest 100.

[2] Supply from existing dams and weirs differs from that quoted in Table 5.2 due to the benefits of interconnection, and the consideration of Emergency Volumes in addition to changes to the Drought Storage Reserves as schematically depicted in Figure 3.3, Chapter3.

[3] Drought Storage Reserve is over and above emergency and minimum operating volumes, as explained in Chapter 3. The actual allocation of Drought Storage Reserves will vary over time, as specified in the System Operating Plan.

[4] Excludes high priority water allocated to specific industries, as explained above. Brisbane river system includes Wivenhoe and Somerset Dams, Lake Manchester, Gold Creek Dam and the Mt. Crosby Weir. Logan River systems include Wyaralong Dam, Cedar Grove Weir and Bromelton Offstream Storage through excludes existing entitlements from Maroon Dam.

[5] Traveston Crossing and Borumba Dams.

5.3.3 Potential impacts of climate change

Scenario analysis has been undertaken assuming a 10% reduction in the LOS yield of surface storages due to climate change. As explained in Section 3.3.5 of Chapter 3, this represents a mid-range scenario based on the majority of climate-catchment modelling results for SEQ.

This scenario would reduce the LOS system yield of supply sources existing in 2006 from 416,000 ML/a to 374,000 ML/a. The LOS system yield including committed infrastructure and the benefits of the establishment and operation of the Water Grid would reduce from about 684,000 ML/a to 631,000 ML/a.

Although the impacts of climate change are difficult to quantify at this time, the adoption of the planning methodology for the Strategy will ensure that SEQ will not run out of water because of the capacity to bring forward the construction of new infrastructure and the predetermined Drought Response Plan.

5.3.4 Benefits of the Water Grid

The Water Grid will enable water to be transported across SEQ to where it is needed most. It will:

- Provide a network of reversible pipelines to connect major bulk water sources in the region;
- Allow water to be moved from areas of surplus to areas that face a shortfall;
- Allow risk to be managed at a regional level rather than on an individual water storage or water supply system basis; and
- Allow optimisation of use through the coordinated management of all SEQ water supply sources.

In total, operating the sources of supply existing in 2006 as a connected Water Grid increases the LOS system yield without allowance for climate change from 416,000 ML/a to 475,000 ML/a, an increase of 14%. To determine the benefit of the Water Grid, the regional water balance model was run in two modes:

- Separate catchment mode – A yield for each dam, or system, was calculated by applying the recommended LOS objectives separately to each catchment within SEQ. The regional yield was the sum of the individual dam yields;[1] and
- Connected mode with connections simulating the SEQ grid – The recommended LOS objectives were applied to the region rather than to individual catchments.

Once committed projects are completed, the 2006 supply zones will be connected with the exception of some rural towns and villages, including Beaudesert, Boonah and the North Stradbroke Island townships of Amity Point and Point Lookout. Figure 5.2 illustrates the major Water Grid pipeline connections. Chapter 6 discusses water supply security for communities not connected to the Water Grid.

The System Operating Plan will direct the actual operation of the Water Grid. The System Operating Plan will describe rules for operating water supply infrastructure in order to achieve the LOS objectives, as specified in the Regional Water Security Program. It will be used to balance the need to maximise water supply security with the need for least cost operation. It will vary the yield from specific supplies over time depending on a range of factors, including inflows to dams, operating costs and risk management. The System Operating Plan is explained in Chapter 7.

5.4 Potential future water sources

The Strategy indicates that additional sources of water will not be required before 2028, unless brought forward as part of a response to a drought as severe as the current Millennium Drought. However, it is important that the best supply options and pipeline routes are preserved to prevent innappropriate development on or near the sites and to enable rapid response to any future drought.

There are a suite of possible future water supply sources that have been considered as part of the Strategy development. These fall into the following broad categories:

- Dams and weirs;
- Groundwater;
- Desalination;

[1] In this calculation, it was necessary to assume minimal Drought Storage Reserves in small dams and that there would be rapid access to alternative supplies. Without limiting this requirement, the LOS yields of small dams would have been reduced to a much greater extent.

- PRW;
- Water trading; and
- Supplies outside SEQ.

Rainwater, stormwater and other types of recycling have been addressed in Chapter 4, Section 4.5, as possible measures to reduce demand on Grid Water.

This Strategy identifies a range of options for detailed investigation, based on initial screening. These investigations will include assessments of engineering feasibility, environmental impacts and cost as well as outcomes from community consultation.

Based on the outcomes of the investigations, the QWC will recommend that sites and pipeline routes for viable options be preserved. More detailed planning will then commence. This will include obtaining relevant environmental approvals.

The levelised cost of the types of infrastructure currently underway in SEQ is illustrated in Figure 4.4 of Chapter 4. Desalination and PRW schemes are more expensive to build and operate than existing sources of supply and new dams and weirs. The schemes involve high technology treatment processes with relatively short economic lives and high electricity consumption. However, they are essential to develop adequate drought resilient supplies.

In particular, the cost of constructing desalination facilities in SEQ is relatively high, due to the limited number of potential sites and the flat topography of the ocean floor. For instance, the intake and outlet pipelines for the South East Queensland (Gold Coast) Desalination Facility will be about 2.5 kilometres long, traversing the Gold Coast Airport, Gold Coast Highway and existing residences.

By contrast, based on levelised cost, water from the proposed Traveston Crossing and Wyaralong dams will be inexpensive (refer Figure 4.4, Chapter 4). Wyaralong Dam is particularly inexpensive, due largely to proximity to major development areas.

5.4.1 Dams and weirs

A comprehensive review has highlighted that there are few sound opportunities for the development of major new storages in the region, beyond committed projects. This is due to the shortage of suitable sites in areas identified as having water available for development in Water Resource Plans. Following completion of the committed projects, the major catchments will be approaching their sustainable extraction limits.

The most significant opportunities to increase the supply from dams and weirs are Traveston Crossing Dam, Stage 2 and the raising of the Borumba Dam wall. In combination, these projects will provide up to another 80,000 ML/a. However, no commitment to Stage 2 has been made by the Queensland Government at this stage.

Following completion of the committed projects, the major catchments will be approaching their sustainable extraction limits as permitted under the Water Resource Plans. An exception would be in those catchments where the operational yield has been reduced well below allocation due to the introduction of drought storage reserves. In these cases, there may be a benefit from increasing the working storage volume of the dam so that water yields can be increased.

There are some opportunities for water harvesting. However, these exist in small catchments that have limited reliability. Water Resource Plans allow for opportunistic harvesting of water during high flow events. This type of harvesting is generally best achieved using small off-stream storages or connections to existing water storages. In SEQ, there are opportunities to use these types of schemes to increase available supplies for rural production and potentially for some smaller urban applications. The key opportunities are in the Gold Coast and Moreton Water Resource Plan areas.

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Gold Coast Water Resource Plan area

A strategic reserve of approximately 30,000 ML/a of high priority entitlement is available in the Gold Coast Water Resource Plan area. Between 5,000 and 6,000 ML/a of this strategic reserve has been set aside for the raising of Hinze Dam. There is some potential to water harvest from Gold Coast creeks and the Coomera River into Hinze Dam. This could be combined with water harvesting from Canungra Creek, a tributary of the Albert River.

Moreton Water Resource Plan area

The Moreton Water Resource Plan makes allowance for a strategic reserve against future infrastructure. A process for release of this reserve will be included in the Resource Operations Plan. Some of the reserve (about 25,000 ML/a) may be able to be accessed by raising the Mt Crosby Weir and by adjusting the operating rules for the Brisbane River system. Some of the reserve may also be accessed in other smaller river systems in the Moreton Water Resource Plan area.

5.4.2 Groundwater

Groundwater resources in SEQ are almost fully developed. The annual volume used for urban purposes over the next 50 years is expected to remain largely static. The use of groundwater for rural production is also considered fully developed and, in some cases, over-developed.

The Moreton Water Resource Plan has established groundwater management areas in Cressbrook Creek, the Lockyer Valley and in the Warrill-Bremer Valley. These areas enable closer management of groundwater in the whole of the Lockyer Valley, and are expected to lead to a reduction in groundwater extraction. Similarly, the groundwater in the Warrill/Bremer alluvial groundwater management area will now be managed and extractions are likely to be authorised under licence.

Groundwater reserves with the potential to supply small quantities of water for urban use in SEQ include:

- The offshore sand dune islands, including North and South Stradbroke, Moreton, Bribie and Fraser islands;
- Localised, onshore sand dune deposits located adjacent to the coastline and extending intermittently from Rainbow Beach in the north to the Gold Coast in the south;
- An extensive system of mostly fractured volcanic rocks associated with what is known geologically as the Gympie Province extending from just north of Nambour to Gympie;
- Sedimentary deposits, mostly sandstones associated with the southern part of the Maryborough Basin and known locally as the Myrtle Creek Sandstone;
- Limited outcrops of relatively young tertiary basalts in the Maleny, Buderim, Sunnybank, Redland Bay and Tamborine Mountain areas; and
- Reasonably extensive tertiary sedimentary deposits outcropping in the Brisbane metropolitan area to the north and south of the city.

Drilling in the extensive sedimentary deposits associated with the Nambour Basin extending from north of Maroochydore inland to Maleny and southwards to Caboolture has revealed that the available groundwater supplies are small and do not warrant development as an urban supply.

Beyond existing commitments, the most significant opportunities are the Moreton Island and the Cooloola-Teewah sand masses. These aquifers have not been considered as normal supply options because of their location within National Parks and the relatively small quantities that could be extracted without unacceptable environmental impacts.

At this stage, other than those groundwater supplies being developed as part of the Drought Regulation, it is not intended to pursue these groundwater opportunities. They are generally small and not considered to be economically viable as a regional resource. In relation to the Drought Regulation, the current project is likely to be the limit of groundwater extractions on Bribie Island. It is also noted that extractions from North Stradbroke Island have not been able to be sustained at current allocations.

Aquifer storage and recovery is under investigation on the Gold Coast to store recycled water for irrigation purposes. Such opportunities in SEQ are considered to be limited and need to be assessed on a case-by-case basis.

5.4.3 Desalination

Desalination is a process that removes dissolved salts from sea water or brackish water. In SEQ, depending on site constraints and bulk transport connections, desalination could be used as a climate resilient water supply to meet the long-term water supply needs of SEQ.

As with any large infrastructure project, construction and operation of a large desalination facility will have environmental, social, planning, technical, financial and economic consequences that require balanced consideration. This section explains the preferred characteristics of a good desalination site, sites that have been considered in SEQ, and the outcome of preliminary investigations.

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How does desalination work?

There are two widely applied and commercially proven desalination technologies – thermal (evaporative) and membrane based (reverse osmosis). Thermal desalination essentially involves boiling water and condensing the vapour, leaving the impurities behind. Membrane desalination involves forcing water at very high pressure through a semi-permeable membrane. Impurities are too large to fit through the pores of the membrane.

Historically, thermal methods have dominated the desalination market. Thermal desalination requires more energy than membrane methods but tends to be more robust. Thermal methods have the capacity to accept variable feed quality while reverse osmosis usually requires extensive pre-treatment.

However, desalination by reverse osmosis is now the most common process, following recent advances in membrane technology. Reverse osmosis is being used in the South East Queensland (Gold Coast) Desalination Facility at Tugun.

Site selection characteristics

There are many desirable characteristics when selecting potential sites for desalination. There are also a number of more critical characteristics from an engineering or technical perspective. These are:

- Proximity to the water source;
- Consistency of feed water quality, ideally with a low level of suspended solids;
- An environmentally acceptable method of disposing of the waste concentrate stream. The preferred method is by open ocean discharge, the most common option for large desalination facilities;
- Ease of distribution of the product water, ideally utilising existing distribution network infrastructure;
- Proximity to a reliable power supply; and
- Available land area, ideally in an appropriate planning zone.

Consideration has been given to the coastal strip from the NSW border to Noosa, including the Gold Coast, Sunshine Coast, the islands of Moreton Bay, and the tidal parts of major rivers, particularly the Brisbane River.

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Information from previous Gold Coast and Sunshine Coast desalination siting studies was incorporated into the review.

Preliminary phases of the desalination siting study have considered the location of desalination plants of sizes varying from 100 to 400 ML/d (36,500 to 146,000 ML/a). Consideration has also been given to the provision of a large desalination facility to be built in modules, as opposed to the construction of multiple smaller facilities located throughout the region.

Investigations were extended to include identification of sites that could accommodate more than 400 ML/d (146,000 ML/a) of water supply. The final decision on the sites and staging of desalination modules will be guided by the engineering and feasibility studies that will follow.

Site selection methodology

The site selection process applied to the preliminary site selection involved several rounds of investigations, which are summarised below:

1. Unsuitable sites were screened out using a geographical information system database that allowed multiple layers of social, economic and engineering information to be mapped. Following this round, 225 locations were identified for further consideration.
2. Specific identification of sites was conducted, with particular consideration of existing land uses and geographical characteristics of the locations. Following this round, 21 sites were identified for further consideration. This round was done in stages.
3. Detailed engineering assessments were conducted to confirm the practical suitability of the identified sites. These assessments included consideration of the ease of construction on the site and construction of the intake and outfall pipes, and the impacts of the brine concentrate dispersion, using hydrodynamic modelling. Other considerations included distance from the site to the coast and site elevation. This round of investigations reduced the list of potential sites to 10, including a strategic site identified through a separate process.
4. Four of the remaining sites were discounted by the QWC, primarily due to private ownership. All sites were located in proximity to a publicly owned site with comparable characteristics. The remaining sites provide a spread of options distributed along the coast from Marcoola to South Stradbroke Island.

The QWC recommends that detailed investigations be undertaken for each of the six selected sites.

Short list of sites for further investigation

Table 5.4 contains the property description and ownership details for the selected sites. The table also contains a preliminary estimate of the estimated maximum treatment capacity, which is typically constrained by available land size. The list is presented in a north to south geographical arrangement.

All potential desalination sites are government owned and are not within National Parks or other types of environmental reserves. One has been recently used for sand mining, one was recently a pine plantation, one is located in an existing industrial estate, one adjoins an existing wastewater treatment plant, one is an agricultural site adjoining an airport and one is unallocated State land. None of the sites are adjacent to residential development.

Poor dispersion characteristics were a constraining factor at the mouth of the Brisbane River. For this option, the small size of the site selected reflects the limit on the size of the plant.

The Bribie Island and North Stradbroke Island sites are very large. Pending detailed investigation, in the order of 60 hectares would be preserved on either site.

Table 5.4 Current short-list of sites for investigation

Description	Ownership and tenure	Available land size and estimated maximum capacity
Marcoola Lot 753 CG3375 Finland Road	Maroochy Shire Council Freehold	53 hectare site More than 400 ML/d (146,000 ML/a)
Kawana Lot 9 SP174900 Lot12 SP174900 Milieu Place, Birtinya	Caloundra City Council Freehold	27.6 hectare site 400 ML/d maximum capacity (146,000 ML/a)
Bribie Island Lot 64 SP104224 (No street address)	State of Queensland State Land	3,110 hectare site More than 400 ML/d (146,000 ML/a)
Lytton Lot 49 SP193294 37 Freight Street	Minister for Industrial Development Freehold	8.3 hectare site 100 ML/d maximum capacity (36,500 ML/a)
North Stradbroke Island Lot 1 USL32114 (No street address)	State of Queensland State Land	1,970 hectare site More than 400 ML/d (146,000 ML/a)
South Stradbroke Island Lot 17 WD2688 Lot 18 WD1474 (No street address)	State of Queensland State Land	63 hectare site 400 ML/d maximum capacity (146,000 ML/a)

Detailed investigations

Detailed investigations will comprise:

- Engineering pre-feasibility studies to determine the full extent of works required at each potential site;
- Detailed bulk transport network analysis to identify how desalinated water will be distributed in Normal Operating Mode and Drought Response Mode, including the need for major interconnections;
- Economic assessment of the capital and operating costs;
- Environmental and social assessment; and
- Community consultation.

Informed by these investigations, the QWC will recommend a strategy for site preservation. Once the preferred sites are selected, the QWC will recommend that environmental approval processes commence. For any sites included in the Drought Response Plan in normal conditions, additional supplies will not be required before 2028.

Any potential desalination facility must meet strict environmental guidelines. This approval process for a potential desalination facility may involve the preparation of an Environmental Impact Statement. An Environmental Impact Statement may be triggered by State or Commonwealth legislation or by a local government planning scheme. Any large desalination facility must also comply with the *Environment Protection Act 1994*.

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Hydrodynamic modelling of brine dispersion

The discharge of brine concentrate produced from desalination can present a potential environmental risk for the receiving waters. In the case of SEQ, Moreton Bay is known to have poor flushing characteristics and is considered a sensitive environment.

As part of the preliminary site selection process for desalination plants, a detailed numerical hydrodynamic transport and water quality model was developed for the bay and surrounding open oceanic areas. The model was used to quantify the impacts of brine discharge by presenting the flushing time, the extent of the plume and the maximum concentration contour at the point of discharge.

The modelling showed that the best outfall locations are on the eastern side of the Moreton Bay Islands. The sites with the poorest flushing characteristics are inside Moreton Bay and Pumicestone Passage. All plumes, with the exception of the mouth of the Brisbane River, have a tendency to hug the coast. This finding has important implications for siting of intakes and outfall facilities to ensure there is no short-circuiting.

Figure 5.6 shows an example output from the hydrodynamic model for a discharge point inside Moreton Bay, which has the poorest flushing characteristics of all the shortlisted sites. The area inside the inner contour (36.65 g/L) is approximately 2.3 hectares. Outside this area the increase in salinity is 0.2 g/L of the background concentration. This represents less than 0.5% difference in that area. Due to these relatively poor flushing characteristics, the preliminary analysis assumed that a desalination facility on this site would be no more than 100 ML/d. However, further environmental analysis in the detailed investigation phase would clarify the specific sizing of the plant to ensure sustainability is maintained.

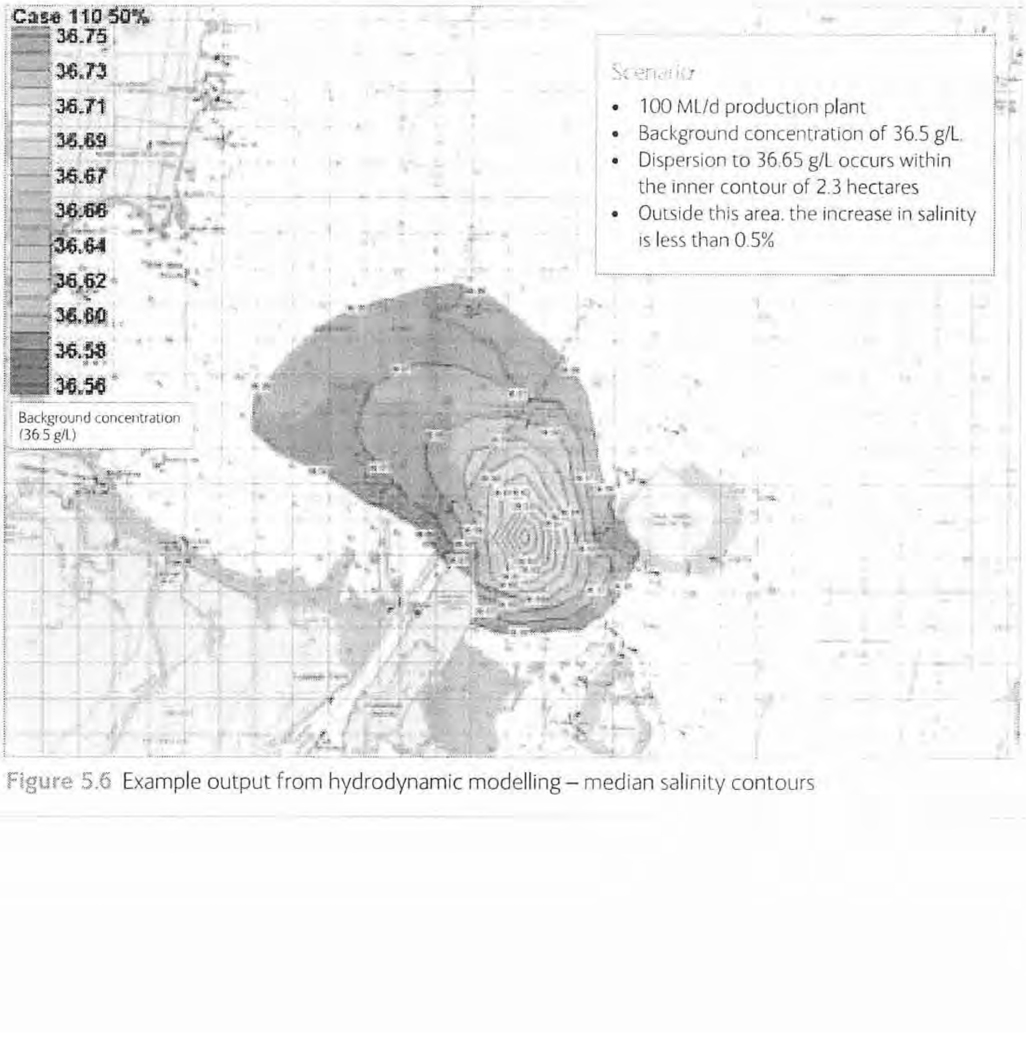

Figure 5.6 Example output from hydrodynamic modelling – median salinity contours

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Desalination as a contingency supply

Opportunities exist to use mobile desalination facilities as part of a Drought Response Plan, where cost effective.

It is possible to purchase mobile desalination facilities that are fitted on barges. These types of facilities may be located in an area of need during a severe drought and can be easily relocated when no longer required. They can be constructed in any size up to about 100 ML/d (36,500 ML/a). They require minimal infrastructure support beyond safe mooring, and can carry their own generators if power is not readily available.

Several of the six potential desalination sites could be suitable for locating a mobile desalination facility. Without additional augmentation, distribution infrastructure may constrain the size of the mobile desalination facility to between 25 and 50 ML/d (9,100 and 18,250 ML/a).

5.4.4 Purified Recycled Water

PRW is wastewater that has been treated to the highest standard through a seven barrier process. PRW can be delivered directly to end-users, such as power stations, and to water storages, thereby increasing their yield.

The Western Corridor Recycled Water Project will be one of the largest PRW schemes in the world. Once completed, it will have the capacity to supply up to 84,700 ML/a of recycled water to industry and power stations and for replenishing Wivenhoe Dam. Up to 25,000 ML/a will be available for rural production in the Lockyer Valley.

PRW has many benefits, including:

- It is climate resilient. At the targeted reduction in demand of 15% in future droughts, future water restrictions would be highly unlikely to significantly reduce the yield of PRW schemes;
- The treatment process removes nutrients that otherwise would have been released into waterways, rivers and Moreton Bay by more than 50%. Phosphorus from existing wastewater treatment plants is one of the key causes of algae blooms in the Brisbane River and Moreton Bay (refer page 126);
- It maximises the use of existing dams, water treatment and distribution infrastructure, minimising the need for upgrades elsewhere in the distribution system. By contrast, desalination facilities often require major network upgrades; and
- Energy requirements are less than for seawater desalination. The pressure required to operate reverse osmosis units is proportional to the salinity of the water being treated. Seawater commonly has a salinity of over 30 times that of treated sewage effluent, resulting in higher energy requirements. Energy consumption is addressed in Section 6.8 of Chapter 6.

Potential PRW schemes have been assessed across SEQ. The assessment took into account wastewater availability, capital and operating costs, options for brine disposal, and the level of dilution and detention in dams.

The QWC recommends that the following schemes be investigated in detail as potential sources of supply beyond 2028, or as part of the response to a severe drought, as identified in Figure 5.5:

- Augmentation of supply from North Pine Dam using PRW produced from wastewater from Sandgate wastewater treatment plants and wastewater treatment plants in Pine Rivers; and
- Augmentation of supply from Hinze Dam using PRW produced from wastewater from one or more of the Coombabah, Elanora and Merrimac wastewater treatment plants at the Gold Coast.

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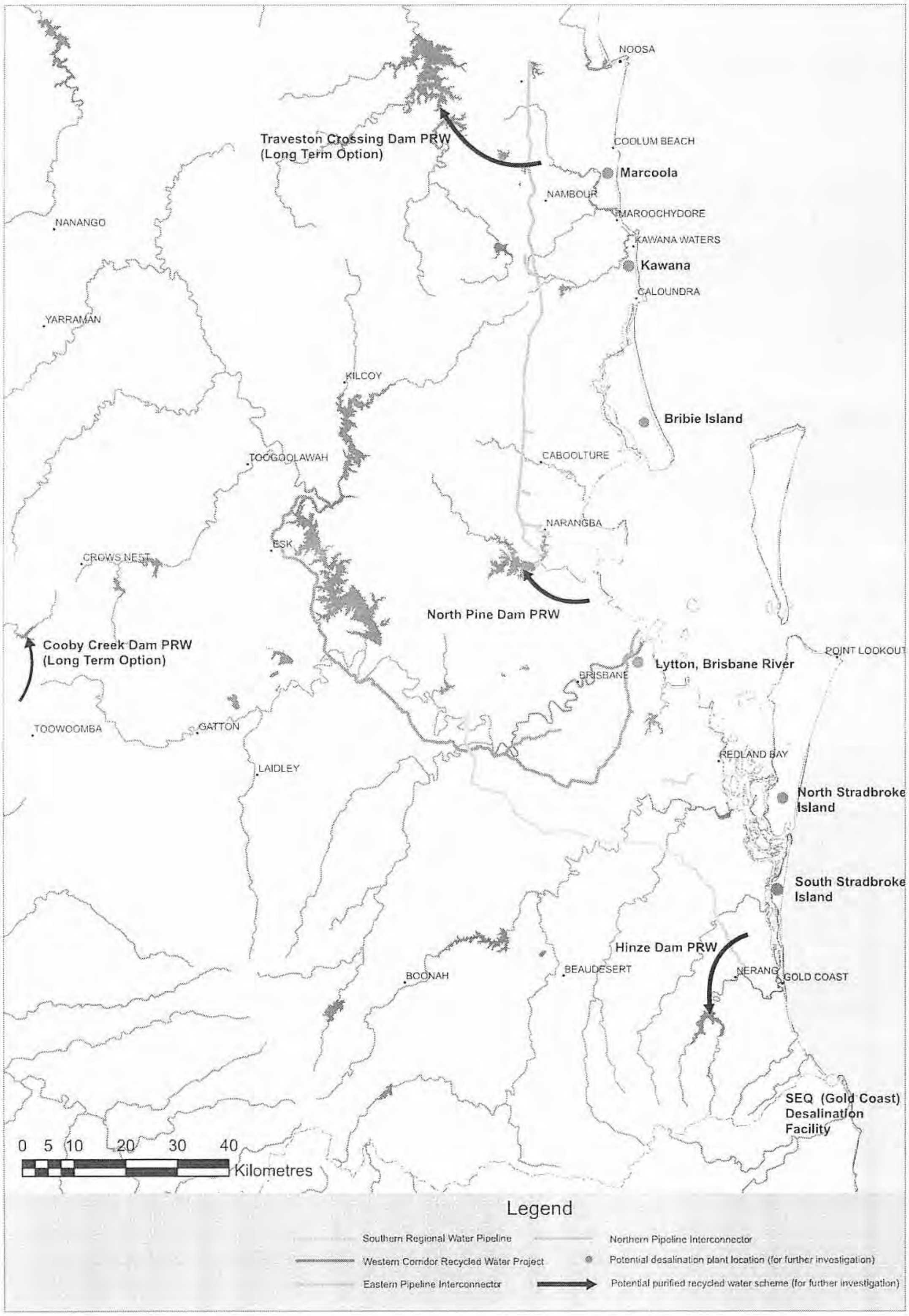

Figure 5.7 Potential desalination sites and PRW schemes

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In the long-term, schemes could be developed at the Sunshine Coast and Toowoomba.

In total, these schemes have the potential to increase the available supply by up to 100,000 ML/a by 2056.

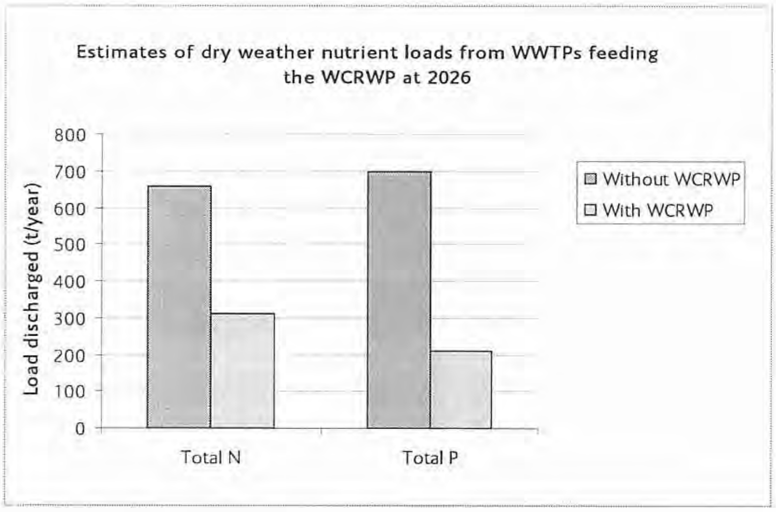
For potential PRW schemes, detailed investigations will include:

- Forecasts of future wastewater flows, including under water restrictions;
- A preliminary risk assessment;
- Analysis of the impact of PRW on the hydrology of the receiving dam, including the likely increase in the available take and the levels of detention and dilution;
- Analysis of the impact of PRW on the ecology of the receiving dam;
- Network design, including the preferred location of advanced water treatment plants; and
- Capital and operating costs, including the costs of compliance with regulatory standards.

Western Corridor Recycled Water Project

When complete, the Western Corridor Recycled Water Project will significantly reduce point source pollution in local waterways and Moreton Bay.

At present, effluent from the six feed water plants is discharged into waterways that flow into Moreton Bay. By 2026, these treatment plants would discharge more than 600 tonnes per annum of nitrogen and 700 tonnes per annum of phosphorous into Moreton Bay. The Western Corridor Recycled Water Project is being designed to reduce these discharges by about 350 tonnes per annum of nitrogen (N) and 490 tonnes per annum of phosphorous (P) over that same period.



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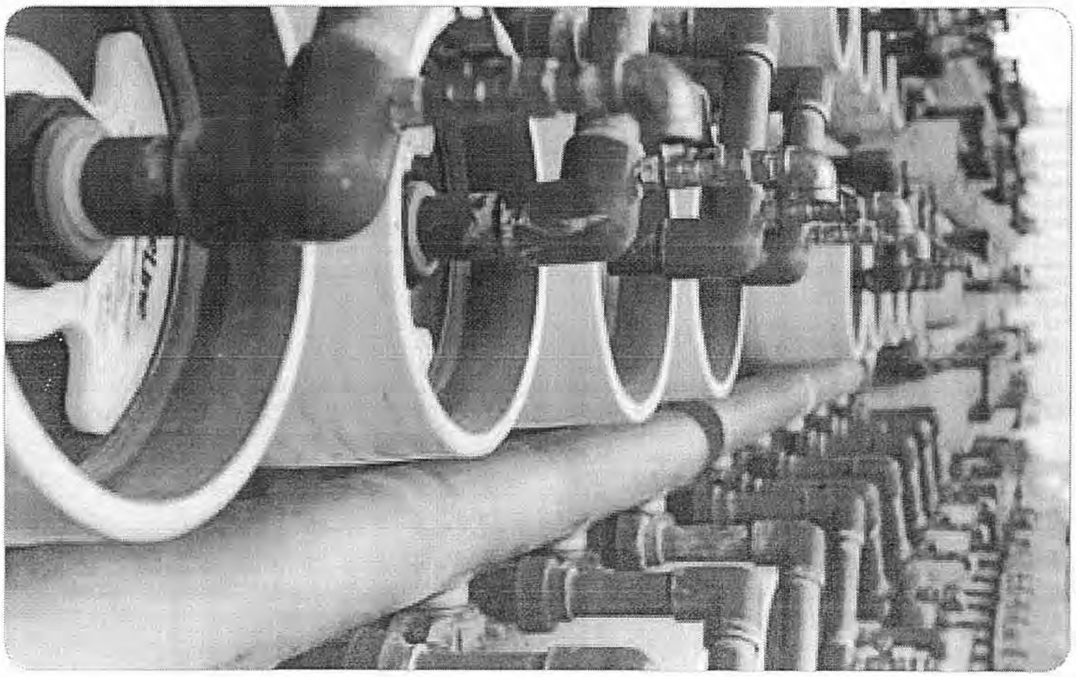
PRW Expert Advisory Panel

A panel of world leaders in ecotoxicology, environmental science, microbiology and advanced water treatment provide independent advice on the regulatory framework and the Western Corridor Water Recycling Project. At January 2008, the panel members were:

- Chair: Professor Paul Greenfield AO (Vice-Chancellor, The University of Queensland) *pictured*
- Professor Linda Blackwell (microbiologist, Australian Water Management Centre, University of Queensland)
- Professor Richard Bull (ecotoxicologist, Washington State University)
- Professor Ian Frazer (Director, Diamantina Institute for Cancer Immunology and Metabolic Medicine, The University of Queensland)
- Professor David Hamilton (environmental scientist, University of Waikato)
- Dr Zelle Hodge (past President of the Australian Medical Association Queensland)
- Professor Mike McLaughlin (environmental chemist, CSIRO)
- Professor Brian Priestly (ecotoxicologist, Australian Centre for Human Health Risk Assessment)
- Dr Joan Rose (microbiologist, Michigan State University)
- Harry Seah (advanced water treatment expert, Singapore Public Utility Board)

More information about the panel is available at www.qwc.qld.gov.au.



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The seven barrier process

The process employed in the Western Corridor Recycled Water Project (WCRWP) is called a seven barrier approach.

- **Barrier 1**: Source control. The first step in managing water quality is to control what is put into the sewerage system. Environmental and other regulations require industry, small business and other commercial enterprises to appropriately manage the disposal of their waste through wastewater management plans.
- **Barrier 2**: Wastewater treatment plant. Our current wastewater treatment plants already provide an important role in treating water to a safe standard to discharge to our waterways. These plants use biological processes to destroy or separate organic compounds, solids and most nutrients, and produce clear effluent suitable for discharge into a waterway. The activated sludge process commonly used in SEQ already removes the majority of nutrients, such as phosphorus and nitrogen, some micro-organisms, and most regulated chemicals. After disinfection, water that has passed through Barrier 2 can generally be used for outdoor irrigation, such as golf courses.
- **Barrier 3**: Micro-filtration. Micro-filtration (MF) is the first of the advanced wastewater treatment steps. In the MF process, water is forced under pressure through micro-porous membranes, which act as a filter to separate small particles. They allow passage of water and dissolved chemicals but sieve out and retain suspended material and micro-organisms including Cryptosporidium and bacteria such as *E. coli*. After disinfection, water that has passed through Barrier 3 can be used for flushing toilets and garden irrigation in dual reticulation areas.
- **Barrier 4**: Reverse Osmosis. Reverse Osmosis operates in a similar manner to MF but forces water under very high pressure through even finer membranes. The process removes any remaining micro-organisms, organic chemicals such as pharmaceuticals, and inorganic chemicals such as salt. Water that has passed through Barrier 4 is currently used for industrial purposes at Luggage Point and the Swanbank Power Station and will be used by other industrial users across the Water Grid.
- **Barrier 5**: Disinfection and Advanced Oxidation. The advanced oxidation process works by producing chemical oxidants which react with organic chemicals to convert them to harmless carbon dioxide. Advanced oxidation destroys any small size molecular impurities that remain after the RO process.
- **Barrier 6**: Natural Environment. After PRW has been produced, it is blended into an environmental buffer such as a dam, river, or underground aquifer. This environmental buffer allows the PRW to mix with the natural water in the catchment, providing an important separation between the water recycling process and its final consumptive use.
- **Barrier 7**: Water Treatment Plant. PRW, mixed with environmentally buffered water, will be treated again at Barrier 7. Water extracted from dams, rivers or aquifers is treated at a drinking water treatment plant prior to consumption. The drinking water treatment process in SEQ usually involves a combination of flocculation, sedimentation, filtration and disinfection.

More information about the treatment process is available at www.qwc.qld.gov.au.

5.4.5 Water trading between rural and urban allocations

Water Resource Plans provide a framework for water trading between water users. In some cases, this framework can provide for the conversion of medium priority to high priority water allocations, and potentially vice versa.

For SEQ, converting medium priority water for rural production to high priority water for urban supply is not considered to be a viable alternative for augmenting urban water supplies. In general, rural water allocations are small compared to existing urban demand. With conversion from medium priority to high priority, the volumes would be significantly smaller. Measures to increase the availability of water for rural production are explained in Chapter 6.

In the right environment, there may be some small trading opportunities. The towns of Kingaroy and Nanango just outside the SEQ study area are investigating the purchase of medium priority allocations owned by Boyne River irrigators. In this situation there exists willing sellers and purchasers of water allocation.

5.4.6 Supplies outside SEQ

In addition to all the potential water supply options described above, there are also opportunities to import water into SEQ from outside the region. Consideration has been given to supplies from:

- North Eastern NSW such as the Tweed, Brunswick, Clarence, Richmond and Wilson River catchments. This was investigated but found to be costly compared to committed SEQ projects and has numerous social and environmental and interstate issues that are currently insurmountable; and
- Northern Queensland. Investigations have commenced into a direct pipeline connection between the Burdekin and SEQ. If this option is found to be economically, environmentally and socially feasible it will be considered as a future supply option.

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Chapter 6

The Strategy

6. The Strategy

This chapter outlines a comprehensive strategy to ensure SEQ never runs out of water. It describes the water supply and demand management initiatives required to meet the needs of regional growth and provide security of supply during drought.

Key messages

- With existing infrastructure commitments, additional water supply projects in SEQ will not be needed prior to 2028, unless required in response to a severe drought.
- The Strategy provides a planning framework to ensure that new supplies are commissioned at appropriate times to prevent a supply gap from developing.
- Without additional supplies beyond 2028, the gap between supply and demand is estimated to be between 97,000 and 308,000 ML/a by 2056, depending on population growth, savings achieved and the impacts of climate change.
- A range of supply options will be investigated, including desalination and PRW. Sites and pipeline corridors will be preserved.
- Drought response planning will be undertaken on an ongoing basis to ensure that adequate supplies can be maintained in the event of a severe drought.
- At all times, sufficient climate resilient supply capability should be identified for development to meet medium-level restricted demand in the event of a future severe drought.
- The Strategy strives to deliver the *Water Supply Guarantee* – sufficient water will be available to support a comfortable, sustainable and prosperous lifestyle while meeting SEQ's social, economic and environmental needs.
- Water wise community attitudes, water efficient technology and drinking water substitutes create the ability to reduce overall demand by about 24% compared to pre-drought trends.
- The Strategy framework is supported by comprehensive demand forecasting and hydrologic modelling, which can be updated as required.
- It is proposed that 42,000 ML/a of additional water will be made available for rural production.
- The Western Corridor Recycled Water Project will reduce nutrient loads entering Moreton Bay, potentially decreasing phosphorus by over 50%.
- The energy intensity of the Water Grid will increase as more climate resilient supplies are constructed and intra-regional transfers occur. The increase will be mitigated through efficient operation of the Water Grid and targeted reductions in per capita demand.

The main purpose of the Strategy is to achieve the *Water Supply Guarantee*. Critical to achieving this outcome is to ensure that available supplies always exceed demand and that the water is used efficiently.

Many elements of the Strategy are already in progress as a response to the Millennium Drought. There remain, however, critical planning elements that must be finalised to secure the region's water supplies into the future and to be able to respond to the uncertainties associated with demand projections, supply estimates and climate impacts.

This chapter applies the planning methodology outlined in Chapter 3 to:

- Identify additional demand management measures (Section 6.1);
- Quantify the potential future supply gap in Normal Operating Mode (Section 6.2);
- Establish Drought Response Plan requirements (Section 6.2);
- Quantify the requirements for climate resilient supplies (Section 6.2);
- Establish criteria for, and key elements of, future infrastructure programs (Section 6.3); and
- Identify a preferred infrastructure program, pending the outcomes of detailed investigations of potential sources of supply (Section 6.3).

In addition, the chapter addresses water supplies for rural communities and rural production, water quality, research and development, and energy.

6.1 Demand Management Program

The Strategy is underpinned by the Demand Management Program, much of which has been established during the Millennium Drought. This Program is intended to achieve the targets introduced in Chapter 4, including an overall reduction in demand for Grid Water of almost 24% compared to pre-drought trends.

These savings measures are cost-effective compared to new sources of supply and can be achieved without significant changes to lifestyle. Chapter 4 explains the basis for the savings and the impacts for residents.

The Demand Management Program is focused on structural measures that will continue to provide cost-effective savings well beyond the time at which additional sources of supply are forecast to be required. Key among these are the requirements for new houses and commercial and industrial buildings to be water efficient, such as through the use of water from rainwater tanks for flushing toilets and other purposes. Unless many of these measures are undertaken now, the opportunity could be lost and the future cost of retrofitting would be prohibitive.

The Demand Management Program also seeks to continue some of the basic behavioural changes that have enabled residents of SEQ to reduce average demand to below 140 litres per person per day during the Millennium Drought without a major reduction in amenity or impact on their lifestyle. These types of behaviour will be encouraged through ongoing education programs and future water pricing arrangements.

This is an ambitious program to implement, and will require a concerted effort by all levels of government as well as business, industry and residents. However, significant achievements have already been made as part of the drought response.

A comprehensive review of the Demand Management Program will be undertaken regularly and as part of the review of the Strategy. Additional demand management measures will be identified with a view towards continuous improvement. Water saving targets may be adjusted over time as a result. These changes will be informed by changes in population growth, climatic conditions, consumption trends and community expectations, as well as technological developments and the timeframe for constructing additional sources of supply.

Consistent with the approach adopted in the Strategy, additional measures should be undertaken where they are cost-effective compared to the cost of building new supplies and where lifestyle impacts are minimal and there are environmental benefits for Moreton Bay and our waterways.

6.1.1 Water saving measures for continuation

Chapter 4 lists a range of demand management measures being implemented as part of the response to the Millennium Drought. The Strategy supports the continuation of the following measures from Table 4.3 (Chapter 4) beyond the drought:

- An average residential personal use target of 230 litres per person per day lifted from 140 litres per person per day;
- Water savings targets for new houses (part 25 of the *Queensland Development Code*);
- Requirements regarding the installation of water efficient fittings and fixtures in new dwellings and renovations (part 29 of the *Queensland Development Code*);
- Development of best practice guidelines for business water use;
- Requirements for businesses using more than 10 ML/a to prepare Water Efficiency Management Plans which outline how they will achieve best practice water efficiency;
- Requirements for all businesses to ensure their urinals and cooling towers are efficient, and businesses using 1 ML/a or more to ensure that all internal water fittings on the premises are water efficient;
- Requirements for rainwater tanks to be installed in new commercial and industrial buildings under the *Queensland Development Code*;
- Requirements for sub-meters to be installed in new residential and commercial multi-unit developments under the *Queensland Development Code*;
- Provision of water use information to residential tenants, in accordance with guidelines issued by the QWC;
- Phased implementation of a standardised billing approach across SEQ, in accordance with guidelines issued by the QWC;
- Completion of the pressure and leakage management program, which will reduce existing transport and distribution system losses by about 22,000 ML/a;
- Expansion of the allowable use of greywater, where appropriate; and
- Educational measures about water wise behaviour, such as the WaterWise schools program.

Rebate and retrofit programs

Retrofit and rebate schemes have been a critical element of the drought response. By June 2008, 200,000 houses across SEQ are scheduled to be retrofitted with water saving devices, saving about 4,000 ML/a. The Queensland Government rebate scheme is forecast to save a total of 11,500 ML/a by end June 2008 through rebates for a range of items including rainwater tanks and water efficient toilets. These rebates are in addition to similar rebates offered by most local governments in SEQ.

In a drought response, subsidies and rebates bring forward these types of savings to a time when they are most required. However, beyond the Millennium Drought, the QWC considers that increasing emphasis should be placed on a regulatory framework that encourages efficient and consistent implementation of water saving measures by water users. Regulatory requirements will generally allow these measures to be installed throughout the community over time as part of asset replacement or with a new investment, such as through the purchase of new fittings and toilets or major house renovations. Tariff structures will also drive investment in efficient appliances. Over time, this approach is likely to ensure a more uniform adoption of the demand management measures to secure long-term water supplies for SEQ.

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It is noted that:

- Under the *Queensland Development Code*, all new houses will be required to meet the water saving target and install new water efficient devices;
- Most houses in SEQ are likely to be renovated before another major supply source is required. Amendments to part 25 of the *Queensland Development Code* will ensure that water efficient devices are retrofitted as part of major renovations; and
- With appropriate amendments to Australian standards, new appliances will be required to be water efficient. Savings will therefore be achieved through natural replacement.

Recycling water

PRW is expected to become, and remain, the predominant form of recycling in SEQ. The benefits of PRW are explained in Chapter 5.

For cost benefit reasons, the QWC considers that other types of recycling should not be actively encouraged in areas where they conflict with existing or planned PRW schemes, such as the Western Corridor Recycled Water Project. In other areas, the benefits and costs of recycled water schemes should be considered on a case-by-case basis. The QWC will develop detailed assessment criteria for these schemes in 2008.

In general, recycled water schemes should be encouraged where they are cost effective compared to alternative sources of supply. Potential economic benefits of recycled water schemes include:

- Achieving the water saving target for new dwellings more cheaply than by using rainwater tanks;
- Reducing and deferring the need for major supply augmentations;
- Reducing or avoiding the need for upgrades to the water distribution system;
- Reducing whole of system operating costs; and
- Reducing the overall demand for water.

Other key considerations include health and safety and environmental benefits for waterways, rivers and Moreton Bay.

6.1.2 Water savings measures proposed for investigation

A range of additional demand management measures are currently being investigated for possible implementation. In combination with the measures that are already being implemented, these additional measures are expected to ensure that our water savings targets are met. These measures are listed in Table 6.1.

Pricing is a key element of the demand management, as noted in Table 6.1. The Queensland Government is in the process of implementing a uniform pricing framework for water in SEQ as part of the review of institutional arrangements. This structure will allow the Government to:

- Ensure that all beneficiaries of Water Grid pay an equitable contribution towards it;
- Average the cost of bulk water supply across the region, so that users share the cost of existing and new infrastructure;
- Levelise the price over time, achieving intergenerational equity in relation to assets whose full capacity will not be immediately utilised; and
- Create strong incentives for the efficient use of water, such as through inclining block retail tariff structures.

The $9 billion infrastructure program that is currently underway will have an inevitable and significant impact on water prices. The Queensland Government has made a number of commitments to ensure that the impacts of these prices on users are kept to an acceptable level. Specifically it has announced that it will operate new Water Grid assets on the basis of a break even rate of return. That is, the rate of return on these assets will be equivalent to the cost of funds required for financing. The Government has also announced that bulk water prices will increase gradually over ten years.

Table 6.1 Demand management measures under investigation

Community education and behavioural change
Promote water efficiency star rating for residential property sales
This measure would be similar to the ACT Government's Energy Efficiency Ratings for the sale of homes. The rating system would be used to disclose to prospective purchasers the current level of water efficiency of the dwelling.
Promote water efficiency star rating for non-residential property
Water consumption in office buildings will be monitored and rated on a scale of one to five stars, from least efficient (one star) to best practice (five stars).
Best practice guidelines for business water use
Water efficiency guidelines have been developed for selected industry sectors. This measure proposes the development of similar guidelines for a much broader range of industry sectors.
Targeted education programs for selected industries
This measure involves the development of a training program for professions and trades involved in the sale and installation of water using appliances and fixtures, and garden and landscaping products.
Ongoing education and awareness
This measure seeks to address and maintain awareness of water conservation after the drought through a marketing and education program. The campaign should be linked with other demand management strategies such as the implementation of a permanent water saving measures.
Structural water efficiency (such as fixtures and fittings)
Retrofit of taps and showerheads on resale
This measure involves enhancing the existing requirement to fit water efficient fixtures and fittings to new homes by requiring the retrofit of existing homes upon resale, or mandating disclosure of water efficiency at point of sale or lease.
Retrofit of water efficient fittings and fixtures as part of major renovations
This measure extends the mandatory installation of efficient fittings and fixtures to all major renovations requiring a building approval and plumbing certificate.
Ban on sale of inefficient water devices
With the exception of toilets, plumbing and white good products do not have to meet minimum water use performance standards. This measure involves working with the Australian Government and industry to develop and implement minimum standards. Consideration could also be given to expanding the range of products covered by the existing Water Efficiency and Labelling Standards.
Insulation of hot water pipes in new buildings
Up to 30% of the heat in hot water is lost from exposed hot water pipes. This results in energy being lost and water being wasted while people wait for it to heat up to the desired temperature. This measure seeks to ensure that heat loss is reduced, such as through insulation. Options will be investigated to require better siting of hot water systems to reduce the length of pipes to bathrooms and other key water uses.

School water efficiency

This measure would involve the installation of permanent web-based smart monitoring and alarm systems on water meters in schools. The monitoring system would issue an alarm if water consumption rises above a pre-set level. This alarm would trigger the school principal or general assistant to contact the water service provider to find and fix the leaks. An audit of 13 Sydney schools showed that 44% of water used within the grounds was lost through leaks. Sydney Water has successfully trialled this type of monitoring.

Permanent water conservation measures

Once water shortages ease, it is proposed that permanent water conservation measures be introduced to minimise water waste. The restrictions would likely be similar to the permanent water conservation measures that have been trialled in the ACT and are currently in place in parts of South Australia. In the ACT, they included the fitting of trigger nozzles to all hoses, set times for sprinkler use, restrictions on the cleaning of paved areas, promotion of the use of high-pressure, low-volume cleaners for vehicles and houses, and encouraging the washing of cars on grassed areas.

Pricing and tariff design

Regionally consistent billing approach

This measure involves phasing in standardised billing across Queensland, starting with SEQ. Water service providers would be required to produce water bills in accordance with guidelines that specify a minimum content and format, with regular billing cycles. This will allow consumers to become more informed about their water consumption.

Water pricing structures to encourage water conservation

Pricing policies and market rules are being considered as part of the review of institutional arrangements for water supply. This measure involves providing pricing incentives to encourage conservation and deter inefficient use.

Wastewater pricing structures for non-residential customers

This measure involves the development of regionally consistent volumetric wastewater charging for non-residential customers, to encourage a reduction in water use in the commercial and industrial sector.

6.2 Regional supply gap

This section explains the regional supply gap in normal conditions and during severe drought. The tables, figures and conclusions have been derived using the methodology, objectives and criteria discussed in Chapter 3, demand forecasts from Chapter 4, and committed infrastructure from Chapter 5.

6.2.1 Supply from existing and committed sources

The SEQ system yield from sources of supply existing in 2006 has been reduced to 416,000 ML/a, based on the proposed Levels of Service (LOS) objectives. This represents a reduction of about 20% below the assumed regional supply prior to the Millennium Drought.

Climate change may result in further reductions, as explained in Chapter 3. A reduction to about 374,000 ML/a is possible, based on a mid-range scenario.

By 2012, committed infrastructure projects incorporating improved regional interconnection will more than offset the reduction. From that time and once water storage levels have recovered from the Millennium Drought, the system will be capable of supplying about 684,000 ML/a. With climate change, the LOS system yield will be about 631,000 ML/a.

6.2.2 Supply gap in Normal Operating Mode

Figure 6.1 and Table 6.2 summarise the regional supply gap projected to 2056, based on existing and committed supplies. The supply gap is the demand for additional supplies over and above existing and committed infrastructure.

Demand is forecast to increase to about 690,000 ML/a by 2026 and 985,000 ML/a by 2056, based on pre-drought trends and medium series population growth. Including additional water for rural production, forecast demand is 722,000 ML/a at 2026 and 1,017,000 ML/a at 2056.

At this rate, demand would exceed the LOS system yield of existing and committed sources of supply by about 38,000 ML/a at 2026 and 333,000 ML/a at 2056. The supply gap would increase significantly with climate change or high series population growth. Under a worst case scenario, the supply gap is forecast at 597,000 ML/a.

Demand management underpins the Strategy. The demand management program outlined in Section 6.1 is forecast to reduce the supply gap by about 155,000 ML/a at 2026 and 236,000 ML/a at 2056, based on medium series population. At 2056, these savings reduce the supply gap by more than 70%. This highlights both the potential contribution of demand management measures and also the need to closely monitor demand outcomes over time.

On the basis of high series population growth and climate change, and a successful demand management program, additional sources of supply will be required to meet demand from 2028. On the basis of medium series population growth and no climate change effects, future supplies need to become operational from 2042.

Without additional supplies, by 2056, the gap between supply and demand would be between 97,000 and 308,000 ML/a, depending on population growth, savings achieved and the impacts of climate change. The purpose of the Strategy is to bring on supplies at appropriate times to prevent this gap from developing.

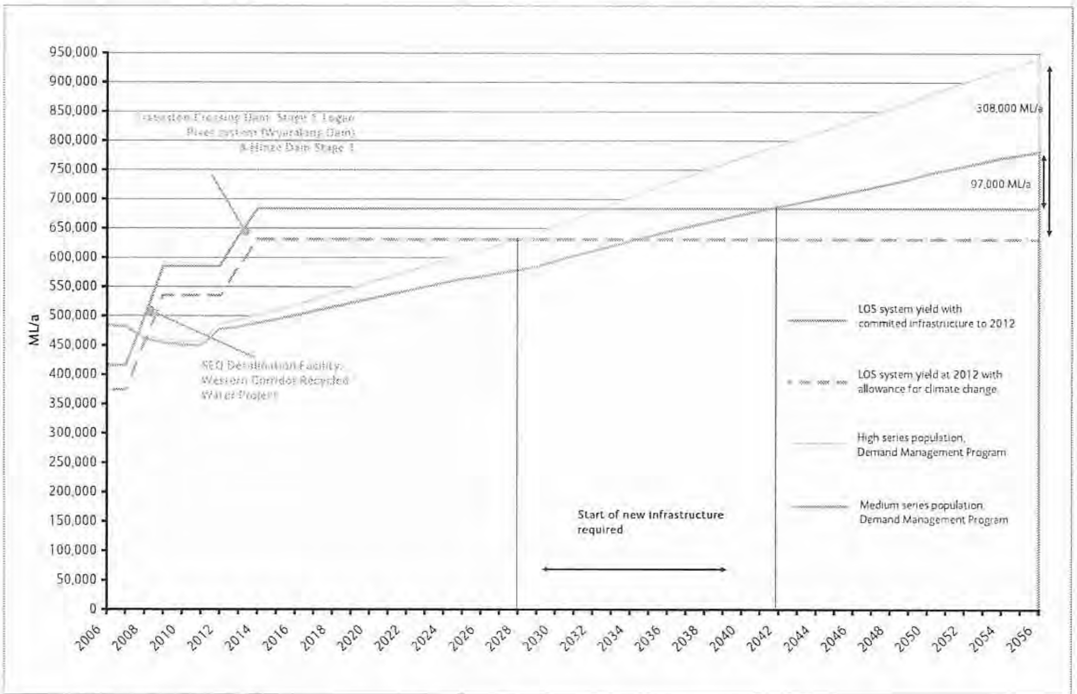

Figure 6.1 Regional supply gap in Normal Operating Mode

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Table 6.2 Regional supply gap in Normal Operating Mode

Scenario	2026				2056			
	Medium series population		High series population		Medium series population		High series population	
	Pre-drought demand trend	Demand management program	Pre-drought demand trend	Demand management program	Pre-drought total water demand trend	Demand management program	Pre-drought total water demand trend	Demand management program
Forecast demand[1] (ML/a)	722,000	567,000	781,000	612,000	1,017,000	781,000	1,228,000	939,000
System LOS yield at 2006 [2] (ML/a)	416,000							
System LOS yield at 2012 with committed infrastructure (ML/a)	684,000							
Supply gap above 2006 supplies (ML/a)	306,000	151,000	365,000	196,000	601,000	365,000	812,000	523,000
Supply gap above 2012 supplies (ML/a)	38,000	-117,000	97,000	-72,000	333,000	97,000	544,000	255,000
System LOS yield at 2006 with allowance for climate change [3] (ML/a)	374,000							
System LOS yield at 2012 with committed infrastructure with allowance for climate change (ML/a)	631,000							
Supply gap above 2006 supplies with allowance for climate change (ML/a)	348,000	193,000	407,000	238,000	643,000	407,000	854,000	565,000
Supply gap above 2012 supplies with allowance for climate change (ML/a)	91,000	-64,000	150,000	-19,000	386,000	150,000	597,000	308,000

[1] Includes demand for power stations, rural communities and additional supplies for rural production, as explained in Section 6.5.

[2] In Normal Operating Mode.

[3] Based on a mid-range scenario of a 10% reduction in the yield of climate affected sources.

6.2.3 Drought response planning requirements

The purpose of drought response planning is to ensure continuity of supply consistent with the LOS objectives and regardless of climatic conditions, as explained in Section 3.4 of Chapter 3. The proposed process for development and implementation of a Drought Response Plan is described in Chapter 7.

Under the LOS objectives, a Drought Response Plan is expected to be implemented no more than once every 25 years, on average. It will be triggered by a drought similar to, or more severe than, the Millennium Drought. Even then, detailed stochastic modelling indicates that three out of four of these droughts will ease within the six month preparatory phase, prior to the commencement of construction of new supply sources.

Process to determine the drought supply requirement

The Drought Response Plan will be defined in advance and will comprise a combination of water restrictions, water efficiency measures and, when triggered, the construction of climate resilient supplies. These supplies must be commissioned within 36 months of implementing the Drought Response Plan.

The implementation of the Drought Response Plan will be triggered when combined regional dam levels reach the T1 trigger level, as explained in Chapter 3. The T1 trigger level is set so that there is forecast to be sufficient water available within the Drought Storage Reserve and climate resilient supplies to meet restricted demand level for a period of 36 months while new supplies are constructed. This 36 month period provides for 6 months of preparation and 30 months for construction. Under the proposed LOS objectives, restricted demand is 85% of pre-drought demand.

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In developing the Drought Response Plan, it is necessary to consider the ability to construct sufficient new climate resilient infrastructure within 36 months.

The drought supply requirement is the gap between the medium-level restricted demand and the climate resilient supply capability of existing supplies at any time over the planning horizon. The drought supply requirement is the estimated amount of drought infrastructure capacity which must be able to be commissioned within the 36-month period.

Forecast drought supply requirement

Figure 6.2 shows how much climate resilient supply will be available in the region when the Water Grid and other committed projects are completed around 2012. At 2006, existing climate resilient supplies were about 190,000 ML/a. At 2012, once committed projects are completed, climate resilient supplies will increase to about 388,000 ML/a.

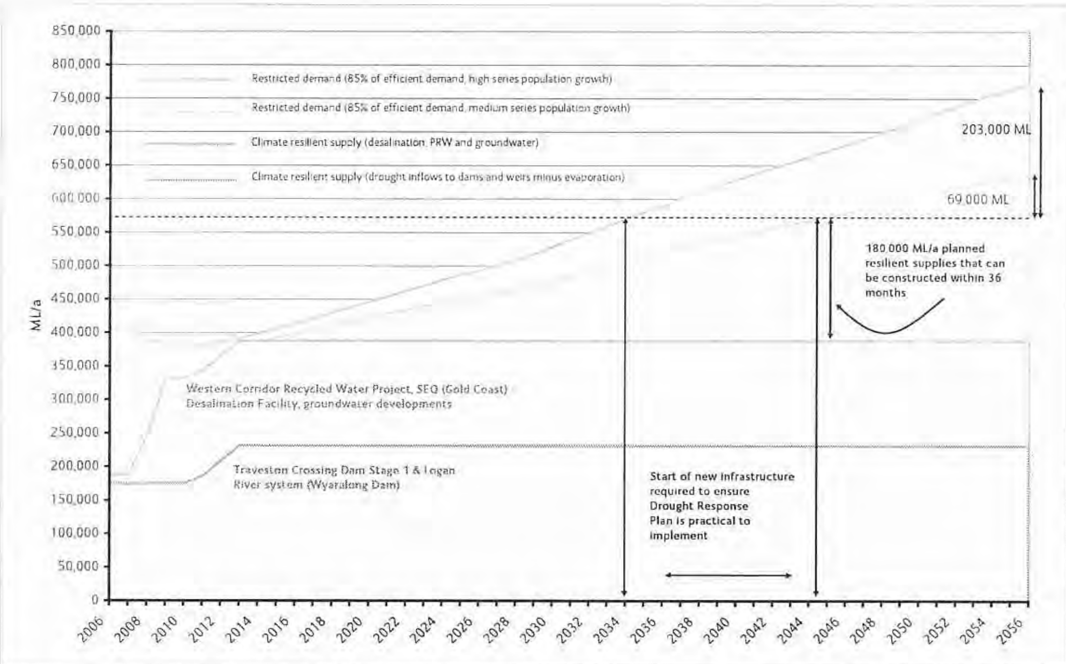

Figure 6.2 Forecast demand and supply in the Drought Response Mode

Figure 6.2 also identifies the projected volume of the drought supply requirement in yellow. If a drought occurred at 2026, with medium-level water restrictions, forecast demand would be about 455,000 ML/a based on medium series population growth and the demand management program. If a drought occurred at 2056, medium-level restricted demand would be about 637,000 ML/a, or 771,000 ML/a under a high series population growth scenario.

Consequently, if a drought event occurred in 2026 such that dam levels approached T1, the drought supply requirement would be approximately 67,000 ML/a under a medium series population scenario or 105,000 ML/a under a high series population scenario.

Similarly, Figure 6.2 suggests that if a drought event occurred in 2056 such that dam levels approached T1, the drought supply requirement would reach approximately 249,000 ML/a under a medium series population scenario or 383,000 ML/a under a high series population scenario.

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The Drought Response Plan of the time would need to address these requirements.

Limits of the Drought Response Plan

There is a practical limit to the amount of infrastructure that can be constructed within 36 months. Pending detailed investigation of potential projects, it is assumed that this limit is 180,000 ML/a. This limit has been selected upon the basis of industry capacity to deliver over a three-year period, the experience of the Millennium Drought emergency program of works and Australian benchmarks for desalination plants.

In comparison, the South East Queensland (Gold Coast) Desalination Facility is scheduled to be commissioned within 37 months of commencing preliminary design. As illustrated in Figure 6.3, actual construction commenced after 10 months. With sufficient planning, larger projects could be delivered within similar timeframes. For instance, construction could be commenced earlier by undertaking water sampling and obtaining approvals while in normal conditions.

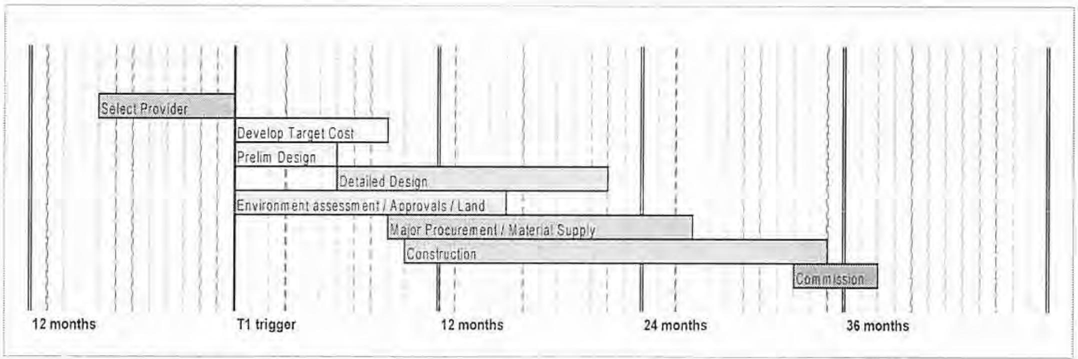

Figure 6.3 South East Queensland (Gold Coast) Desalination Facility construction timeframe

If the drought supply requirement becomes greater than 180,000 ML/a at any particular point in time, it may not be possible, if a drought occurs, to procure and commission sufficient drought infrastructure in time to avoid harsh restrictions – meaning that the LOS objectives would be at risk of not being achieved.

The risks of this scenario can be reduced through construction of additional climate resilient supplies as part of planned infrastructure development to maintain supplies during normal conditions. The key is to keep the drought supply requirement below 180,000 ML/a in the future.

In a drought scenario and without additional supply capacity beyond the committed projects, it is expected that the drought supply requirement will exceed 180,000 ML/a for the first time between 2034 and 2044. From this time, the need for additional climate resilient supplies would be expected to drive the selection of infrastructure required to meet the needs in normal conditions and at the same time to ensure that the Drought Response Plan is practical to implement. Of the additional supply capacity required in normal conditions, between 69,000 and 203,000 ML/a of additional climate resilient supplies will be required to limit the drought supply requirement to 180,000 ML/a.

These factors should be considered in future long-term planning decisions as the Strategy is reviewed.

Medium-term security of supply

In most years, the Water Grid's performance will exceed the LOS objectives. Figure 6.4 illustrates the frequency of triggering restrictions where the demand targets are achieved, climate change impacts are negligible, and medium series population projections are realised.

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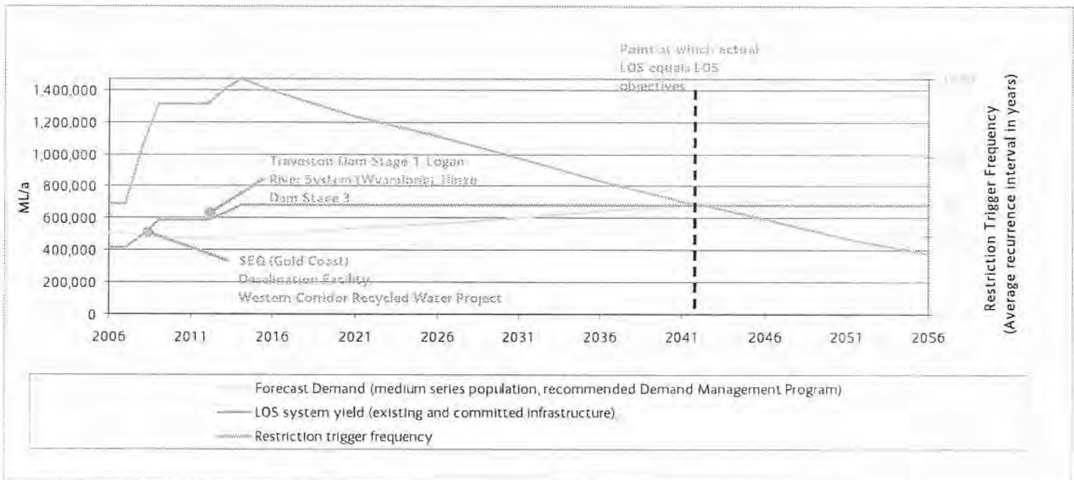

Figure 6.4 Forecast frequency of restrictions with existing and committed infrastructure

As this figure illustrates, the yield from existing and committed sources will approximately equal annual demand at around the year 2042 based on medium series population growth and without an allowance for climate change. At this time, the probability of restrictions is estimated to be one in 25 years, thereby matching the LOS objective of restrictions no more than once every 25 years on average. This signals the need to augment system capacity at this time.

Prior to 2042 the actual LOS system yield is expected to exceed the LOS objectives. For instance, around 2020, the likelihood of triggering medium-level restrictions is less than one in 300 years on average. After 2042, without augmentation, system performance would be below the LOS objectives and additional supply sources required. By 2056, without augmentation, medium-level restrictions would likely be triggered about once every six years.

6.2.4 Summary of the supply gap

In summary:

- The demand management program will reduce demand by about 24% compared to pre-drought trends;
- With these savings, additional supply capacity will be required from between 2028 and 2042, unless brought forward as part of the response to a severe drought;
- Without additional supplies, by 2056, the gap between supply and demand would be between 97,000 and 308,000 ML/a, depending on population growth, savings achieved and the impacts of climate change. The purpose of the Strategy is to bring on supplies at appropriate times to prevent this gap from developing; and
- Of the additional supply capacity required in normal conditions, between 69,700 and 203,000 ML/a of climate resilient water is required to ensure that future Drought Response Plans are practical to implement.

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6.3 Meeting the supply gap

Planning for between 97,000 and 308,000 ML/a of additional supply capacity by 2056 over and above the current infrastructure program is challenging. This section provides a summary of potential supply options and infrastructure programs.

6.3.1 Potential supply options

Future supply options were identified in Chapter 5 and listed in Table 6.3.

Table 6.3 Potential sources of supply for detailed investigation

Type of source	Potential source
Dams and weirs	• Borumba Dam Stage 3 • Traveston Crossing Dam Stage 2 • Raised operating levels in Wivenhoe Dam • Smaller surface water upgrades, including additional water harvesting into dams and off stream storages and raisings of Wappa Dam and the Mt Crosby Weir
PRW schemes	• Augmentation of supply from Hinze Dam • Augmentation of supply from North Pine Dam • Augmentation of supply at Sunshine Coast • Augmentation of supply at Toowoomba
Desalination sites	• At Marcoola • At Kawana • At Bribie Island • At Mouth of the Brisbane River • At North Stradbroke Island • At South Stradbroke Island

In total, dams and weirs have been estimated to potentially supply up to an additional 120,000 ML/a in normal conditions. However, upgrades to existing dams would be unlikely to increase climate resilient supplies. Further development of surface sources is restricted by water resource planning outcomes and suitable sites for the construction of dams.

PRW schemes are limited by practical and economic considerations. Potential schemes are small compared to the Western Corridor Recycled Water Project and need to be integrated with a relatively large dam to provide an effective environmental barrier (refer to the seven barriers in Chapter 5). By 2056, the schemes identified for more detailed investigation could supply up to 100,000 ML/a, allowing for reduced sewer flows during drought.

The combined potential supply from possible dam and weir upgrades and PRW schemes is estimated to be 220,000 ML/a, which is less than the potential supply gap of 308,00 ML/a identified by 2056.

Hence, sites for future desalination plants and PRW schemes need to be preserved and protected from inappropriate urban encroachment. Desalination and PRW scheme sites identified for investigation are not required immediately but should be preserved until the detailed investigations have been completed and decisions are made on the long-term requirements. Preliminary investigations indicate that some of these sites could accommodate very large desalination facilities with a capacity many times larger than the desalination facility at Tugun.

As explained in Chapter 5, detailed studies will be undertaken to inform future decisions regarding the location of future desalination plants and PRW schemes.

Other supply strategies to mitigate the need for major sources of supply development could include small groundwater development opportunities and rainwater, stormwater and local recycling. There are currently no plans for substantial increases in the volume of water extracted from groundwater.

6.3.2 Key elements of future infrastructure programming

Potential supplies can be combined into numerous programs. These programs will be determined based on detailed investigations but must achieve the following criteria:

- LOS system yield must exceed forecast demand at all times;
- The drought supply requirement should not exceed 180,000 ML/a; and
- New supplies be commissioned before demand equals LOS system yield, providing a buffer against project delays and higher than forecast demand growth.

At this stage the key planning assumptions for formulating the future infrastructure program are:

- Demand will be reduced by about 24% compared to pre-drought trends;
- Beyond existing commitments, additional supply capacity is not expected to be required until at least 2028. This provides time to research the local impacts of climate change, to adjust assumptions about the impact of climate change on the planning model if required, to implement measures that may further reduce demand, and to thoroughly plan for supply augmentations;
- Beyond 2028, drought response capacity will potentially drive the content and timing of the preferred program. About 70% of the additional supply capacity required at 2056 should be climate resilient, to ensure that the drought supply requirement does not exceed 180,000 ML/a. Figure 6.5 illustrates the requirements for additional climate resilient supply capacity. Figure 6.6 illustrates the same requirements with high series population growth and an allowance for climate change;
- Based on this requirement, desalination and PRW would comprise more than 30% of the supply system at 2056. By comparison, water from dams and weirs comprised about 92% of the total regional supply prior to the Millennium Drought, as explained in Chapter 5;
- Pending detailed investigation, PRW may provide up to 100,000 ML/a of climate resilient supply. This is equivalent to the total supply gap in Normal Operating Mode at 2056, based on medium series population growth. The potential benefits of PRW, as outlined in Chapter 5, include improved water quality in waterways and Moreton Bay;
- Desalination would be required to meet any demand for climate resilient supplies not provided by PRW;
- The distribution costs and the capacity of interconnections in the Water Grid are key considerations for the sequence, timing and location of supply projects. Over time, LOS system yield may be increased through the construction of additional interconnections;

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- Transport capacity constraints will always drive the need to locate supply sources as close as possible to large demand nodes such as Brisbane; and
- The Queensland Government has announced that a pipeline will be constructed from Wivenhoe Dam to secure supply to Toowoomba and surrounding areas following consideration of recommendations from the Toowoomba Water Supply Task Force. Long term, a PRW scheme may be developed in Toowoomba to reduce the demand for water from Wivenhoe Dam.

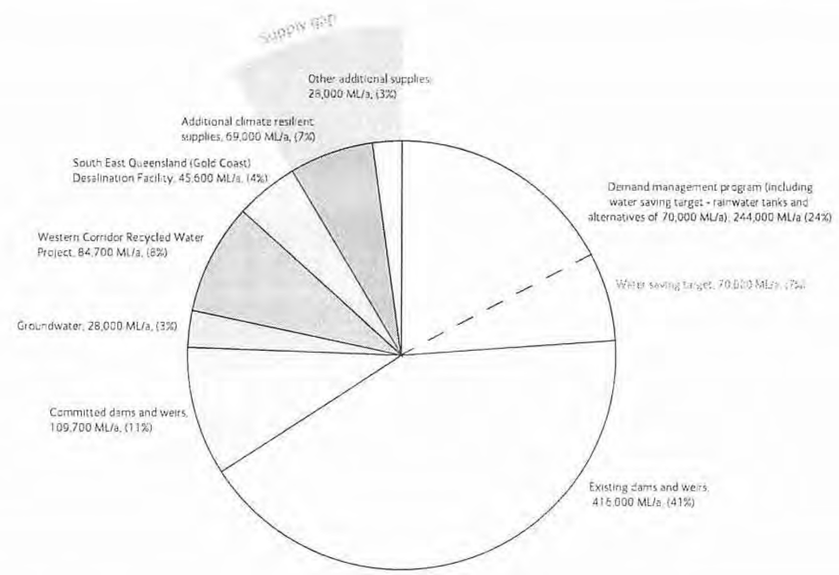

Figure 6.5 Projected future supply at 2056 (medium series population growth, no allowance for climate change)

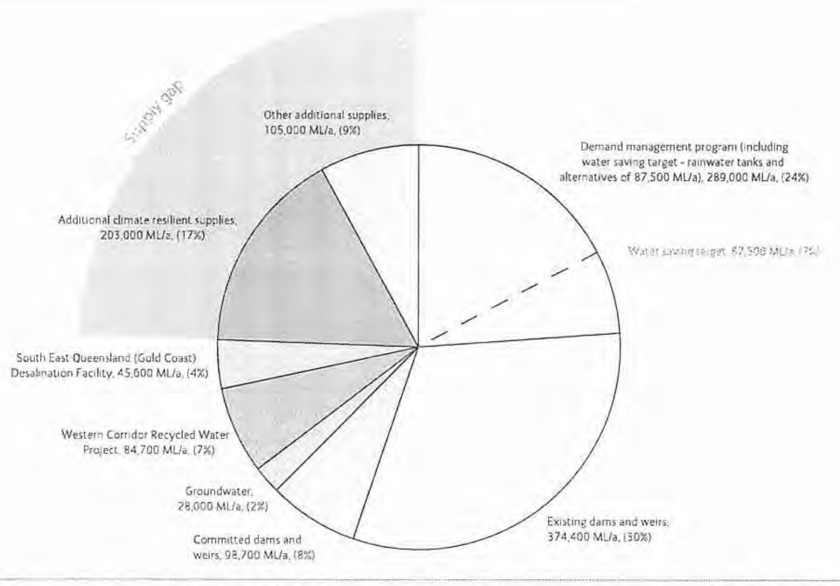

Figure 6.6 Projected future supply at 2056 (high series population growth, allowance for climate change)

6.3.3 Potential infrastructure programs

Figure 6.7 and Figure 6.8 illustrate possible alternative programs, based on medium series population growth to 5.2 million and without an allowance for climate change. Both programs meet the criteria listed in Section 6.3.2. The development of additional dam and weir capacity is the major point of difference.

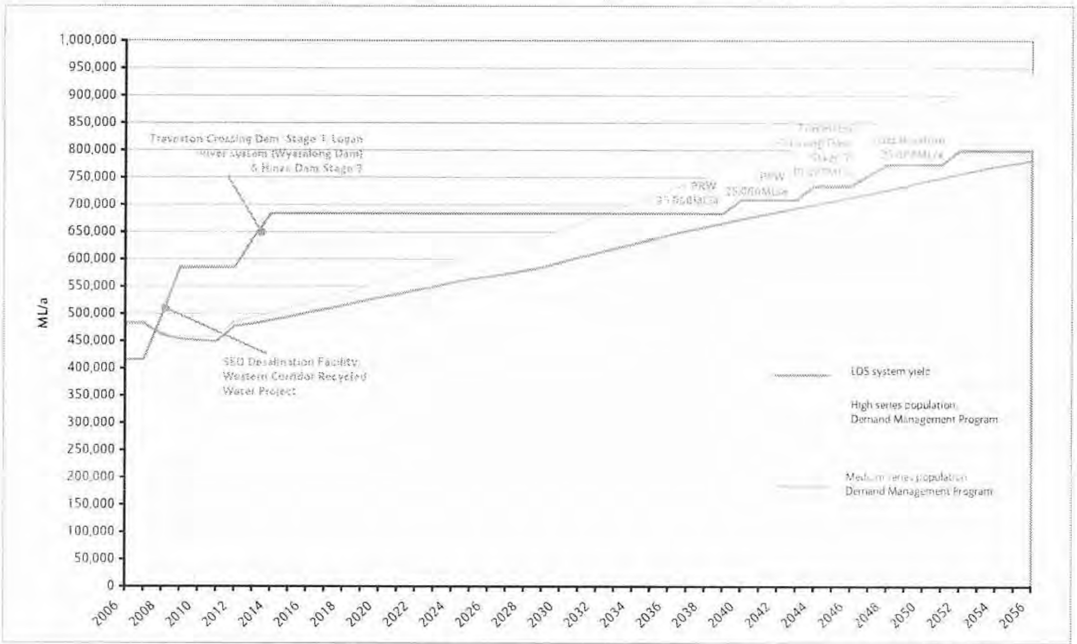

Figure 6.7 Projected infrastructure program: Climate resilient and surface supplies (medium series population growth and no allowance for climate change)

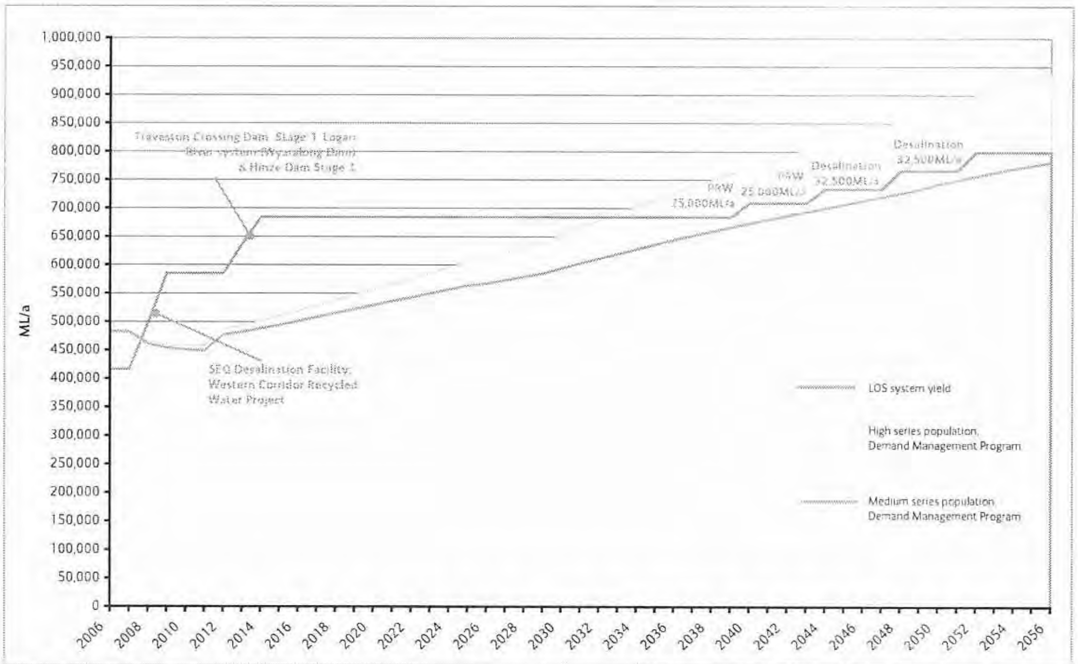

Figure 6.8 Alternative infrastructure program: Climate resilient supplies (medium series population growth and no allowance for climate change)

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On the basis of portfolio analysis, as explained in Section 3.6.2, a program containing a combination of climate resilient supplies and dams and weirs is preferred, pending the outcomes of detailed investigations.

Table 6.4 lists the timeframes for the delivery of new projects to deliver the program illustrated in Figure 6.7. This program will be refined based on community input regarding the LOS objectives and, over time, the outcomes of the detailed investigations of potential supply sources. Future versions of the program will also incorporate major pipeline upgrades, such as Stage 2 of the Northern Pipeline Inter-connector.

Table 6.4 Draft projected infrastructure program: 2012 to 2056 (medium series population growth and no allowance for climate change)

Source	Preliminary capacity (ML/a)	Commencement of supply
PRW scheme	25,000	2040
PRW scheme	25,000	2044
Traveston Crossing Dam Stage 2	40,000	2048
Desalination plant	25,000	2052

Figure 6.9 illustrates how this program could be adjusted to respond to high series population growth and a 10% reduction in the yield of dams and weirs due to climate change. Table 6.5 contains another alternative version of the projected infrastructure program.

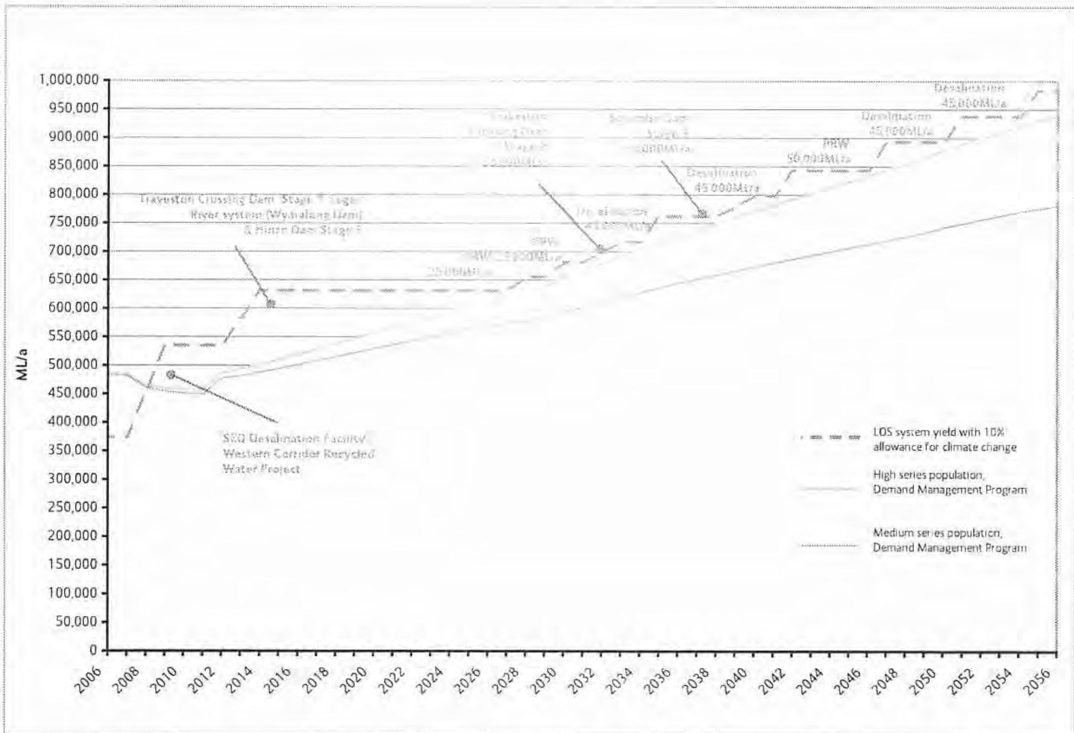

Figure 6.9 Draft projected infrastructure program: 2012 to 2056 (high series population growth to 6.2 million and allowance for climate change)

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Table 6.5 Draft projected infrastructure program: 2012 to 2056 (high series population growth and allowance for climate change)

Source	Preliminary capacity (ML/a)	Commencement of supply
PRW scheme	25,000	2028
PRW scheme	25,000	2030
Traveston Crossing Dam Stage 2	36,000	2033
Desalination	45,000	2035
Borumba Dam Stage 3	36,000	2040
Desalination	45,000	2042
PRW	50,000	2047
Desalination	45,000	2051
Desalination	45,000	2055

The concept and impacts of portfolio analysis are explained in Chapter 3. For this Strategy, the portfolio model was used to:

- Assess the cost effectiveness of selected demand management measures (refer Chapter 4); and
- Broadly assess the cost of alternative portfolios to achieve the target LOS objectives.

More detailed investigation and portfolio analysis will be undertaken to determine future preferred infrastructure programs, based on the outcomes of detailed investigation. The main components of the portfolio model are outlined in Table 6.6

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Table 6.6 Components of the portfolio model

Component	Overview
Supply schedule	The supply schedule incorporates committed projects and a future infrastructure program, including the cost of installing rainwater tanks on new dwellings. For each new dam or weir, the model incorporates assumptions regarding the yield in the year after the dam is constructed and the period before the LOS yield is available. Most demand measures are not included in the schedule, as they will not impose significant additional costs on the community and are common to all portfolios. The cost effectiveness of these measures was separately addressed, as explained in Chapter 4.
Capital expenditure schedule	A schedule of costs has been developed based on standard unit rates. Costs for each supply are assumed to be distributed evenly over a specified construction period (typically three to five years). The schedule incorporates an allowance to bring forward land acquisition for Traveston Crossing Dam Stage 2. It also includes replacement costs for each major infrastructure component.
Operational expenditures	The model includes estimates of fixed and variable costs based on standard unit rates. Fixed costs are assumed to be incurred from the year of commissioning, irrespective of the level of utilisation. Variable costs are incurred for the assumed volume to be supplied from a particular source. When supply exceeds demand, the Water Grid Manager will choose between alternative sources of supply. Various factors will influence the decisions on which supply sources to use first. To minimise economic costs, the portfolio model selects options with the lowest variable operating costs. In practice, operating costs will not be the only consideration.
Drought response planning expenditures	The model includes capacity to determine the probability weighted cost of implementing future Drought Response Plans.
Sensitivity testing	The model provides the capacity to undertake a range of sensitivity tests, including for population growth, demand growth, operating costs and reduced yield from surface supplies due to climate change.

Table 6.7 sets out the estimated present value costs for the draft program outlined in Figure 6.7 and Table 6.4. The costs of this program are compared to the costs of the alternative, illustrated in Figure 6.8, that did not contain any dams or weirs beyond existing commitments. Both programs are assessed on the basis of a 4% real discount rate and a 30-year evaluation period, commencing 2027 and ending 2056.

Table 6.7 Present value cost of alternative portfolios: 2027 to 2056 (medium series population growth and no climate change)

Type of cost	Climate resilient and surface supplies (Figure 6.7) $M	Climate resilient supplies only (Figure 6.8) $M	Difference $M
Capital	1,727	1,782	55
Fixed operating	1,646	1,669	23
Variable operating	1,202	1,227	25
Total	**4,574**	**4,677**	**103**

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The present value cost of the total portfolio of climate resilient and surface supplies (including Traveston Crossing Dam Stage 2) is $4,574 million at 2027. The present value cost of the alternative portfolio is $4,677 million at 2027. In both cases, capital expenditure comprises around 38% of the total cost, fixed operating costs around 36% and variable operating costs around 26%.

Table 6.8 contains estimates of the cost impact of changes to key inputs, such as an allowance for the impacts of climate change or a 30% increase in operating costs due to increased electricity prices.

Table 6.8 Sensitivity testing given changes in key parameters: 2027 to 2056

	Climate resilient and surface supplies (Figure 6.7) $M	Climate resilient supplies only (Figure 6.8) $M	Difference $M
Base case	4,574	4,677	103
Climate change	6,129	6,285	156
High population/high savings	7,768	8,371	603
30% increased opex	4,935	5,045	111
30% increased capex	5,092	5,212	120

Figure 6.9 illustrates how the draft infrastructure program could be adjusted to respond to high series population growth and a reduction in dam yields due to climate change. At about $8,644 million, the present value cost of this program at 2027 is more than $4,000 million higher than the program contained in Figure 6.7 .

The main findings of the economic analysis are that:

- Substituting additional climate resilient supplies for Traveston Crossing Dam Stage 2 adds around $103 million to the total present value cost of the portfolio at 2027. This is estimated to be equivalent to around $6 million per annum or 1.1 cents per kilolitre of bulk water supplied throughout SEQ between 2027 and 2056;
- Over 52% of the increase in cost comes from the higher capital cost associated with the climate independent source with the increase in fixed and variable operating costs accounting for the remaining 48% of the increase in overall cost; and
- The results of sensitivity analysis confirm that the program containing a combination of climate resilient supplies and dams and weirs represents a lower cost option under a range of different values for key parameters and model inputs.

6.4 Rural towns and villages

The Strategy plans to provide increased security of supply to more than 200,000 residents of SEQ who live in towns that are not connected to the Water Grid or rely on water from individual rainwater tanks or groundwater bores.

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6.4.1 Communities with reticulated drinking water

About 20,000 residents of SEQ live in communities that have drinking water supplies not directly connected to the Water Grid. These communities have a diverse range of water supply sources and varying levels of security. They also differ in terms of size and forecast population growth.

Over time, the Strategy seeks to achieve the same LOS objectives for these communities as for the remainder of the Water Grid.

Commencing in 2008, in partnership with relevant local governments, the QWC will review the future supply needs of all of the rural towns and villages with reticulated supplies. The review will inform decisions regarding supply augmentations and drought response planning. Options to improve security of supply include:

- Direct connection to the Water Grid through the construction of new pipelines;
- Augmentation of existing sources of supply through the provision of additional surface and groundwater supplies; and
- Carting of water.

A number of communities are indirectly supplied from Water Grid assets, such as water taken from infrastructure on the Logan River. They include Beaudesert, Kooralbyn, Rathdowney and Kilcoy. These communities will benefit from improvements to Water Grid supplies.

For other communities, additional security of supply may be able to be provided through direct pipeline connection to the Water Grid. For these communities, similar LOS objectives will be targeted but may not be able to be delivered in the short term. This applies to towns like Canungra, Aratula, Boonah, Kalbar, Mount Alford, Dayboro and Kenilworth.

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Amity Point, Dunwich and Point Lookout on North Stradbroke Island have very secure groundwater supplies and are unlikely to require augmentation. Caloundra Shire Council has announced that it is planning to construct a pipeline that will connect Maleny to the Water Grid.

6.4.2 Communities without reticulated drinking water

Another 180,000 residents of SEQ are reliant on drinking water from rainwater tanks and private bores. About 5,000 of these people live in small villages, such as Tamborine, with the remainder dispersed across rural and rural residential developments.

These residents will be able to supplement local supplies from the Water Grid as necessary. Demand forecasts for the Water Grid include water to supplement rainwater tanks during periods of low rainfall. Carting of water to rainwater tank supplied communities is generally a practical method of ensuring security of supply.

Local government planning schemes specify the minimum size of rainwater tanks required for new houses in areas where reticulated drinking water is not available. These requirements currently vary across SEQ. The QWC will review the appropriate minimum size across SEQ, taking into account the costs of new rainwater tanks and carting. Local governments may choose to mandate larger tanks than the minimum size.

Water carters will continue to have regulated access to stand pipes in the Water Grid. Residents will continue to be responsible for organising and paying for carting.

Over time, reticulated drinking water may be supplied to some rural villages that are currently supplied from rainwater tanks and private bores. Factors that will be taken into account when considering supplying these villages with reticulated water include:

- Demand from residents and industry;
- Population health;
- Cost and cost recovery; and
- Community views.

Local governments currently decide whether a reticulated drinking water system is provided to rural villages and the price that will be charged to consumers for the service. This decision may be influenced by the availability of state financial assistance.

The QWC will develop a new policy framework to guide decisions regarding the supply of reticulated drinking water supplies to communities that are currently reliant on drinking water from rainwater tanks and private bores.

6.5 Rural production

Rural communities, industries and environments make a major contribution to the region's economy, providing diverse business, agriculture, grazing, forestry and recreational opportunities. The Regional Plan recognises the significant role rural areas play, and the importance of ensuring a healthy and viable rural future and enhancing the interdependence of the urban and rural communities.

For the rural sector, access to water and the cost of that water has proven to be a major challenge in SEQ.

The Strategy proposes options to improve reliability of supply and, where possible, provide additional supplies. It specifically addresses policies in the Regional Plan to improve the efficiency of rural water use and to identify alternative economic sources of water for rural use. This section explains these options.

6.5.1 Reduce demand

More efficient use of existing supplies potentially makes large volumes of water available for the rural sector. Improved rural water use efficiency will continue to be driven by:

- Programs to improve on-farm efficiency, such as the SEQ Irrigation Futures program;
- Water markets and trading;
- Appropriate pricing to better reflect NWI pricing principles; and
- More efficient rural water supply schemes.

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Queensland Government initiatives for rural water supply

Rural Futures Strategy

The Regional Plan requires the development of a *Rural Futures Strategy* to provide a framework for integrated rural planning in SEQ to ensure a viable rural production sector capitalising on existing advantages and ready to meet changing circumstances. It will build upon existing strategies, policies and programs, and provide a whole-of-government approach to address planning and economic issues in rural SEQ. The *Draft Rural Futures Strategy* is due for release in 2008.

SEQ Irrigation Futures

SEQ Irrigations Futures is a Queensland Government program to achieve a reduction in irrigation water use of up to 10% across the region by 2009. The program addresses better irrigation management and off-farm impacts from irrigation. It also includes system efficiency assessments, field trials and workshops and, where appropriate, financial incentives to assist irrigators to achieve reduced water use. The *South East Queensland Infrastructure Plan and Program* includes a commitment of $15 million towards the program.

6.5.2 Increase supply

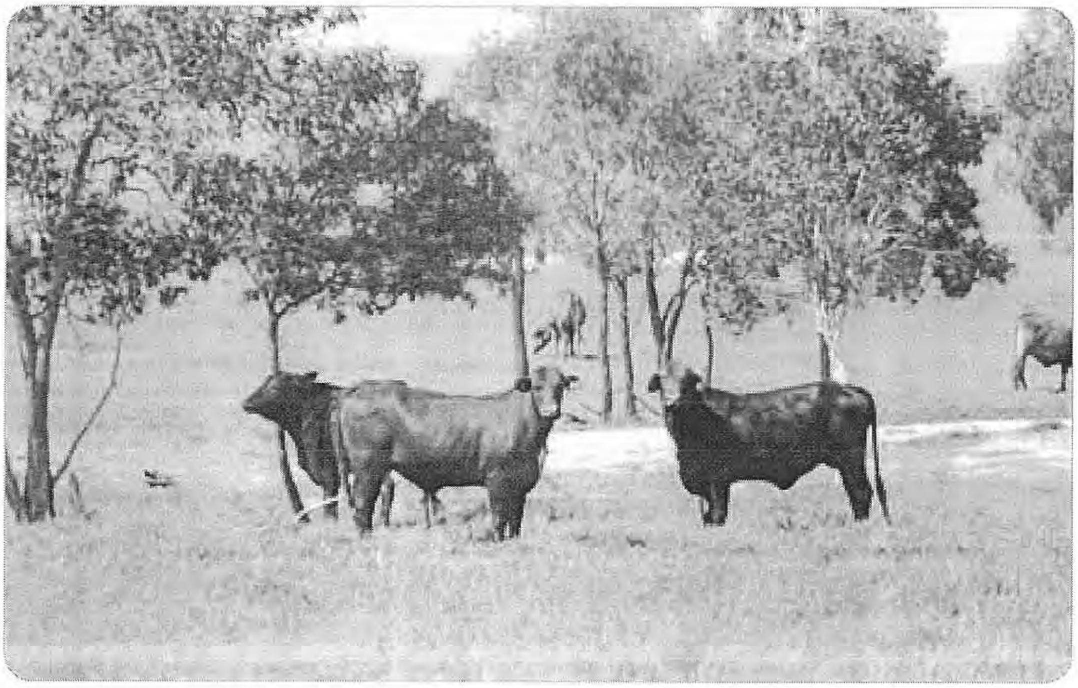
The allocation of water for rural production is dictated by water resource planning and associated water allocation processes, as discussed in Chapter 2. Apart from opportunistic water harvesting, the formulation of the Water Resource Plans in SEQ have resulted in:

- No additional allocations being identified for the rural sector in the Moreton and Logan Basin Water Resource Plans;
- Limited additional allocations in the Mary Basin; and
- An amount of about 500 ML/a nominally being allocated for rural development in the Gold Coast Water Resource Plan area.

The Queensland Government has already announced that:

- 10,000 ML/a of allocation will be made available to irrigators on the Mary River. The methodology by which the allocation will be implemented is currently under consideration;
- 25,000 ML/a of recycled water will be made available to Lockyer Valley irrigators when not required to meet urban supply requirements. Supply of recycled water is subject to a range of conditions, including groundwater recovery. Groundwater recovery would provide additional stored water in the aquifers and enable irrigators to continue irrigating when recycled water is unavailable; and
- 7,000 ML/a of recycled water will be made available to irrigators below Wivenhoe Dam, when not required to meet urban supply requirements.

At a minimum, irrigators will be required to pay the operating costs for the Western Corridor Recycled Water Project to provide recycled water either from Bundamba or Lowood. Irrigators will also be expected to fund the capital costs of new transportation and reticulation infrastructure for using recycled water in the Lockyer Valley.



Existing irrigation entitlements and contractual arrangements are expected to remain irrespective of the review of institutional arrangements for water supply. Pricing and product reviews that are already underway, such as for irrigators below Wivenhoe Dam, will be carried forward by the relevant new entities.

To further improve the availability of water for rural production, the QWC recommends that:

- 7,000 ML/a of high priority water previously used by the Swanbank Power Station be reserved to enhance high priority supply reliability for urban growth in Boonah and, subject to sufficient water being available, to enhance the reliability of supply to irrigators on Warrill Creek; and
- The reliability of supply to irrigators on the Logan River be increased through modification of operating rules following completion of the Bromelton Off-stream Storage.

Additional rural water allocations

Additional supplies could potentially be made available from the Water Grid for rural production when not required to meet urban needs (for example, temporary or seasonal supply). These types of arrangements would be appropriate in Normal Operation Mode where LOS system yield exceeds forecast demand over a relevant period. Any temporary arrangements would be subject to physical supply constraints, and compliance with the relevant Water Resource Plan and Resource Operations Plan.

Temporary allocations would be expected to be made available by the Water Grid Manager through a competitively neutral and transparent process. This is consistent with the Queensland Government's offer to supply up to 25,000 ML/a from the Western Corridor Recycled Water Project to irrigators in the Lockyer Valley.

As a medium-term priority, the Water Grid Manager will develop arrangements, including price, to provide the opportunity for temporary allocations of water not required to meet urban needs.

6.6 Strategy to meet drinking water quality standards

SEQ has a diverse range of water sources and treatment systems, and a complex transport and distribution system. This results in a range of water quality from different supplies contributing to the Water Grid.

To ensure water quality is maintained at appropriate standards, each Water Grid participant will be required to prepare and implement a water quality risk management plan. These plans will need to comply with the *Australian Drinking Water Guidelines (2004)* and be either third party accredited or independently auditable. Plans must be compliant with the Hazard Analysis and Critical Control Point (HACCP) or International Standards Organisation (ISO) 22000 and 9001 standards.

The Water Grid Manager manages the water quality strategy for the Water Grid. The Water Grid Manager will oversee the preparation and implementation of a Strategic Water Quality Management Plan. Each Water Grid participant will provide their own section of the plan, which will identify risks and control or mitigation measures.

The QWC considers that a number of plans should be prepared to ensure the quality of drinking water from the Water Grid, including:

- A review of the costs and benefits of moving to a common residual disinfection standard across SEQ. The review will focus on disinfection by-products, residual maintenance, costs and operability;
- A review to set critical limit treatment standards across the Water Grid;
- The establishment of systems for compliance monitoring and reporting on water quality. This will ensure that water remains of a high quality as it travels through the Water Grid from the supply to the tap; and
- The establishment of procedures for managing incidents affecting water quality. Appropriate procedures and protocols need to be established between the Water Grid participants so that any water quality event can be managed and risks minimised. This includes practicing or staging events to prove that the protocols are effective.

Rainwater tanks

Queensland Health does not recommend the use of water from rainwater tanks for drinking and food preparation if a potable reticulated water supply is available.

Many people in Queensland rely on water from rainwater tanks for their sole drinking water. Although the risk of contracting illness from these supplies is low when roof catchments and tanks are well maintained, the quality of water from rainwater tanks is not as consistently high as that provided by well-managed reticulated supplies. Scientific research indicates that health concerns associated with microbial organisms such as bacteria and viruses can be addressed by ensuring that hot water is heated to above a specified temperature and held for a specified period of time.

6.6.1 Fluoridation

On 5 December 2007, the State Government announced the introduction of a program to provide for the fluoridation of the State's water supplies.

Fluoridation involves a small amount of fluoride being added to top up natural levels already in the water. This equates to between 0.6 and 0.9 parts of fluoride per million parts of water.

Fluoridation occurs in the water treatment systems supplying most Australians outside Queensland and it has

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done so for up to 50 years. Currently, only 5% of Queenslanders have access to water fluoridation compared to 70% to100% of the population in the other Australian States and Territories.

Water fluoridation helps protect teeth against decay. Children living in Townsville (fluoridated), show up to 65% less tooth decay than children living in Brisbane (non-fluoridated). The fluoridation program will ensure more than 90% of Queenslanders will have fluoridated water supplies by 2012. In SEQ, fluoridation is expected to be introduced by 2010.

The National Health Medical Research Council recently undertook a detailed review of the efficacy and safety of different forms of fluoridation. Water fluoridation was consistently found to protect against any ill health effects.

6.7 Research and development

Applied research and development will improve the sustainable and integrated management of water in SEQ. This targeted research will make significant contributions towards reducing costs and environmental impacts, as well as improving planning and investment decisions.

6.7.1 The Urban Water Security Research Alliance

The Urban Water Security Research Alliance is the largest urban water research program in Australia. It was formed in 2007 as a partnership between the Queensland Government, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), The University of Queensland (UQ) and Griffith University (GU). The partners have committed $50 million over five years.

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The objective of the program is to collaboratively develop the knowledge and tools to inform and support the implementation of the Strategy. The program will address areas of uncertainty such as climate change, changes in technology and the introduction of PRW. Research is being undertaken on three themes, with each theme involving a number of specific projects. The themes are described in Table 6.9.

Table 6.9 Projects comprising the Urban Water Security Research Alliance

Closing the loop	
PRW	The Alliance will research opportunities to improve the operation of the Western Corridor Recycled Water Project treatment process, minimising costs and improving the overall quality of the product and waste streams. The focus is on the management of the wastewater streams and the operation of the wastewater treatment plants.
Stormwater and aquifers	This project has two components: to assess stormwater harvesting opportunities across SEQ; and to examine management strategies for surface water, groundwater and PRW in the Lockyer Valley.
Decentralised systems	This project will investigate technology for onsite water recycling. It will assess the suitability of currently available and innovative techniques for use in residential and commercial high density developments, both existing and new.
Informed decision making	
Community attitudes to sustainable water sources	This social research project will collect information on community attitudes to water restrictions, PRW and other alternative water supplies. It will assist in the development of a comprehensive communications program to maintain high levels of public confidence in PRW.
Organisational learning	This project will examine the factors that underlie a sustainable water industry, predominantly through the use of case studies.
Managing our new water supply system	
Climate and water	Through the use of modelling, this project will address how the climate has changed, what the key drivers are, and the regional implications for water resources
Life cycle analysis and integrated modelling	This project proposes to develop and apply an integrated bio-physical model for SEQ. The model will enable planners to better understand the water cycle, together with the impact of water management on waterways and greenhouse emissions.
Enhanced treatment	This project will identify and evaluate at least one alternative treatment process that is able to achieve similar water qualities and risk profiles as the micro-filtration and reverse osmosis process used for PRW.
Reducing losses from water supply systems:	This project involves two research elements: the identification and reduction of leakages from reticulation systems; and the reduction in losses through evaporation from dams and weirs.

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6.7.2 Water Cycle Sciences Project

The multidisciplinary Water Cycle Sciences Project is another key element of water research in SEQ. Managed by the Department of Natural Resources and Water, the project has a focus on identifying the barriers and solutions to the biophysical, economic and social challenges of achieving a long-term sustainable water cycle. The project aims to provide leadership and advice to policy makers, water regulators and water operators to obtain the best triple bottom line outcome.

6.7.3 Queensland Climate Change Centre of Excellence

In March 2007, the Queensland Government established the Queensland Climate Change Centre of Excellence as a specialist unit within the Department of Natural Resources and Water. The Centre will provide policy advice and scientific information on climate change and its impact on the community, economy and environment. The new centre will form links with national and international climate researchers to ensure Queensland benefits from global research on climate change, as well as having strong links with national policy initiatives. At the same time, that knowledge will be applied at a regional level so that the local climate change impacts can be assessed and managed.

Greenhouse policy for water infrastructure

The Australian Government ratified the Kyoto protocol in December 2007. The Australian Government has committed to a 60% reduction in greenhouse gas emissions by 2050 with a further commitment to establish a renewable energy target of 20 per cent by 2020. A national Emissions Trading Scheme (ETS) planned for 2010 will establish a cap and price for greenhouse gas emissions released to the atmosphere.

The Queensland Government's *ClimateSmart 2050 – Queensland Climate Change Strategy 2007* includes a range of initiatives to reduce emissions. It includes an18% gas scheme and the Smart Energy (industry energy efficiency) Program.

Energy consumption will be a key consideration in the design and operation of bulk water supply infrastructure, including desalination and water recycling schemes that use significant quantities of energy. This additional energy use must be balanced against the benefits of additional security provided by non-climate dependent water sources.

In 2007 the Australian Government announced a $1 billion National Urban Water and Desalination Plan that funds grants of up to $100 million for up-front capital costs to approved major desalination, water recycling, and major stormwater capture projects across Australia so long as these source 100% of their energy requirements from renewable sources or fully offset the carbon impact of their operations.

In this context, consideration should be given to securing renewable energy or combinations of renewable energy and greenhouse gas offsets for major Water Grid projects.

The investment and deployment of renewable energy and greenhouse gas offset projects will contribute to the policy goals of the Queensland Government and position Queensland at the forefront of climate change mitigation nationally and internationally.

Demand management and efficiency measures adopted across the community will also play an important part in addressing greenhouse gas emissions as the amount of energy used by the Water Grid will reduce in line with lower water usage.

6.8 Energy

6.8.1 Energy to deliver water

Until recently, SEQ's water has been supplied through dams and other low-energy-intensity infrastructure. Diversifying the sources of supply to achieve the LOS objectives comes with an increased energy cost. Managing this increase is a key consideration for water supply planning.

Desalination and PRW schemes are five to12 times more energy intensive than treated dam water, as illustrated in Figure 6.10. Increased movement of water across the SEQ will also increase overall energy intensity.

Rainwater tanks, where plumbed into households and operated by pump, are also relatively energy intensive when compared with dam supplied water. Improving water quality through UV treatment or micro-filtration will potentially double the energy intensity, to a point where treated tank water is only marginally less energy intensive than desalination.

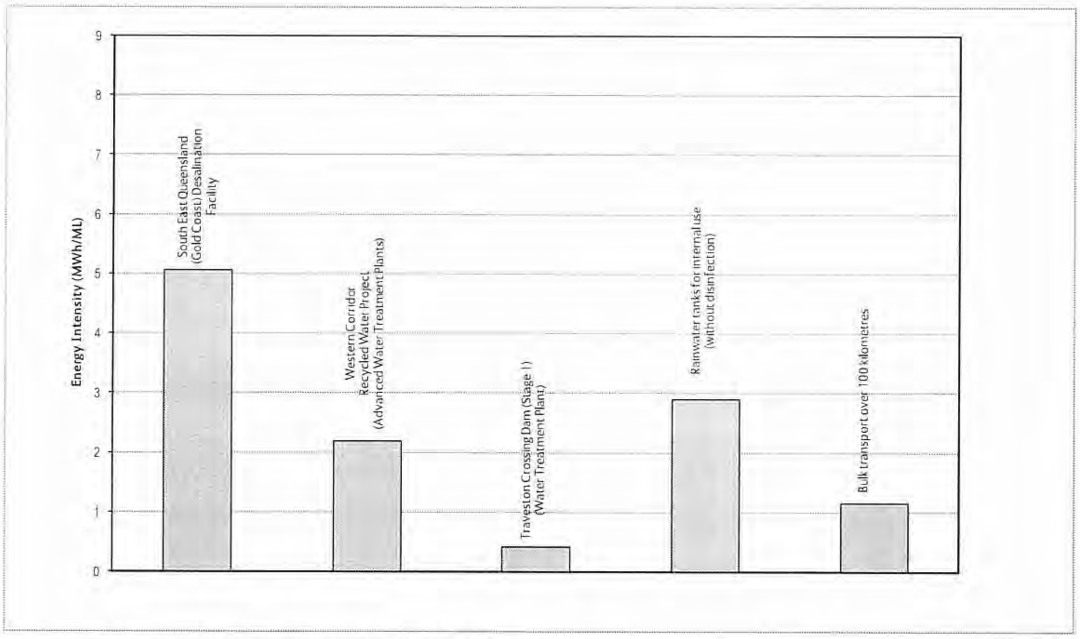

Figure 6.10 Estimated energy intensity of supply options

[1] Based on findings by the Water Cycle Sciences Project. See Gardner, Ted (2006) "Urban metabolism of an ecosensitive subdivision in Brisbane, Australia" Presentation to ENVIRO '06 Conference and Exhibition.

[2] Calculated for the Southern Regional Water Pipeline, flowing north. Actual energy intensity for bulk transport will depend on a range of factors including changes in height and direction, pipeline capacity and utilisation.

As illustrated in Figure 6.11 desalination will comprise only 29% of the total energy consumed to supply water into the Water Grid at 2012 even though it is energy intensive. By comparison, dams and groundwater aquifers comprise about 36% of the total energy consumption, but deliver about 69% of the total system capacity. These estimates are based on the Water Grid operating at full capacity.

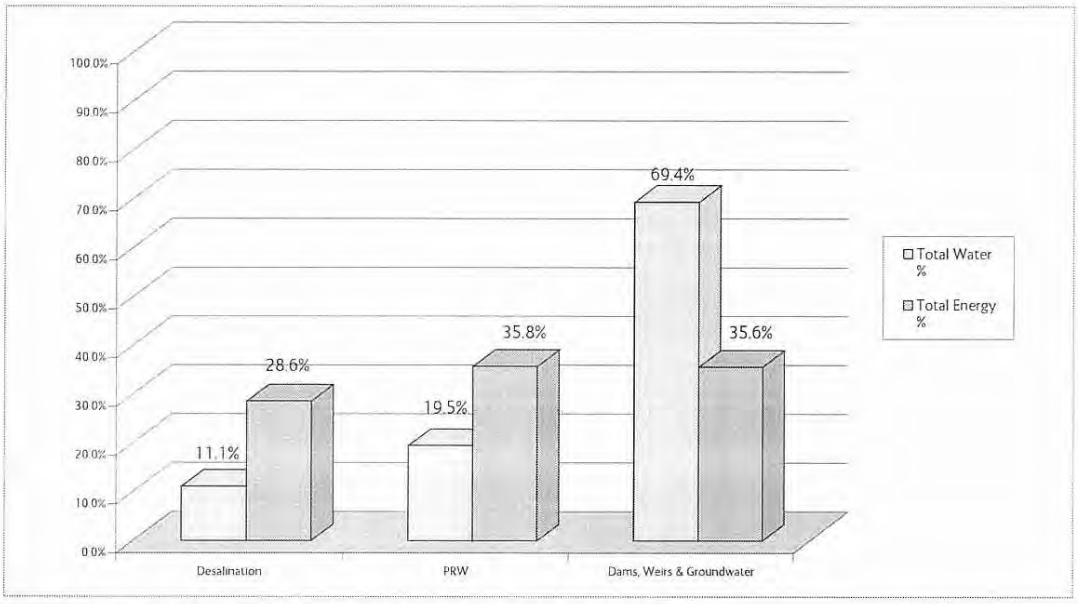

Figure 6.11 Projected energy consumed and water supplied in 2012

By 2012, approximately 1.25 megawatt hours of energy will be used to supply a megalitre in the Water Grid, including bulk transport and operating at capacity. Across the Water Grid, this equates to approximately 1040 gigawatt hours per annum.

At this rate, the energy intensity of water delivered to an average home will be equivalent to 4.5% of a household's typical energy use. On average, this is equivalent to the amount of energy that is used for standby power and substantially less than the amount used for the television and sound system, as demonstrated in Figure 6.12.

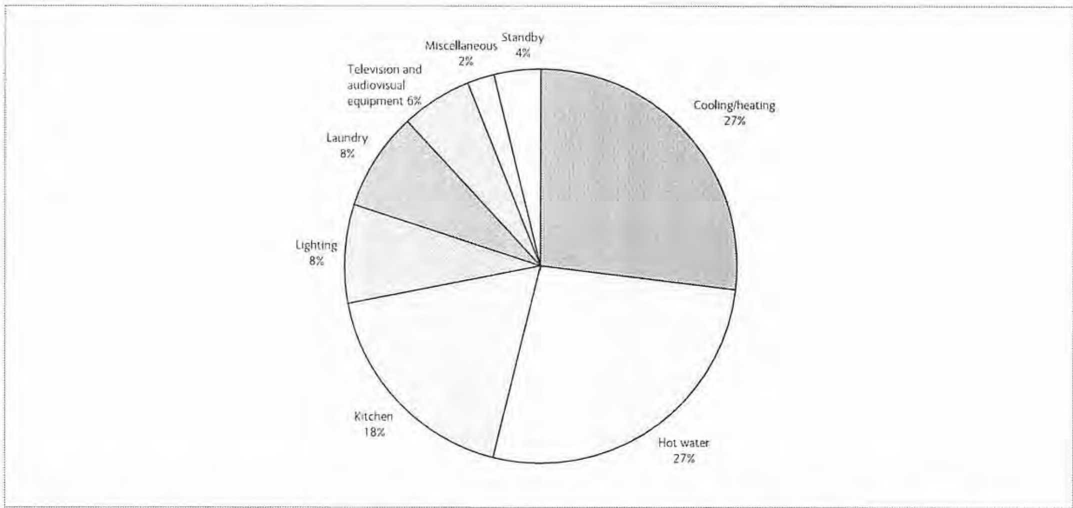

Figure 6.12 Typical Energex household annual kWh consumption estimations June 2005 – May 2006

In practice, beyond the drought, desalination and PRW schemes may not be required to operate at maximum capacity at all times, thereby reducing their energy consumption.

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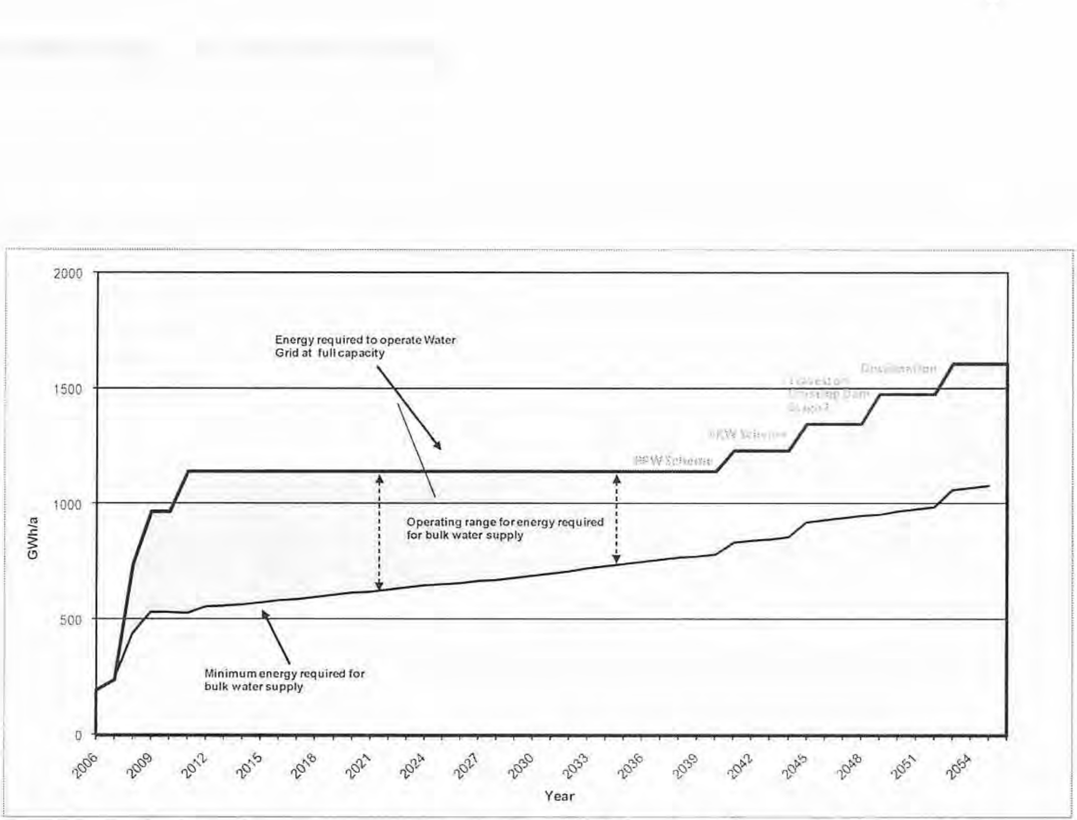

Figure 6.13 Possible energy consumption for bulk water supply (medium series population growth and no allowance for climate change)

Figure 6.13 illustrates the increase in energy required to operate the Water Grid at capacity, based on the preferred infrastructure program contained in Section 6.3.3. It also illustrates the energy required for supply to equal demand, based on using the least energy-intensive sources first. At any time, actual energy used will be within this range. Without the demand management program, significantly more water would be required, and the overall energy requirement would increase accordingly.

Despite the growing energy intensity of the Water Grid, total energy used to manufacture, treat, pump and distribute water is forecast to remain a very small proportion of SEQ's total energy consumption. Figure 6.14 illustrates energy consumed for water supply as a proportion of forecast energy demand projections for the next 50 years. Energy consumption for water supply is expected to peak at approximately 4.1% of total energy consumption at around 2012, reducing to approximately 2.1% by around 2056.

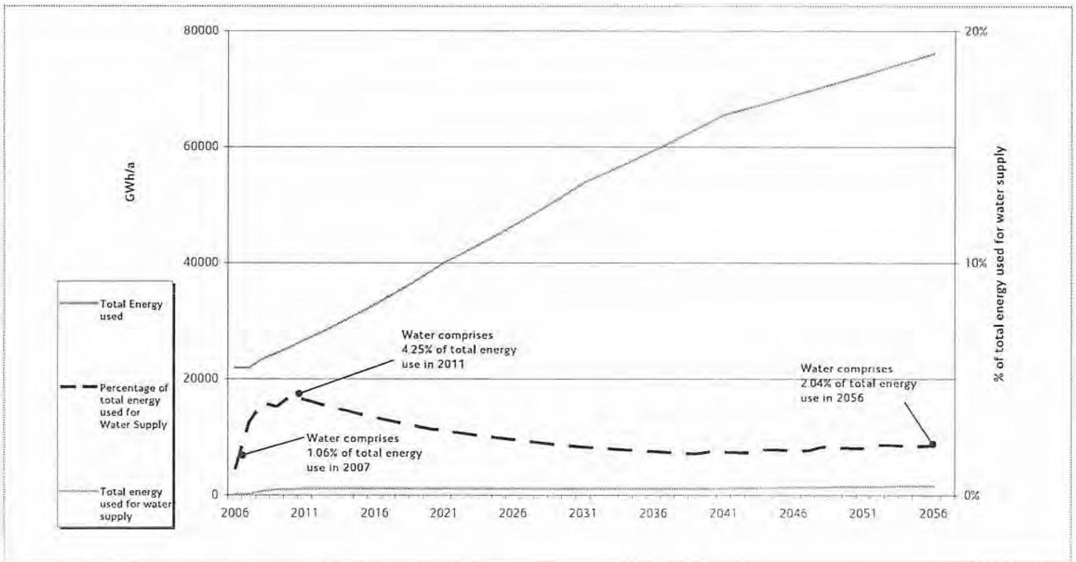

Figure 6.14 Possible energy consumption for bulk water supply and total energy consumption

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6.8.2 Water and energy reporting

Industries across the country are increasingly required to become energy and water efficient. The co-dependence of energy and water in many industries presents opportunities to improve water and energy efficiency simultaneously, with a net benefit to business of lower electricity and water bills.

Industries are currently targeted under mandatory Federal and State initiatives to identify and report on energy efficiency opportunities. At the same time, in SEQ, industries captured under the *Water Regulation 2002* are required to implement WEMPs.

The overlap between mandatory reporting for energy and water may result in potential for synergies, conflicts and duplication between an individual business's water and efficiency management plans. The QWC proposes to work in collaboration with water service providers and the Queensland and Federal Governments to improve the efficiency of reporting for industry and move towards streamlined water and energy reporting.

6.9 Strategy outcomes

An outcome of the Strategy is a list of actions that, if implemented, would deliver the *Water Security Guarantee*. Table 6.10 provides an overview of the key elements of the Strategy and the likely outcomes.

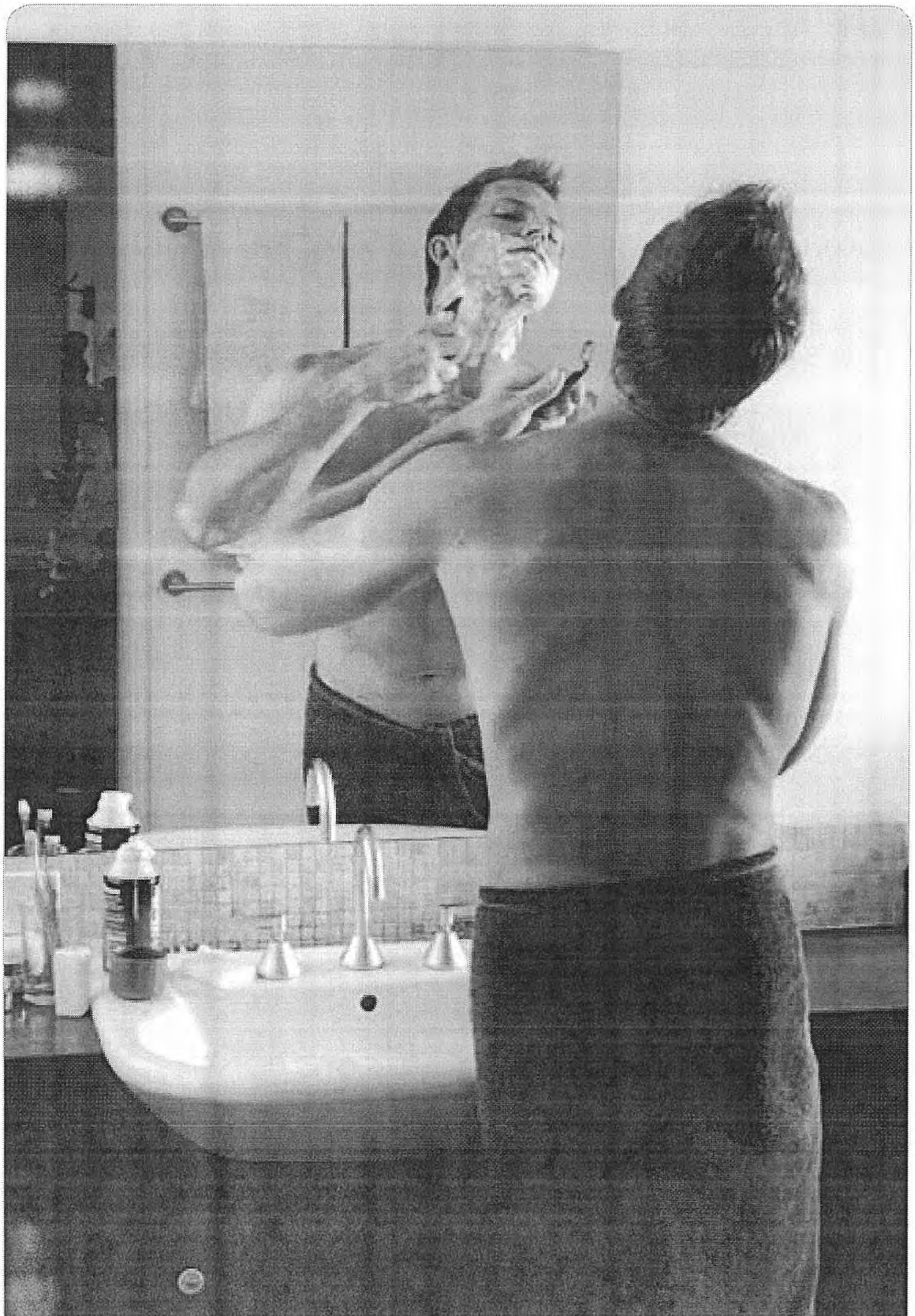
Table 6.10 Summary of Strategy outcomes

Issue	Strategy outcomes
LOS approach	• Implementation of a new water supply planning methodology, based on the LOS approach and detailed hydrologic analysis. • Implementation of LOS objectives for the Water Grid, including: – medium-level water restrictions are expected to be required no more than once every 25 years on average; – medium-level water restrictions are not expected to exceed six months duration more than once every 50 years on average; and – medium-level water restrictions will require a reduction in demand of 15%. • Operated collectively, the system yield will be increased by about 14%, due to optimised use of all water sources and taking advantage of variable conditions across the region.

Issue	Strategy outcomes
Efficient water use	• A target overall reduction in water demand of 24% compared to pre-drought trends while still maintaining the active, outdoor lifestyle that residents of SEQ enjoy. • A water efficiency target for urban residents of 230 litres per person per day of reticulated water supplies. • Business and industry regulated to achieve best practice water efficiency. • Urban water system losses will be reduced from 14% in 2005 to a target of 8%. • Power stations in the SEQ region will be required to use recycled water for the majority of their needs, where appropriate. • Detailed investigation into a range of potential demand management measures. These measures will target efficiency through efficient fixtures and fittings, regulation, pricing and education rather than through financial incentives. • Implementation of permanent water conservation measures, including alternative outdoor watering days.
Secure supplies	• Additional major urban water supplies are not expected to be required until between 2028 and 2042, except as part of a drought response. • Without additional supplies, by 2056, the gap between supply and demand would be between 97,000 and 308,000 ML/a, depending on population growth, savings achieved and the impacts of climate change. The purpose of the Strategy is to bring on supplies at appropriate times to prevent this gap from developing. • Detailed planning will be undertaken for a range of potential sources of supply, including desalination and PRW. • Desalination or PRW projects are expected to fill most of the initial predicted supply gap and provide up to 30% of total supply by 2056. • Sites for future water supply projects will be preserved and development approvals sought to minimise impacts on future generations. • A Drought Response Plan for future droughts will be prepared, including planning for climate resilient supply infrastructure. Detailed planning will be undertaken to ensure that drought projects can be delivered within 36 months.
Recycling	• PRW will be the predominant form of recycling in SEQ. • Other types of recycling may complement PRW schemes.

Issue	Strategy outcomes
Rainwater tanks and stormwater harvesting options	• Rainwater tanks and stormwater harvesting is expected to comprise about 7% of the SEQ water supply at 2056. • All new homes in SEQ must meet mandatory water saving targets. Rainwater tanks and stormwater harvesting are options to meet the target. • From 1 January 2008, most new industrial and commercial buildings will be required to install a rainwater tank. • Water to top up every pool in SEQ will be sourced from a rainwater tank or downpipe rainwater diverter. • Stormwater harvesting is a possible solution to achieving the water saving target for new residential developments. • Supply strategies involving increased recycling and increased capture of rainwater and stormwater will contribute to the improved water quality of waterways and Moreton Bay.
Groundwater	• Water from groundwater aquifers will continue to make a small contribution in the delivery of urban supplies. The sustainable take from these aquifers is expected to remain relatively static over time. • Over time, the overall take from regulated groundwater aquifers in the Warrill Creek and Lockyer Creek catchments is planned to be reduced to sustainable levels.
Rural communities	• Consistent LOS objectives are being targeted across communities with reticulated drinking water. • Drought Response Plans will be prepared for communities that are not directly connected to the Water Grid. • About 180,000 residents of SEQ rely solely on water from rainwater tanks and groundwater aquifers. These residents will be able to access water from the Water Grid when required. • A policy position will be developed for providing reticulated drinking water to communities that rely on water from individual rainwater tanks and groundwater aquifers.
Rural production	• Up to 42,000 ML/a of additional rural water supplies will be made available in normal conditions, subject to shared use of the Water Grid, improved on-farm water use efficiency and other conditions. Additional supplies may be made available on a temporary basis. • Rural water use efficiency will continue to be driven by on-farm efficiency measures, water markets and trading, appropriate pricing to better reflect NWI pricing principles, and a continuing drive for improved rural water supply scheme efficiencies.
Operating the Water Grid	• The System Operating Plan will direct water security, water quality and sustainability outcomes while optimising energy use. • Measures will be introduced to ensure that the Water Grid is managed in accordance with the *Australian Drinking Water Guidelines* and the *Australian Guidelines for Water Recycling*.

Issue	Strategy outcomes
Integration with the SEQ Regional Plan	• Water and sewerage network planning will be undertaken as part of integrated land use and infrastructure planning. • A Water Sensitive Urban Design approach will be adopted, whereby planning for water supply and sewerage is integrated with planning for stormwater management. • The new institutional arrangements strengthen the policy framework for Water Sensitive Urban Design in SEQ. • Water Sensitive Urban Design will be encouraged through the water saving target for new houses and other measures.
Environmental outcomes	• Environmental flows are maintained under Water Resource Plans. • The Western Corridor Recycled Water Project will reduce nutrient loads entering Moreton Bay, potentially decreasing phosphorus by over 50%.
Flood mitigation	• New or raised dams will provide additional flood mitigation benefits. • For existing dams, flood impacts will not be increased.
Research and development	• Research and development programs will influence and support future water decision making by exploring new technologies and opportunities.
Review and refinement	• The QWC will monitor and report on the implementation of the Regional Water Security Program. • The Strategy will be reviewed in parallel with the Regional Plan.



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Chapter 7

Implementation and review

7. Implementation and review

This chapter provides a summary of the actions that would need to be undertaken in the short to medium-term to implement the Strategy. It also explains the proposed timeframe for future reviews.

Key messages

- The Strategy is part of a suite of regional water policies that contribute to achieving the outcomes of the Regional Plan.
- If adopted, there will be a number of different agencies responsible for implementation of elements of the Strategy.
- The final Strategy will form the basis of any advice to the Minister for Infrastructure and Planning to assist in formulating a revised Regional Water Security Program.
- The Regional Water Security Program sets out the future planning actions to ensure ongoing water security for SEQ.
- The QWC is responsible for monitoring, reviewing and reporting on the implementation of the Regional Water Security Program.

The Strategy is part of a suite of regional water policies that contribute to achieving the outcomes of the Regional Plan, as described in Figure 2 of Chapter 2. The Strategy will be implemented in conjunction with those policies and strategies.

To deliver the *Water Supply Guarantee*, a range of more detailed plans must also be prepared, as described in Table 7.1. The scope of these plans varies from regional policies down to detailed operational plans. The Strategy must also be reflected at a local level in planning for new development areas, such as through the implementation of Water Sensitive Urban Design (WSUD).

Before building future water infrastructure, detailed feasibility assessments are required to prove project viability and sustainability. Necessary Commonwealth and State Government approvals must also be obtained. The Queensland Government manages the impact assessment process for water infrastructure projects of State significance.

Table 7.1 SEQ water planning framework

	Elements	Responsibility
Regional planning	• Regional Water Security Program – Supply source plans – Demand management measures – Bulk Water Treatment Plans – Bulk Transport Plans – Recycled water and major wastewater treatment plant plans – Drought Response Plans	• Minister for Infrastructure and Planning to make Regional Water Security Program • QWC to provide advice and implement the plan with support from: – Department of Natural Resources and Water – Water entities – Local government
	• System Operating Plan	• QWC
	• Healthy Waterways Action Plans	• Healthy Waterways Partnership

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	Elements	Responsibility
Development scale planning	• Structure and master plans	• Local government
	• Distribution network planning	• Distribution entity
	• Minor wastewater treatment plant plans	• Distribution entity
Development application assessment	• Development assessment	• Councils

7.1 Implementing the Strategy

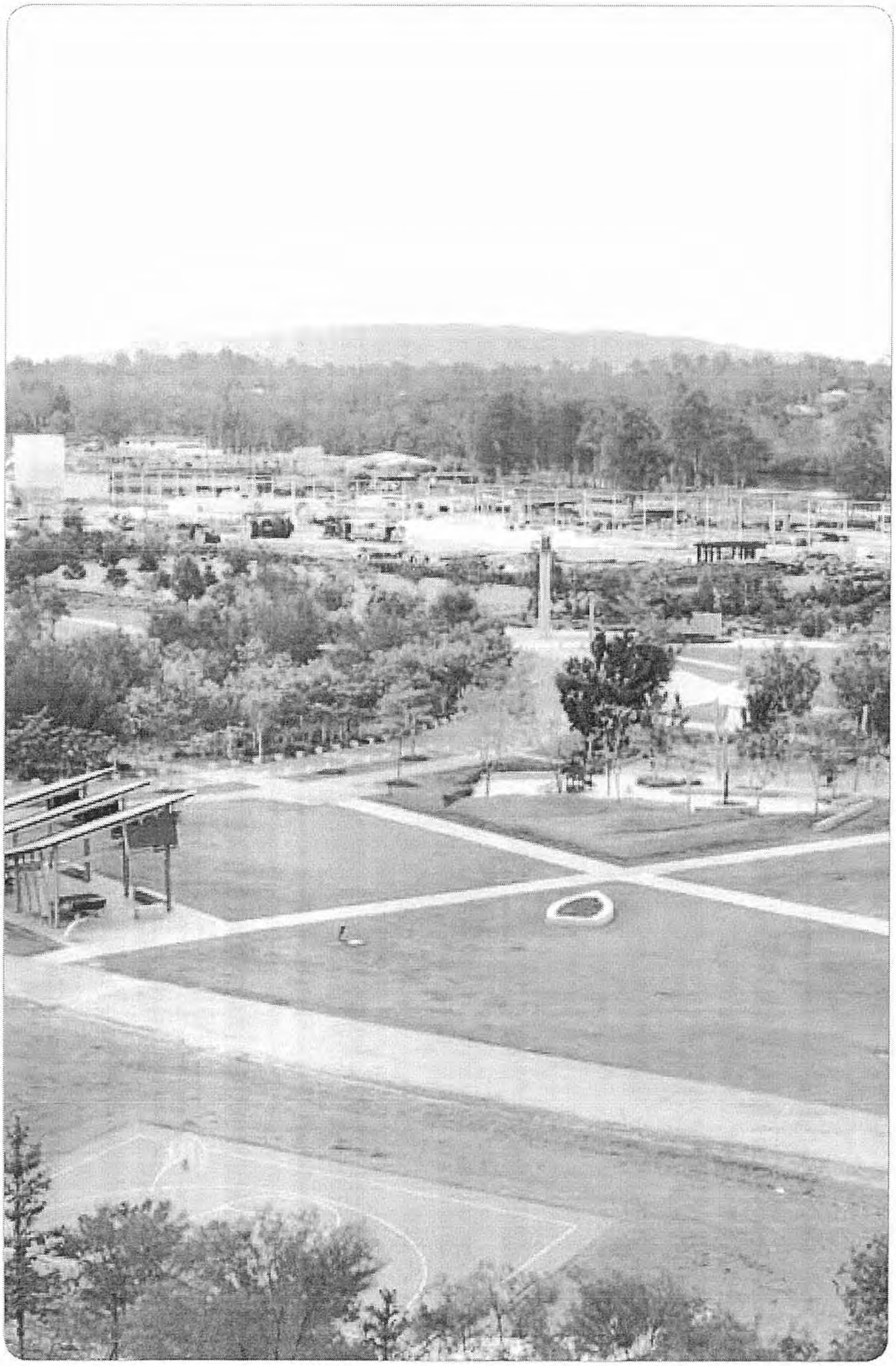
The Strategy is the product of a partnership between the QWC, Queensland Government and the Local Governments of SEQ, as represented by the Council of Mayors (SEQ). Successful implementation of the Strategy will depend on continuing partnerships and developing a range of new partnerships, to plan and deliver services and infrastructure.

Table 7.2 summarises the activities and initiatives that the QWC considers should be undertaken over the next 10 years to achieve the goals of the Strategy. The actions have not been considered or endorsed by the Queensland Government or Council of Mayors (SEQ) and will be reviewed as part of the final Strategy, informed by community input. This input may result in some actions being amended or removed and others being identified. The final Strategy will also provide an indication regarding the priority of each action.

The activities are additional to initiatives already committed to and included in the *Drought Regulation*.

Table 7.2 Recommended planning activities and initiatives

Reference number	Potential activity or initiative	Potential responsible agency
South East Queensland Water Strategy		
1.	Review the Strategy as necessary and in parallel with the review of the *SEQ Regional Plan 2005-2026* and more regularly if necessary.	QWC
Regional Water Security Program		
2.	Every six months, or more frequently if required, report to the Queensland Government on the status of the implementation of the Regional Water Security Program.	QWC
3.	Every six months, or more frequently if requested by the QWC, report to the QWC on the implementation of projects within the Regional Water Security Program.	All agencies assigned responsibilities under the Program
System Operating Plan		
4.	Review and update the System Operating Plan as required.	QWC
5.	Prepare a Water Grid Risk Management Plan.	Water Grid Manager
6.	Research and refine system operating rules for the conjunctive use of major dams and other supply sources based on predictive modelling of future inflows as a medium-term priority. These rules will optimise the Water Grid LOS system yield within Water Resource Plan limits.	QWC and Water Grid Manager



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Reference number	Potential activity or initiative	Potential responsible agency
7.	Regularly publish a report on implementation of, and compliance with, the System Operating Plan.	QWC
Drought Response Plan		
8.	Prepare Drought Response Plan for future droughts, as a medium-term priority.	QWC
9.	Review the Drought Response Plan on a regular basis and as required.	QWC
Demand management		
10.	Require rainwater tanks to be installed in specified new commercial and industrial buildings, as a short-term priority.	DIP
11.	Require water service providers to provide water use information to water users, regardless of whether they are the property owner or tenant, as a short-term priority.	Water service providers
12.	Investigate a water efficiency star rating scheme for residential property sales, as a medium-term priority.	DIP and NRW
13.	Investigate a water efficiency star rating scheme for non-residential properties as a requirement upon sale, as a medium-term priority.	DIP and NRW
14.	Continue to develop water efficiency guidelines to assist businesses in implementing Water Efficiency Management Plans, as an ongoing priority.	QWC
15.	Development and delivery of targeted education programs for selected industries for selected industries, as a medium-term priority.	NRW
16.	Continue community awareness and school education strategies to maintain and raise awareness about water efficiency practices beyond the Millennium Drought, as an ongoing activity.	NRW, QWC and water retailers
17.	Develop permanent water conservation measures for implementation immediately after the Millennium Drought.	QWC
18.	Investigate options to require the installation of water efficient fittings and fixtures to all existing homes upon resale, or mandating disclosure of water efficiency at point of sale.	DIP
19.	Amend regulations to require the installation of water efficient fittings and fixtures to all major renovations requiring a building approval and plumbing certification as a medium-term priority.	DIP
20.	Work with the Australian Government to promote the Water Efficiency Labelling Scheme and ban the sale of appliances that do not meet these requirements as an ongoing activity.	NRW
21.	Amend the *Queensland Development Code* to require insulation of all hot water pipes in new structures, as a medium-term priority.	DIP
22.	Assess, and undertake a trial of, the use of web-based water monitoring systems to detect leaks within schools, as a short-term priority.	Education Queensland
23.	Amend legislation to require sub-meters to be installed for separate dwellings in new community title developments, sole occupancy units under single title, and new multi-unit business developments, as a short-term priority.	DIP
24.	Progressively implement standardised water billing across SEQ as a medium-term priority.	Water service providers

Reference number	Potential activity or initiative	Potential responsible agency
25.	Investigate water pricing policies and market rules to provide incentives to encourage conservation and deter inefficient use, as part of the implementation of new institutional arrangements.	QWC
26.	Investigate wastewater pricing policies and market rules for non-residential customers to provide incentives to encourage conservation and deter inefficient use, as part of the implementation of new institutional arrangements.	QWC
27.	Investigate opportunities to coordinate reporting against energy and water efficiency regulations, as a medium-term priority.	QWC and Department of Mines and Energy
28.	On an ongoing basis, develop and recommend additional policy options to assist in achieving and maintaining a 24% reduction in total demand compared to pre-drought trends and water saving targets, including residential water use of 230 litres per person per day of Grid Water.	QWC, Queensland Government agencies and water service providers
29.	Monitor and manage water demand on an ongoing basis using the South East Queensland Water Accounting Framework, and reassess future demand forecasts to ensure assumptions continue to be relevant.	QWC
Dams and weirs		
30.	Plan for the siting and staging of a new regional Water Treatment Plant to service Traveston Crossing Dam with connection to the Water Grid.	QWC
31.	Plan for the timely staged connection of the Bromelton Off-Stream Storage and Wyaralong Dam supplies to the Water Grid via a new regional Water Treatment Plant at the Cedar Grove Weir.	QWC
32.	Review the operational rules for storages in the Logan River to incorporate new sources of supply, as a medium-term priority.	NRW
33.	Ensure Water Resource Plans and related activities support the operation of the dams and weirs as a regional system in normal conditions and during drought events, while continuing to meet environmental flow requirements and reliability for other users.	NRW
34.	Undertake further detailed hydrologic analyisis to better address the potential impact of climate change on inflows to major dams.	QWC
35.	Review the operation of the Brisbane River system to optimise the water supply yield and balance flood storage and water supply storage volumes.	QWC
36.	Investigate a potential raising of the Mount Crosby Weir.	QWC
37.	Investigate potential raising of Wappa Dam.	QWC
Purified Recycled Water		
38.	Implement and maintain the recycled water regulatory framework.	NRW
39.	Investigate potential PRW schemes associated with Hinze Dam and North Pine Dam, and on the Sunshine Coast and at Toowoomba.	QWC
Other types of recycling		
40.	Develop detailed guidelines for decision making regarding the appropriateness of alternative types of recycling, including dual reticulation recycled water schemes, as a medium-term priority.	QWC

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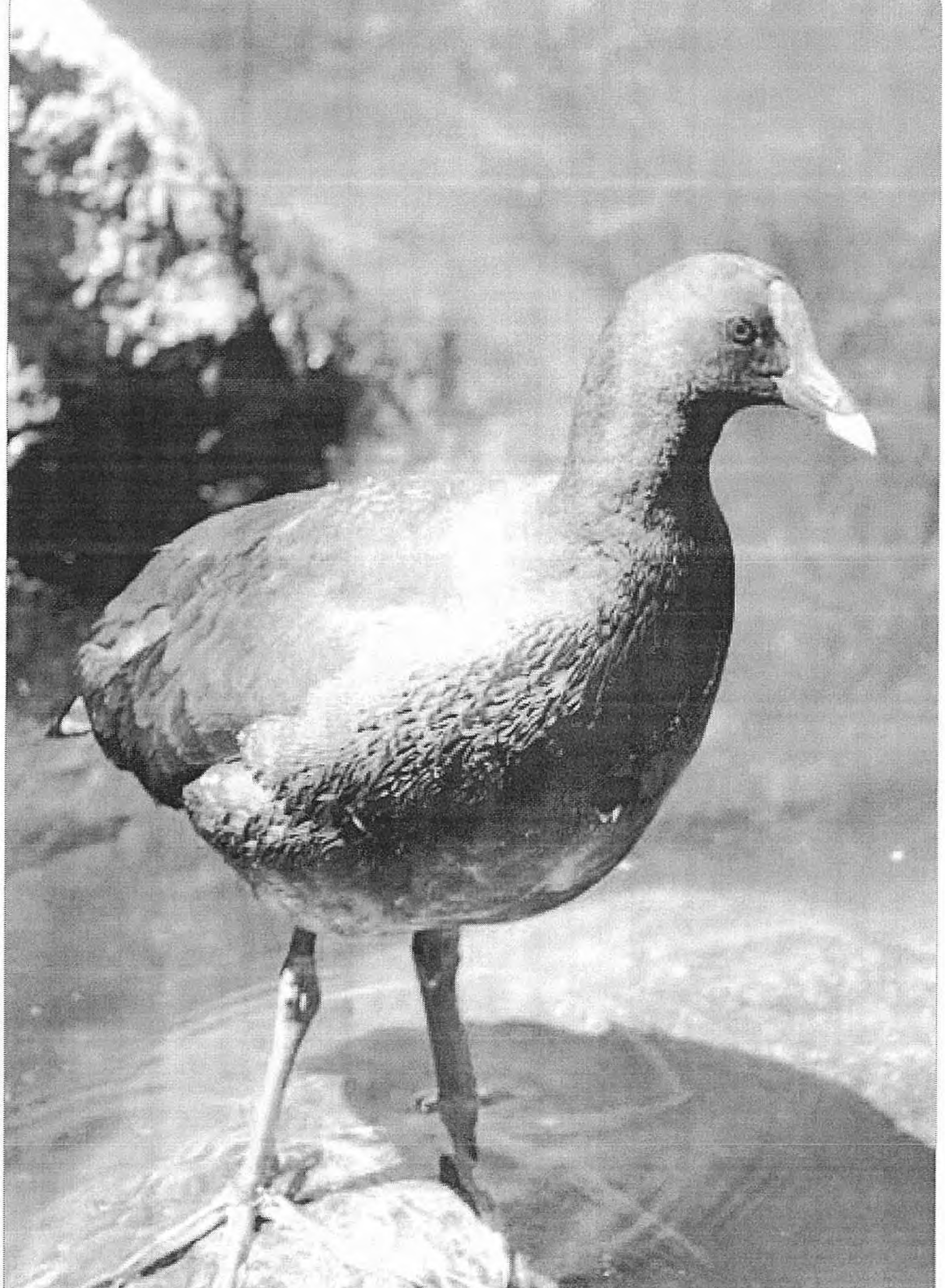

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Reference number	Potential activity or initiative	Potential responsible agency
41.	Prepare regional recycled water plans as a long-term priority with consideration for all the large wastewater treatment plants in SEQ.	QWC
42.	Investigate opportunities for providing recycled water to industrial and residential Major Development Areas as part of the structure plan process.	QWC, Distribution Entity and local government
43.	Continue to investigate opportunities to major water using industries, especially manufacturing, to use recycled water.	Local government and retail entities
Desalination		
44.	Undertake detailed investigations of potential desalination projects including for inclusion in medium-term Drought Response Plans. Sites to be investigated are Marcoola, Kawana, Bribie Island, the mouth of the Brisbane River, North Stradbroke Island and South Stradbroke Island.	QWC
45.	Undertake an engineering study to identify potential corridors for connecting pipelines and electricity infrastructure and the full extent of works required at each preserved site, as a medium-term priority.	QWC
46.	Assess transportation network implications associated with the development of potential desalination facilities, such that large volumes from a single facility or combination of facilities could be distributed through the Water Grid, as a medium-term priority.	QWC
47.	Undertake a detailed social, economic and environmental assessment of the cost of developing identified sites and connecting infrastructure including brine dispersion modelling, as a medium-term priority.	Queensland Government
48.	Identify and preserve corridors for connecting infrastructure, based on the outcomes of detailed investigations, as a medium-term priority.	QWC
49.	Undertake design and obtain approvals for the preferred sites contained in the Drought Response Plan, as a medium/long-term priority.	Manufactured water entity
Rural towns and villages		
50.	Construct a water supply pipeline to Maleny from the Landers Shute water treatment plant.	Maroochy Shire Council
51.	Preserve 1,200 ML/a of water meeting appropriate LOS objectives from the Warrill Valley Water Supply Scheme for urban use in Aratula, Boonah, Kalbar and Mount Alford.	NRW
52.	Investigate future water security options for Beaudesert, Kooralbyn and Canungra, as a medium-term priority.	QWC
53.	Identify an additional source of supply for Dayboro, potentially including a pipeline to Petrie, as a medium/long-term priority.	QWC
54.	Review minimum requirements regarding rainwater tank design where reticulated drinking water supplies are not available, as a medium-term priority.	QWC
55.	Develop a policy position regarding the provision of reticulated water supplies to communities that currently rely on drinking water rainwater tanks and groundwater bores, as a medium-term priority.	QWC
Water for rural users		
56.	In the Lockyer Valley and mid Brisbane River area, make available 32,000 ML/a of recycled water to the rural sector subject to conditions.	QWC and Water Grid Manager

Reference number	Potential activity or initiative	Potential responsible agency
57.	In the Lockyer Valley, review the extent of the groundwater management area and develop operational rules to improve and protect the resource.	NRW
58.	In the Mary Basin, make available 10,000 ML/a of rural water below the Traveston Crossing Dam.	NRW
59.	In the Warrill Valley, reserve 7,000 ML/a of High Priority B allocation, to improve rural water availability.	NRW
60.	Investigate the conditions under which uncommitted high priority water from the Warrill Valley Water Supply Scheme can be made available to irrigators, as a medium-term priority.	QWC
61.	Continue the SEQ Irrigation Futures project.	NRW
62.	Develop arrangements including pricing policies, to make additional water available for rural production, when not required to meet urban demand, as a medium-term priority.	Water Grid Manager
Research and development		
63.	Continue the Water Cycle Science Project to identify barriers and solutions to achieving a sustainable water cycle.	NRW
64.	In partnership with councils and developers, undertake and analyse demonstration projects for alternative options to achieving the water saving target for new residential developments, including stormwater harvesting and dual reticulation recycled water schemes.	Urban Water Security Research Alliance (UWSRA)
65.	Research opportunities to further improve the quality of PRW through source control and management within natural water bodies.	UWSRA
66.	Research community attitudes to alternative water supplies.	UWSRA
67.	Assess the skills base in SEQ to implement the Strategy and develop required programs.	UWSRA
68.	Research the impact of climate change on the yield of dams in SEQ.	Queensland Climate Change Centre of Excellence and UWSRA
69.	Assess in detail the environmental impact of the Strategy, including waterways and greenhouse gas emissions.	UWSRA
70.	Research wastewater treatment technologies to minimise the high salinity concentrate.	UWSRA
71.	Research and evaluate options to reduce evaporation from dams.	UWSRA
Water quality management		
72.	Prepare a Recycled Water Management Plan for the Western Corridor Recycled Water Project, as a short-term priority.	DIP with project participants
73.	Develop a Regional Drinking Water Quality Management Plan, as a short-term priority.	Water Grid Manager
74.	Establish and implement network management protocols, as a medium-term priority.	Water Grid Manager
75.	Review and standardise risk assessments and management plans for other manufactured water sources.	Manufactured Water entity

Reference number	Potential activity or initiative	Potential responsible agency
76.	Review and standardise risk assessments and management plans for SEQ Water Grid bulk supply assets.	Bulk Supply entity
77.	Based on the risk management plans and critical limits for Water Grid inputs, review the adequacy of existing water treatment processes and schedule staged upgrades as appropriate.	Bulk Supply entity
78.	Develop hydrodynamic models for all major dams, where not already available.	Bulk Supply entity
79.	Prepare a coordinated water quality risk assessment and management plan for SEQ Water Grid bulk transport assets.	Bulk Transport entity
80.	Prepare a coordinated water quality risk assessment and management plan for SEQ Water Grid distribution asset.	Distribution entity

7.1.1 Regional Water Security Program

The Regional Water Security Program (the Program) will be the primary mechanism for ensuring that the Strategy is implemented.

On 13 November 2006, a Regional Water Security Program was made. It incorporated projects and measures that were included in the *Water Amendment Regulation (No 6) 2006*. The Program is expected to specify responsibilities of Government departments, the QWC and water service providers in delivering the Program

The Minister for Infrastructure and Planning may request that the QWC review the Program and provide revised regional water security options for his consideration. Within four months of receiving formal, final advice from the QWC on recommended options, the Minister will make and publish a revised Program. The final Strategy will be used by the QWC as the basis for formulating any regional water security options. The QWC will continue to monitor progress against the Program and update the System Operating Plan for the Water Grid as appropriate.

7.1.2 System Operating Plan

The operational control of all bulk water supply assets will be governed by the System Operating Plan and the directions of the Water Grid Manager. The System Operating Plan sets out how service providers are to manage their assets to achieve the objectives of the Regional Water Security Program. It also specifies the share of available water that each Water Grid Customer is entitled to receive from the total supply of water available under the Regional Water Security Program, as determined by the process specified in the Water Market Rules. All water service providers are obliged under the *Water Act* to comply with the System Operating Plan.

The System Operating Plan will be governed by the physical limitations of the Water Grid, such as the size of pipes and water treatment plants. It will also be limited by the Water Resource Plans and the accompanying Resource Operations Plans.

The Water Grid Manager must determine how best to meet the bulk supply needs of the region by considering:

- The storage levels in the region's dams and weirs;
- The comparative cost of operating different sources of water;
- The energy and environmental impacts of the different sources of water;
- Maximum extraction limits for surface water supplies;

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- Minimum production volumes for desalination and advanced water treatment plants that supply recycled water; and
- Scheduled maintenance requirements for assets.

The dynamic regional water balance model developed for the Strategy will be an essential tool in determining the details of operating the Water Grid. The QWC recommends that water resource planning be updated to better enable the operation of the Water Grid as a connected system while continuing to meet environmental flow requirements and reliability for other users. This update is likely to include updates to Resource Operations Plans and Resource Operations Licences, which are explained in Chapter 2. In particular, the System Operating Plan will have significant impacts on water sharing and allocation of drought storage reserves.

7.1.3 Drought Response Plan

The Drought Response Plan is a key component of the Strategy. The Strategy recommends that future drought water supply projects be scoped and progressed to a point where they can be delivered within a 30-month window, from dam levels reaching the T2 trigger and following a six-month period of medium-level restrictions. To achieve this program, sites may need to be acquired, detailed designs prepared, development approvals obtained, basic site works undertaken and procurement options obtained for key items, such as reverse osmosis membranes.

Operationally, regular monitoring of the regional water balance will be used to identify appropriate timeframes to trigger the implementation of new infrastructure to meet growth requirements..

7.1.4 Development planning and approvals

The QWC report, *Our Water – urban water supply arrangements in South East Queensland*, recognised that the new institutional arrangements for water supply and sewerage will require a review of the current planning and infrastructure delivery arrangements under the *Integrated Planning Act 1997* (IPA).

A review is currently underway in consultation with the Council of Mayors (SEQ). The review seeks to identify implications of the new water supply arrangements on IPA processes and possible future options to address the issues for consideration by the State Government and other stakeholders. Included will be the full range of matters covered by the IPA relevant to water supply and sewerage, such as:

- Development approval processes;
- Water and sewerage infrastructure planning;
- Infrastructure charges; and
- Integration with Local Growth Management Strategies, structure plans, master plans and State Infrastructure Agreements, as described in the Regional Plan.

The review will examine different options for different size developments to minimise the number of parties involved in each development assessment. Options to facilitate WSUD within new developments will also be considered under the review.

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7.2 Review and updating of the Strategy

Utilising an adaptive approach to planning and regular updating of water balance assessments, the QWC will coordinate the review of the Strategy at appropriate times. In general, it will be reviewed on a minimum five-year cycle aligned with the review of the Regional Plan. However, implementation and monitoring of the Strategy will be reported annually through the QWC Annual Report.

To ensure successful implementation of the Strategy, the QWC will institute a program of monitoring and review that will include:

- Infrastructure implementation against milestones and performance criteria;
- Continual analysis and assessment of the water balance against population growth, economic development and regional water efficiency;
- Regular review and evaluation of the Water Grid's performance, seeking improved efficiencies and service delivery;
- Incorporating findings from the research and development program; and
- Reviewing outcomes delivered through Strategy implementation against performance indicators, that will be continued in the final Strategy.

This approach will guide further Strategy development and assist in ensuring the *Water Supply Guarantee* can be achieved.

The QWC is committed to open, accountable and inclusive community engagement processes. The QWC intends to provide stakeholder organisations, individuals and interest groups with opportunities to influence water planning and management. Figure 7.1 identifies the principle stakeholder organisations and interest groups.

Figure 7.1 Strategy consultative framework

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Key terms

Term	Definition
Allocation	A right to take water that is an asset separate from land title and can be traded. Water allocations are generally granted via processes contained within Resource Operation Plans.
Brisbane River system	Wivenhoe and Somerset Dams, Lake Manchester, Gold Creek Dam and the Mt Crosby Weir.
Climate resilient supply	Climate resilient supplies include desalination and PRW, and adopted net inflows to dams and extractions from groundwater aquifers under extended and severe drought conditions. For the Strategy, the climate resilient supply from dams and weirs across SEQ is equal to the inflows in the second worst water year on record, adjusted for evaporation and river transport losses and repeated.
Demand management	Any program that reduces water consumption and the demand for water from the region's bulk water sources. Demand management programs may include water use efficiency measures, reductions in water losses, water trading to make better use of existing supplies, and substitution of existing supplies with alternative supplies such as rainwater tanks, recycled water and stormwater.
DIP	Department of Infrastructure and Planning.
Drought Regulation	Water Amendment Regulation (No.6) 2006.
Drought Response Mode	The mode of operation when the combined regional storage levels drop below the T1 trigger and enter the regional Drought Storage Reserve. This mode has two phases – the preparation phase and the construction phase.
Drought Response Plan	A pre-determined suite of restrictions, demand management programs and new sources of supply that will be implemented once combined dam levels reach a specified trigger.
Drought Storage Reserve	Volume of water located between the working storage and the emergency storage volumes. This volume is held in reserve as a contingency volume for use in severe drought once the Drought Response Plan is triggered. The reserve is used to supplement supplies during periods of restrictions and construction of climate resilient supplies to ensure the region never runs out of water. The reserve is calculated depending on the mix of water supply sources at the time, but has a nominal supply of 36 months at a restricted demand including consideration of climate resilient supplies.
Drought Supply Requirement	The capacity of climate resilient supplies that must be procured and commissioned within 36 months as part of the Drought Response Plan. The Drought Supply Requirement is equal to medium-level restricted demand minus existing climate resilient supplies.
Effective evaporation	Losses due to surface evaporation and seepage minus infiltration.
Emergency volume	The volume of water in a dam, below the Drought Storage Reserve but above the minimum operating level, which is not intended to be accessed. This volume is set for each dam to maintain water quality and provide some margin for unidentified contingencies. The regional emergency volume is expected to be in the order of 5% of combined storage volume.

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Term	Definition
Entitlement	A term used to describe some water authorities granted under the *Water Act 2000*. A water entitlement is a water allocation, interim water allocation or a water licence.
Environmental flows	Flow requirements specified in Water Resource Plans necessary to maintain and support aquatic biota and ecosystem processes.
Federation Drought	The drought experienced in SEQ from 1898 to 1903. Prior to the Millennium Drought, it was the most severe drought in recorded history in SEQ.
Full cost recovery	A form of cost recovery that ensures an appropriate return on capital, a return of capital and recovery of all operation and maintenance costs.
Greywater	Wastewater from the bath, spa bath, shower, wash basins and laundry, which can be diverted for use on lawns and gardens. It does not include water from the kitchen, swimming pool or toilet, as this water would pose health and environmental risks.
Grid Water	Any water supplied into or extracted from the Water Grid.
Groundwater	Water that exists beneath the surface in underground streams and aquifers.
Levelised cost	The cost of a measure expressed in terms of $/ML. Levelised cost is generally calculated by dividing the net present value of the cost of the measure by the net present value of the water saved or supplied.
Level of Service (LOS) objectives	Objectives for capacity, security and restriction of the Water Grid. The objectives are described in terms of the maximum frequency, duration and severity of restrictions that may be expected by the community.
Logan River system	Wyaralong Dam, Cedar Grove Weir, Bromelton Off-stream Storage and Maroon Dam.
ML	A megalitre or 1,000,000 litres.
Mary River system	Traveston Crossing and Borumba Dams.
Measures	Used to describe initiatives or projects which are expected to achieve a defined outcome.
Millennium Drought	The drought that has occurred in SEQ (and other parts of Australia) from 2001 and had not broken when this Strategy was prepared. The Millennium Drought has had a greater rainfall deficit in the region than the Federation Drought.
Minimum operating level	The level to which existing infrastructure permits water extractions and cannot under normal circumstances be supplied to customers. In general, the minimum operating volume will be located below the Working Storage, Drought Storage Reserve and Emergency Volume. The minimum operating level is also referred to as dead storage.
Normal Operating Mode	This is the mode of operation when the combined regional water storage level is within the Working Storage. Most commonly, the region will operate in this mode.
NRW	Department of Natural Resources and Water.
Priority	Groups of water allocations and interim water allocations are assigned a priority, largely based on the performance of the groups and the rules in place to provide for the sharing of available water between the priority groups.
	High priority
	A group of water allocations and interim water allocations that perform more reliably than lesser priority groups, as available water in a water supply scheme is generally set aside in order of priority (i.e. high priority first), for the upcoming water year used for that scheme. Currently high priority water allocations are mainly used for urban

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Term	Definition
Priority (continued)	High priority (continued)
	purposes and for power generation, although they are also sometimes utilised for irrigation, particularly for high value, long-life crops such as fruit trees.
	Medium priority
	A group of water allocations or interim water allocations that has less security than high priority as once the available water in a scheme has been set aside for the high priority group, the remainder is divided amongst those in the medium priority group. Access to medium priority water is often prohibited before access to higher priority water begins to reduce. Medium priority allocations are generally used in the rural production sector.
PRW	Purified Recycled Water.
Queensland Water Commission (QWC)	A statutory authority established to advise the Queensland Government on matters relating to water supply and demand management, and to facilitate and implement Regional Water Security Programs.
Regional Water Security Options	Advice from the QWC regarding options to achieve water security in SEQ required by the Minister for Infrastructure and Planning. Among other things, the options must address: • Desired LOS objectives; • Demand management for water; • The extent to which implementation of the desired LOS objectives would involve modifying existing water supply works or building new water supply works; and • The likely costs and pricing implications and the preferred ways of sharing the cost.
Regional Water Security Program	A program to achieve water security for the region made and published by the Minister for Infrastructure and Planning within four months of receiving Regional Water Security Options from the QWC. A Regional Water Security Program was made in November 2006.
Reliability of supply	An indication of the proportion of time that a supply system is able to meet the full assumed demand. Reliability may be expressed as the proportion of time over an historical period that the full demand is met or conversely not met.
Resource Operating Plan (ROP)	A plan that details the water sharing rules, infrastructure operating rules and other water management rules that will be applied in the day-to-day management of water supplies within a catchment and/or water supply scheme.
Restricted Demand	The volume of water required to meet the region's needs if the combined regional storage drops below the T1 trigger. The LOS objective for medium-level restrictions to reduce demand by 15% below the demand when permanent water conservation measures are in force. See also Water Restrictions.
SEQ	South East Queensland, as defined in the SEQ Regional Plan.
SEQ Regional Plan	South East Queensland Regional Plan 2005-2026.
Sewer Mining	The extraction of raw sewage effluent from the wastewater collection system for treatment and use as recycled water. Waste from the treatment plant is generally returned to the sewer. The final quality of the water produced can be fit to purpose.

Term	Definition
South Maroochy system	Cooloolabin, Poona and Wappa Dams.
Standards of Service	The characteristics of product delivered by water retailers to their customers. The *Water Act 2000* describes the requirements for establishing Standards of Service. Examples of standards of service relate to water quality, delivery pressure and continuity of supply.
Stochastic modelling	A stochastic model is a tool for estimating probability distribution of potential outcomes by allowing for random variation in one or more inputs over time. The random variation is usually based on fluctuations observed in historical data for a selected period using standard time-series techniques.
System losses	The difference between the amount of water extracted from water supplies and that delivered to water users. The difference may be due to approved activities such as fire fighting or unapproved such as theft or due to leakage losses.
System Operating Plan	A plan made under section 360V of the *Water Act 2000* to give effect to the Regional Water Security Program. The System Operating Plan describes rules for operating water supply infrastructure in order to achieve the LOS objectives, as specified in the Regional Water Security Program.
T1 Trigger to the Drought Response Plan	The combined regional storage level that will trigger the initiation of the Drought Response Plan Preparation Phase. The T1 Trigger will be set at a level which ensures there is a minimum of 36 months of regional water supply available. The T1 Trigger is dependent on demand, and the volume of climate resilient supply available.
T2 Trigger to the Drought Response Plan	The combined regional storage level that will trigger the initiation of the Drought Response Plan Construction Phase. T2 is set at a level which ensures there is a minimum period, nominally 30 months, of regional water supply available prior to the completion of additional climate resilient supplies.
Urban activity	A residential, industrial, retail, commercial, sporting, recreation, tourism or community activity within the urban footprint.
Urban footprint	One of four regional land use categories in the SEQ Regional Plan. The urban footprint identifies land to provide for the region's urban development needs to 2026.
Water harvesting	The taking of unsupplemented water during high flow events. Water harvesting generally involves extraction of water when set flow thresholds are exceeded and pumping and storing the water off-stream for later use.
Water Grid	The group of bulk supply and transport assets that when operated conjunctively deliver the LOS objectives.
Water Grid Manager	An entity established in SEQ to purchase bulk supply, treatment and transport services, sell water and water services to Water Grid customers, and oversee the physical operation of the Water Grid.
Water Resource Plan (WRP)	Subordinate legislation under the *Water Act 2000* that provides the framework for defining the balance between water for consumptive use and environmental requirements. These plans also provide the basis for establishing tradable water allocations including the specification of: • Water allocation security objectives (WASOs); and • Environmental flow objectives (EFOs).

Term	Definition
Water Restrictions	Permanent water conservation measures Permanent initiatives that will be introduced following the end of the Millennium Drought. These will make a contribution to achieving the system capacity target equivalent to 375 litres per person per day. Medium-level water restrictions Initiatives that form part of the Drought Response Plan to reduce demand for Grid Water by 15%.
Water trading	The purchase and sale of a right to take water. Once established, water allocations can be bought and sold separately from the land title to which water entitlements have been previously tied. Water trading is used as a mechanism to promote higher efficiency. Water users have an incentive to use water more efficiently if they can realise the benefits of reduced use, for example by selling any surplus water allocation through a market process to others who place a higher value on it.
Water year	An annual cycle that associated with the natural progression of the hydrologic seasons. It is intended to commence with the start of the season of soil moisture recharge, includes the season of maximum runoff, stream flows and groundwater recharge and concludes with the season of maximum evapo-transpiration. In SEQ, it is generally described as the period 1 June to 31 May but does vary from catchment to catchment.
Working storage	The portion of a dam or weir above the Drought Storage Reserve that is drawn upon in Normal Operating Mode.
Yield	The average annual volume that can be drawn from a supply source or a supply option to meet a specified demand at a specified level of service. Yield is always associated with some measure of probability of occurrence, whether it is reliability or probability of achieving a LOS. Historical No Failure Yield (HNFY) In relation to a dam, weir or other water storage: the maximum amount that, if it had been extracted in each year for which flow data exists, the storage would not have reached minimum operating level. That is, extraction of the HNFY every year would not cause the dam to be drawn down below the dead storage level during the worst drought on record. This approach does not accommodate a drought worse than the worst drought on record. LOS Yield The yield of a dam, weir or other water storage to achieve the LOS objectives. LOS system yield The combined yield of all water sources achieving the LOS objectives.

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Reference list

Title	Website
Regional planning framework	
South East Regional Plan 2005-2026	www.oum.qld.gov.au/?id=29
South East Queensland: Infrastructure Plan and Program 2007-2026	www.oum.qld.gov.au/?id=315
Water for South Eastern Queensland: A long-term Solution	www.qwc.qld.gov.au/myfiles/uploads/long_term_solution.pdf
Our Water – Urban Water Supply Arrangements in South East Queensland	www.qwc.qld.gov.au/myfiles/uploads/institutional%20arrangements/Urban_Water_Supply_Arrangements_in_SEQ.pdf
Planning, Information and Forecasting Unit (PIFU), Population and Housing Fact Sheet for SEQ Region	www.lgp.qld.gov.au/docs/corporate/publications/planning/demographics/profiles/demographic_and_housing/seqregion.pdf
Queensland Government Population Projections to 2051: Queensland and Statistical Divisions	www.oesr.qld.gov.au/queensland-by-theme/demography/population/regular-publications/qld-govt-pop-proj-2051-qld-sd/qld-govt-pop-proj-2051-qld-sd-2006.pdf
Improving water use efficiency in Queensland urban communities	www.nrw.qld.gov.au/compliance/wic/pdf/reports/urban_wateruse/00_exec_summary.pdf
Related legislation	
Water Act 2000	www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WaterA00.pdf
Water Amendment Regulation (No. 6) 2006	www.legislation.qld.gov.au/LEGISLTN/SLS/2006/06SL202.pdf
Water Regulation 2002	www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WaterR02.pdf
South East Queensland Water (Restructuring) Bill 2007	www.austlii.edu.au/au/legis/qld/bill/seqwb2007494/
Integrated Planning Act 1997	www.legislation.qld.gov.au/LEGISLTN/CURRENT/I/IntegPlanA97.pdf
Queensland Development Code 2003	www.lgp.qld.gov.au/?id=247
Water Resource Plans	
Gold Coast	www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WatResGCP06.pdf
Logan Basin	www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WatResLBP07.pdf
Mary Basin	www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WaterReMaryP06.pdf
Moreton	www.legislation.qld.gov.au/LEGISLTN/SLS/2007/07SL031.pdf
Interim Resource Operations Licences	
Logan River Water Supply Scheme	www.nrw.qld.gov.au/water/management/pdf/logan_river.pdf
Mary River Water Supply Scheme	www.nrw.qld.gov.au/water/management/pdf/mary.pdf
Nerang Water Supply Scheme	www.nrw.qld.gov.au/water/management/pdf/nerang.pdf
Warrill Valley Water Supply Scheme	www.nrw.qld.gov.au/water/management/pdf/warrill_valley.pdf

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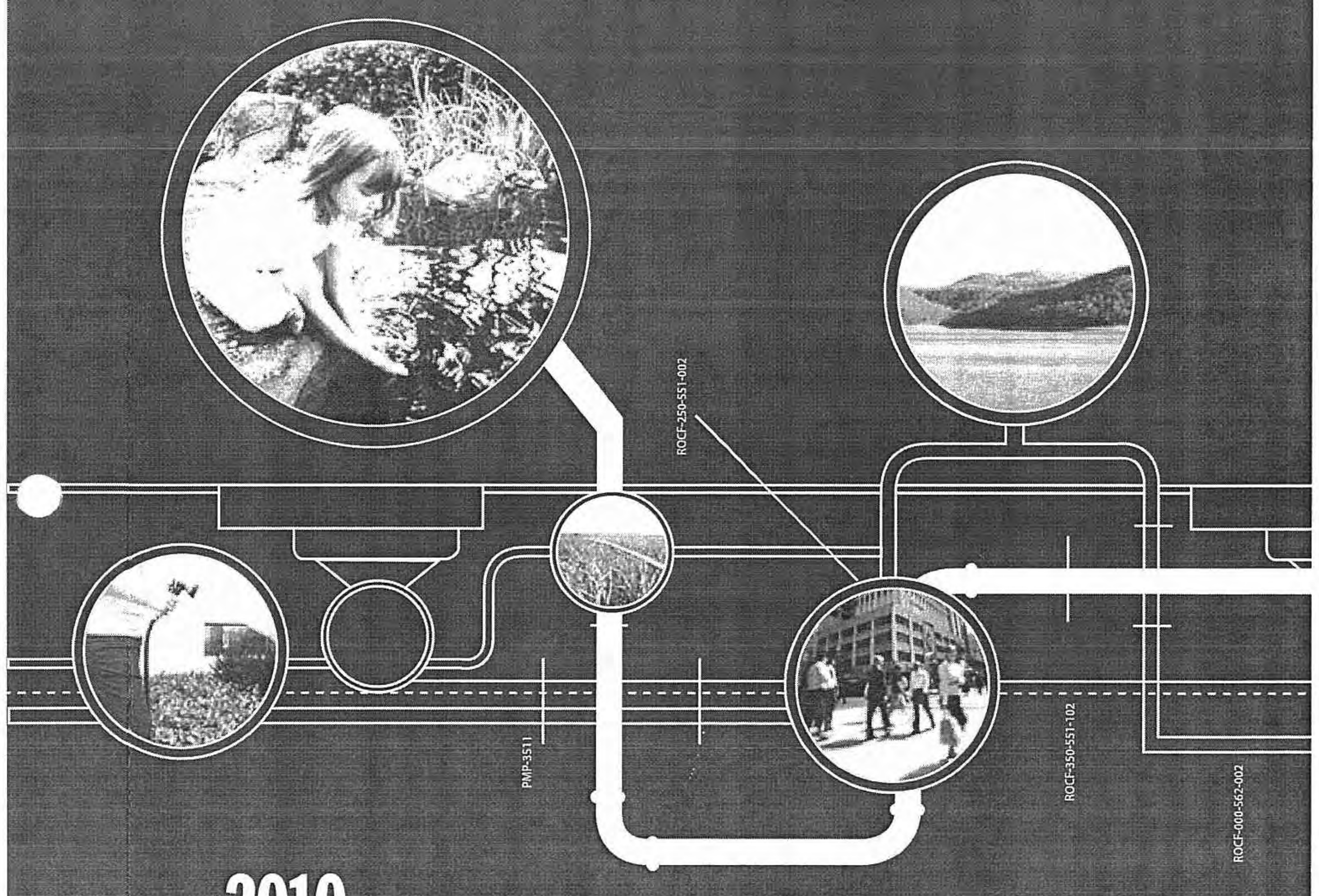
Title	Website
Climate	
South East Queensland Drought to 2007	www.climatechange.qld.gov.au/forecasts/pdfs/seq_drought_2007.pdf
Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Synthesis Report	www.ipcc.ch/ipccreports/ar4-syr.htm
Drinking water quality guidelines	
Australian Drinking Water Guidelines	www.nhmrc.gov.au/publications/synopses/_files/adwg_11_06.pdf
Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)	www.ephc.gov.au/pdf/water/WaterRecyclingGuidelines-02_Nov06_.pdf
Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) Augmentation of drinking water supplies draft for comment	http://www.ephc.gov.au/pdf/water/AugmentationofDrinkingWaterSupplies__ConsultationDraft_July07.pdf
WSAA Facts 2005-2006	www.wsaa.asn.au/frameset2.html

Queensland water Commission

South East Queensland Water Strategy



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South East Queensland
Water Strategy

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Executive summary

The *South East Queensland Water Strategy* (the Strategy) is the adaptable blueprint for maintaining water security in South East Queensland (SEQ) into the future.

The Strategy enhances the transparency of planning for, and operation of, the SEQ Water Grid. It delivers a Water Supply Guarantee, which ensures sufficient water is available to support a comfortable, sustainable and prosperous lifestyle while meeting the needs of urban, industrial and rural growth and the environment.

This Guarantee will be delivered through a demand management framework, appropriate infrastructure investment and efficiencies gained through operation of the region-wide SEQ Water Grid.

Context

The Millennium Drought is now behind us. Our water supply is now secure, due to SEQ dams currently at or near full capacity and due to the range of measures that were adopted as part of the drought response. These measures include improved water use efficiency, new supplies and streamlined institutional arrangements. All of SEQ is now under the same consistent out-of-drought water management framework, with average regional residential consumption remaining consistently below 200 litres per person per day.

Now is the time to plan for the region's future needs, ensuring that security of supply is maintained in the face of population growth and climate variability and change. The opportunity now exists to use water and operate existing infrastructure more efficiently, deferring the next bulk water supply source for as long as possible. A more staged and inclusive approach to planning for these new supplies can also be adopted.

The Strategy builds on the range of institutional changes that are currently underway to ensure the efficient and effective operation of the SEQ Water Grid, and on the enhanced security provided by the diverse range of supply sources that have now been constructed.

Within this context, the key features of the Strategy are encapsulated in the general themes of:

- use less
- be supply-ready
- manage efficiently.

Use less

Efficient water use: Planning has been based on the conservative assumption that the community will reduce per-person water consumption by over 24 per cent compared to trends prior to the Millennium Drought.

Target 200: The Strategy challenges residents to do even better than planning assumptions, maintaining average consumption at or below 200 litres per person per day. If this can be achieved, the need for new supplies will be deferred.

Local water supplies: Off-Grid supplies, such as rainwater tanks, must now be installed for all new houses and most new industrial and commercial buildings. This water will be used for appropriate internal purposes, as well as for outdoor watering. The Strategy supports the adoption of stormwater harvesting and recycling where efficient and effective.

Be supply-ready

Drought planning: The Strategy plans to minimise the impact of future droughts through planned investment, prudent management and a pre-determined drought response plan. It sets an objective that the community experience water restrictions no more than once every 25 years, on average.

New water supplies: The Strategy will be reviewed before another major supply source is required. In the meantime, a range of potential supplies will be investigated in detail. Based on current information and technology, desalination facilities will underpin future water security for SEQ.

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Manage efficiently

Purified recycled water: The Western Corridor Recycled Water Scheme provides security of supply as a standby facility. This means that existing sources can be more effectively utilised because in times when dam levels are low, purified recycled water will be available to supplement our dams—ensuring that security of region's water supply can be maintained.

Rural production: A range of measures to enhance the availability of water for rural production will be investigated, including making water that is not required for urban use available on an interruptible basis. Up to 32 000 megalitres per year of recycled water has been made available for supply to the Lockyer Valley and other areas, subject to commercial arrangements that are fair and do not disadvantage other SEQ water users.

Our vision

The Strategy's vision is expressed as desired Level of Service (LOS) objectives, which relate to the expected frequency, duration and severity of restrictions during future droughts. A conservative approach has been taken when determining the required LOS system yield for SEQ, which considers population growth, climate change and variability and the extent of the potential rebound in consumption demand following the drought.

The LOS objectives mean that future investments in the water supply system will be made so that sufficient water from the SEQ Water Grid will be available to meet average regional urban demand of up to 375 litres per person per day, including an allowance of up to 230 litres per person per day for residential uses. Infrastructure will be planned so that the frequency of restrictions will be no more than once every 25 years, on average. These restrictions would be much less severe than those that applied during the recent drought, which prohibited almost all outdoor water use.

Use less

The Strategy outlines measures for residents, business and industry to maintain efficient and responsible water consumption by residents, business and industry.

The Strategy challenges SEQ residents to do even better than the planning assumption of an average residential consumption of 230 litres per person per day, maintaining average residential consumption at or below 200 litres per person per day (Target 200). If this target is achieved, future water supplies can be deferred and the amount of water that is treated and distributed through the SEQ Water Grid can be reduced—saving money and electricity and reducing the carbon footprint.

The Strategy's aim is to achieve this target without significantly changing the lifestyle that SEQ residents enjoy, including the ability to sustain healthy, water-wise gardens. The challenge is maintaining, in the long term, the behavioural change brought about by the drought, as actual residential consumption will vary between households and across SEQ, and between seasons and years.

Building on Permanent Water Conservation Measures, which were introduced across SEQ on 1 December 2009, where time restrictions have generally been relaxed but efficiency measures remain in place, a range of other existing measures will continue and a number of new measures will be investigated in order to encourage efficient water use. These measures include:

- ensuring that all new buildings are water-efficient
- ensuring that existing buildings become more water-efficient, such as by requiring water-efficient showerheads to be installed as part of major renovations
- moving business and industry towards best practice water efficiency, through the preparation and implementation of water efficiency management plans
- minimising system losses
- undertaking targeted information and education programs, such as for schools and selected industries.

The QWC will review the key components of the demand management program on an ongoing basis and will seek to ensure that the program encourages water efficiency at the lowest overall economic, social and environmental cost.

Local supplies

Since 1 January 2007, all applications lodged for the construction of new homes in SEQ have had to demonstrate how they achieve the mandatory water savings targets. Detached houses must target savings of 70 000 litres per year, while terrace houses and townhouses must aim to achieve savings of 42 000 litres per year.

The water savings targets are forecast to apply to about 500 000 new houses by 2026 and about 800 000 houses by 2056, depending on population growth and household type.

These off-Grid supply sources are forecast to reduce demand on the SEQ Water Grid by about 35 000 megalitres per year in 2026 and about 60 000 megalitres per year in 2056— almost one and a half times the capacity of the existing desalination facility at Tugun. Savings from existing rainwater tanks and new tanks on commercial and industrial buildings are in addition to this.

Internally plumbed rainwater tanks are one option to achieve the water savings target. Alternatives include communal rainwater tanks, stormwater harvesting and dual-reticulation recycled water systems. Each of these options can have beneficial outcomes for other elements of the water cycle—such as capturing stormwater run-off and reducing the discharge of nutrients into waterways—but must be balanced against cost considerations.

The most appropriate solution will vary depending on local circumstances. To ensure that these decisions are well informed, a range of research is underway and some demonstration stormwater harvesting schemes are proposed.

Be supply-ready

Saving water will postpone, but not preclude, the need for additional supplies in the future, to meet growth and ensure security in times of drought.

Scenario analysis indicates that the construction of the next supply source will probably be triggered by demand growth. While this could be required in 2021, it is more likely to occur around mid-2020s (refer to Figure A). The 2021 timeframe could be delayed if there is:

- high series population growth and a regional average residential consumption of 200 litres per person per day
  or
- medium series population growth and a regional average residential consumption of 230 litres per person per day.

Residential consumption can have a major impact on the timing of the next major supply. By achieving the voluntary target of maintaining average residential consumption at or below 200 litres per person per day, additional supplies could be deferred by at least five years. For example, the earliest time at which a new supply will be required could be deferred from 2021 to around 2027.

Several scenarios have been prepared to assess the possible implications of the uncertainties of the key variables of population growth, demand and climate change. Table A illustrates possible augmentation timeframes. The Strategy has been developed to ensure that the region's water supplies will be secure in all of these scenarios.

Climate change and our dams

Climate change may have a significant impact on the supply from our dams. The majority of climate modelling done to date indicates that SEQ is likely to become hotter and drier, with reduced inflows to dams and increased demand for water.

The CSIRO is undertaking local-scale modelling for SEQ. The preliminary results indicate that, while climate change may reduce yield by about 10 per cent, the impact is likely to occur over decades, rather than immediately.

The impact of climate change is being researched through the Queensland Climate Change Centre of Excellence and the Urban Water Security Research Alliance. The Strategy will be revised as our understanding of the likely impacts of climate change on SEQ water supplies improves.

Table A Impact of reduced consumption on the timing of the next augmentation

Scenario	Regional average residential consumption	
	230 litres/person/day	200 litres/person/day
Earliest date with: • high population growth • provision for climate impact	2017	2022
Likely date with: • high population growth	2021	2027
Likely date with: • medium population growth • provision for climate impact	2020	2027
Latest date with: • medium population growth	2026	2032

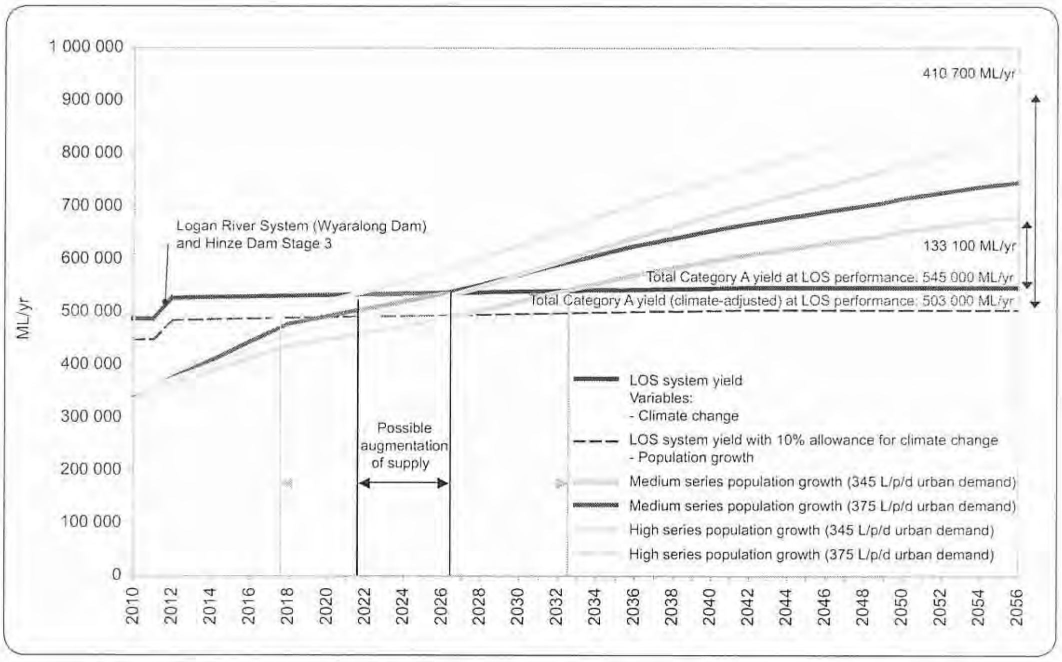

Figure A Water balance in normal operating mode

The purpose of the Strategy is to augment supplies at appropriate times to prevent a gap from developing. The QWC will update the Strategy regularly and as key assumptions change. The timing of future infrastructure will become clearer as projected population growth estimates are revised, average residential consumption patterns are confirmed and there is more certainty about the long-term impacts of climate change on water supply sources. Changes to these forecasts will have a direct impact on the planning program for potential water supplies.

The construction of major new supplies may also be triggered as part of a drought response. A drought response plan is an integral part of the Strategy as it establishes an upfront plan to ensure continuity of supply regardless of climatic conditions. The QWC will complete the drought response plan in 2011.

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Our potential future sources of supply

Prudent planning for future supplies is needed, to ensure that the best options can be selected when required. With new supplies unlikely to be required until after 2021, the QWC will take advantage of that time to investigate the options thoroughly, including appropriate research and stakeholder engagement.

It is expected that desalination facilities will underpin our future water security, based on existing information and technology. The Queensland Government has announced priority and reserve desalination sites, as listed in Table B.

Table B Priority and reserve desalination sites

Category	Site	Property description	Owner
Priority	Lytton	Lot 49 SP193294	State of Queensland
	Marcoola	Lot 753 CG3375	Sunshine Coast Regional Council
Reserve	Tugun (duplication of existing facility)	Lot 30 SP197355	Gold Coast City Council/State of Queensland
	Bribie Island	Lot 67 SP214143	State of Queensland

There are also a number of small potential dams and weirs that will be investigated, as well as options to upgrade existing supplies. Options will be investigated in the Mary River catchment, including raising Borumba Dam and water harvesting. Making use of the remaining strategic reserve of unallocated water in SEQ warrants further investigation, given the limited number of alternatives.

Purified recycled water is currently available to augment Wivenhoe Dam as part of a drought response, increasing the amount that can be taken from dams and weirs in normal conditions. Over time, community confidence in purified recycled water schemes may permit the development of additional schemes and the further utilisation of the Western Corridor Recycled Water Scheme. The QWC considers it prudent to proceed with investigations of these potential schemes, with a view to preserving land for treatment facilities and pipeline corridors if viable. The QWC will continue to provide information to the community regarding purified recycled water.

The water supply options that will be investigated in detail are listed in Table C.

Table C Potential supplies to be investigated in detail

Type of source	Potential source
Desalination sites	• Marcoola (priority site) • Lytton, near the Brisbane River mouth (priority site) • Duplication of the facility at Tugun on the Gold Coast (reserve site) • Bribie Island (reserve site)
Dams and weirs	• Borumba Dam Stage 3, water harvesting from the Mary River or a combination of both • Raised operating levels in Wivenhoe Dam • Raising of the Mt Crosby Weir • Additional minor supplies in the Logan and Albert catchment, potentially including a pipeline between the Bromelton Off-stream Storage and Wyaralong Dam • Stormwater augmentation of dams
Purified recycled water schemes	• Augmentation of Hinze Dam • Augmentation of North Pine Dam

Scenario analysis indicates that if climate change impacts occur relatively soon additional water supplies might need to be available from 2017, with construction commencing by 2014. While unlikely, it is prudent to be ready to respond if necessary. The QWC will now commence detailed planning and obtain preliminary approvals to ensure that new supplies can be delivered efficiently when required. The QWC will engage with local councils and neighbouring communities in all stages of the planning process.

The detailed planning will inform a final decision regarding the next major supply when regionally significant supplies are needed. The Strategy sets out the process by which the QWC will assess alternatives and the basis for its advice to Queensland Government, including a Statement of Needs process similar to that used in the electricity sector.

Manage efficiently

Water supply for SEQ is secure for the short to medium-term, due to the construction of the SEQ Water Grid and key storages being full or near full. Given this situation, and assuming continued water efficiency, there is about 1 per cent probability of key storages falling to 40 per cent of capacity over the next 10 years, triggering the re-introduction of Medium Level Restrictions.

This Strategy seeks to ensure that the benefits of the short to medium-term security are maximised, deferring the time when major new supplies will be required. It establishes a framework for the efficient operation of the SEQ Water Grid, which complements the measures in place for efficient water use in homes and businesses.

The SEQ Water Grid allows water supplies to be managed efficiently in a way not previously possible, providing the ability to shift our water to where it is needed most.

Linking our water sources across the region has produced a 14 per cent increase in the LOS system yield of sources of supply existing in 2006. The increase is being achieved through the coordinated management of dams, and by managing risk at a regional level.

The SEQ Water Grid also benefits from the availability of the desalination facility at Tugun and the Western Corridor Recycled Water Scheme. These supplies provide a secure supply in severe drought, enabling more water to be taken from dams when levels are high. Importantly, they deliver this benefit without being operated at capacity at all times.

In the case of the Western Corridor Recycled Water Scheme, this means that the policy of using the Scheme to augment Wivenhoe Dam only when key Water Grid storage levels fall to 40 per cent of capacity reflects an optimal operating strategy at this time.

The Western Corridor Recycled Water Scheme is expected to directly supply up to about 36 000 megalitres per year for urban purposes, depending upon the level of demand from the power stations. However, its overall contribution towards the yield of the SEQ Water Grid is much greater. In conjunction with desalinated water, the Scheme increases the capacity of the Water Grid by up to 100 000 megalitres per year.

At the same time, increasing the trigger would have minimal impact on overall system yield, deferring the next source of supply by up to one and a half years,. Increasing the trigger point at which purified recycled water is added to Wivenhoe Dam—currently 40 per cent—would increase operating costs and the likelihood of the dam spilling. The costs and benefits of changing the trigger will be assessed as demand approaches supply.

Water for rural towns

About 20 000 SEQ residents live in communities that have drinking water supplies not directly connected to the SEQ Water Grid. These communities differ in terms of size and forecast population growth, and they are serviced by a diverse range of water supply sources with varying levels of security.

A number of communities are indirectly supplied from SEQ Water Grid assets and are benefiting from improved security of supply following the completion of new supplies. These communities include:

- Beaudesert, Kooralbyn and Rathdowney, which are supplied from the Logan River system
- Aratula, Boonah, Kalbar and Mount Alford, which are supplied from the Warrill Valley system.

Over time, the Strategy seeks to achieve the same LOS objectives for all communities with reticulated water supplies as for those connected to the SEQ Water Grid. Options to improve security to a number of towns are currently being investigated, with the highest priorities being Beaudesert and Canungra given the size and recent history of water supply issues in these communities.

Water for rural production

Rural producers in SEQ used about 150 000 megalitres per year of water in 2005.

The Queensland Government has announced that up to 32 000 megalitres per year of additional water supplies will be made available for rural production from the Western Corridor Recycled Water Scheme, outside times of severe drought.

The QWC will lead the investigation of a range of other options to potentially improve the availability of water for rural production. These options may increase the total amount of water available, or improve the reliability of its supply.

The SEQ Water Grid provides opportunities for aligning the management of urban and rural water supplies in some catchments. A range of options are to be investigated, including ways to provide higher levels of reliability for existing allocations and provide certainty about allocations earlier in the water year. Any such supply must occur within a transparent framework, which ensures that the costs are appropriately shared.

For example, 8250 megalitres per year of high priority water previously used by the Swanbank power station and Ipswich City Council has been reserved under the SEQ System Operating Plan to increase supply reliability for urban growth in Boonah and surrounding towns. Through this reserved water, the reliability of supply to irrigators in the Warrill Valley has also been improved.

The Strategy builds on existing Queensland Government initiatives in the Rural Futures Strategy, to ensure appropriate pricing, fair water trading and improved water use efficiency.

Energy for water

By using water more efficiently, the amount of water that is treated and distributed through the SEQ Water Grid will be reduced and region's carbon footprint lowered.. The Strategy estimates that, by maintaining average total consumption at 24 per cent below pre-drought trends, a 38 per cent saving in energy consumption can be achieved for bulk water requirements in 2048. These savings are equivalent to the total energy consumption of around 86 000 homes in 2020. Additional savings will be achieved if residents of SEQ achieve the voluntary Target 200.

Despite these savings, SEQ's water supply system will become increasingly energy-intensive over time, especially with an increased reliance on climate independent desalination. When dam levels are high, the SEQ Water Grid encourages lower energy use as it:

- allows less energy-intensive sources to be used first
- reduces water transfers.

With existing infrastructure, the energy intensity of bulk water delivered to a home in SEQ is still less than 3 per cent of typical household energy consumption.

Institutional arrangements

Reforms needed for water management in SEQ were implemented in order to fully realise the benefits of the SEQ Water Grid and ensure the efficient and effective operation of the diverse range of supply sources.

The first phase of reform implementation was completed on 1 July 2008, with the establishment of the four new entities that own and operate the SEQ Water Grid.

With the establishment of the three new distributor-retailers owned by local councils on 1 July 2010, the next stage of institutional reform was completed. These entities own and operate the water reticulation and wastewater infrastructure in the region.

Beyond the physical operation of the SEQ Water Grid, the reformed institutional arrangements also have the potential to deliver significant benefits to the community through:

- simplified business structures to deliver water services in a coordinated manner
- creation of economies of scale and scope due to the reduced number of entities
- efficiency in service provision by specialist entities, with the amalgamation of technical skill sets
- higher technical skill levels across the industry through coordinated training and education
- clarification of the respective roles of state and local governments
- improved transparency and accountability for bulk transport and distribution networks with a strong asset management regime
- enhanced economic regulation.

Implementation and review

The Strategy outlines the key elements of the first Statement of Needs, which are the projects that must proceed over the next 10 years in order to ensure that the LOS objectives can be achieved. The key elements are as follows:

- Committed projects should be completed.
- Beyond these projects, additional bulk water supplies could be required in 2021.
- Operational improvements and capital upgrades should continue, in order to comply with water quality requirements under the *Water Supply (Safety and Reliability) Act 2008*.
- A drought response plan will be prepared.

The QWC will review and update the Strategy at least every five years, aligned with the review of the *South East Queensland Regional Plan 2009-2031*, or as major developments or changes in key assumptions occur. The QWC will report annually on the implementation of the Strategy, considering the currency of key assumptions.

Chapter 1

Setting the scene

This chapter explains the purpose of the *South East Queensland Water Strategy* (the Strategy), the guiding principles and the Water Supply Guarantee, which is the Queensland Water Commission's (QWC) vision for the future and the basis for water supply planning.

Key messages

- The Strategy will deliver the Water Supply Guarantee, a vision of sufficient water to support a comfortable, sustainable and prosperous lifestyle while meeting the needs of urban, industrial and rural growth and the environment.
- This vision includes a well-informed, water-wise community that is engaged in the planning process as decisions are made. Key elements of this vision are:
  - balancing community expectations of water security, quality and cost
  - embedding water efficiency throughout the water supply and demand chain
  - managing water security through diversified and integrated water supplies, and drought preparedness
  - improving environmental outcomes, including healthier waterways, through integrated strategic planning and catchment management.
- The Strategy provides a comprehensive planning and implementation framework to secure water supplies for South East Queensland (SEQ) for the long-term.

1.1 Purpose of the Strategy

As described in the *South East Queensland Regional Plan 2009–2031* (the Regional Plan), the purpose of the Strategy is to ensure that water in SEQ is managed on a sustainable and integrated basis to provide secure and reliable supplies of acceptable quality for all uses for the long term.

For the purposes of water planning, the local government areas that make up SEQ are:

- Brisbane City Council
- Gold Coast City Council
- Ipswich City Council
- Lockyer Valley Regional Council
- Logan City Council
- Moreton Bay Regional Council
- Redland City Council
- Scenic Rim Regional Council
- Somerset Regional Council
- Sunshine Coast Regional Council.

Planning for SEQ must be integrated with planning for adjoining areas. Water is already supplied to and from SEQ from adjoining areas. The Strategy takes these supplies into account. It also identifies other potential opportunities.

The largest existing supply from SEQ is to Toowoomba. Toowoomba Regional Council is responsible for water planning and management in Toowoomba. The Strategy takes into account the amount of water that might be supplied from the SEQ Water Grid through the recently completed pipeline.

Figure 1.1 shows the extent of the area covered by the Strategy.

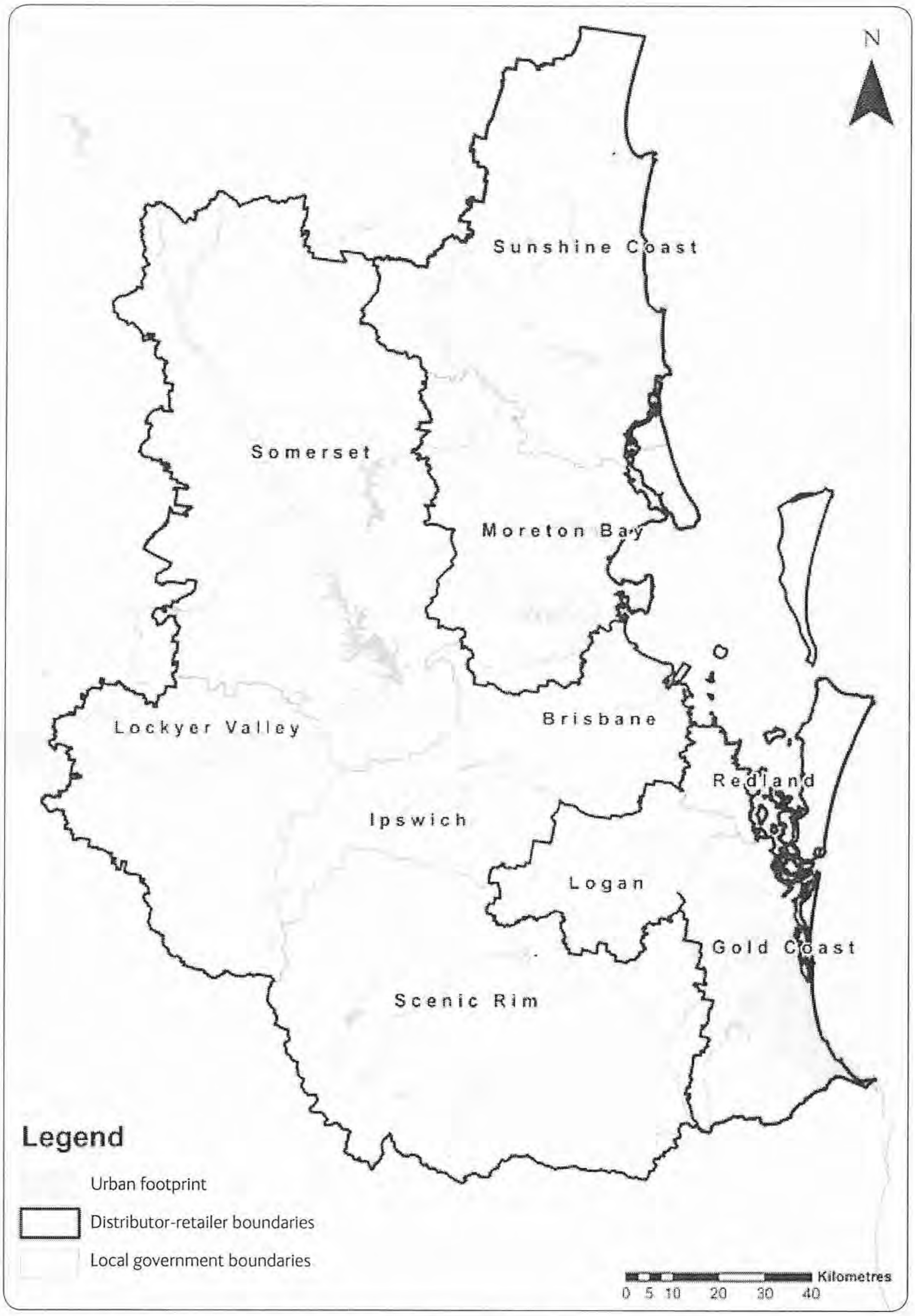

Figure 1.1 Area covered by the *South East Queensland Water Strategy*

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1.2 Guiding principles

The QWC is responsible for advising the Queensland Government on achieving water security in SEQ. The *Water Act 2000* sets out the role of the QWC. The principles underpinning the Strategy derive from section 346 of the *Water Act 2000*.

Guiding principles

- Water is a scarce resource that is to be shared across the region.
- Water quality should be managed from its source to its end-users in a way that:
  - ensures the health of catchments, aquifers and their ecosystems
  - delivers water of a quality desired by the end-users at the lowest overall cost.
- Water supply arrangements should maximise efficient and cost-effective service delivery and the efficient use of water, such as appropriate connectivity between supply sources, in accordance with the Level of Service (LOS) objectives.
- The cost of water sources should be shared among users who benefit from them. Pricing should recognise Queensland Government commitments under inter-governmental agreements.
- Regional water supply assessments should consider environmental, social and economic factors, and include 'least cost planning' to ensure proper economic comparison of all supply and demand options.
- QWC water restrictions should help to achieve the region's objectives for long-term demand management for water and enable the appropriate management of any significant threat to the sustainability and security of the region's water supply.
- Flood mitigation and dam safety should be considered in assessments of regional water supply.

1.3 The Water Supply Guarantee

Economic development and a highly liveable environment have resulted in significant migration to SEQ in recent years, with the population doubling since 1981. This growth has increased demand for water.

In addition to this increased demand, SEQ recently experienced a severe drought and the worst recorded inflows to major storages in its history. In response to the drought, the community has demonstrated an outstanding commitment to reducing water consumption by embracing water restrictions and other voluntary water-saving behaviours.

The Strategy aims to reflect the community's attitude towards water through the vision of the Water Supply Guarantee for SEQ.

To deliver this regional vision, the Strategy was developed using the LOS approach to regional water planning. It includes ongoing consideration of climate change, climate variability, population growth and other regional factors affecting supply and demand.

The vision for water security in SEQ is explained in more detail below.

The Water Supply Guarantee

It is our vision that there will be sufficient water to support a comfortable, sustainable and prosperous lifestyle while meeting the needs of urban, industrial and rural growth and the environment.

Known as the Water Supply Guarantee, this water security vision will be achieved by:

- balancing community expectations of water security, quality and cost
- embedding water efficiency throughout the water supply and demand chain
- managing water security through diversified and integrated water supplies and drought preparedness
- improving environmental outcomes, including healthier waterways, through integrated strategic planning and catchment management.

1.3.1 Balancing community expectations

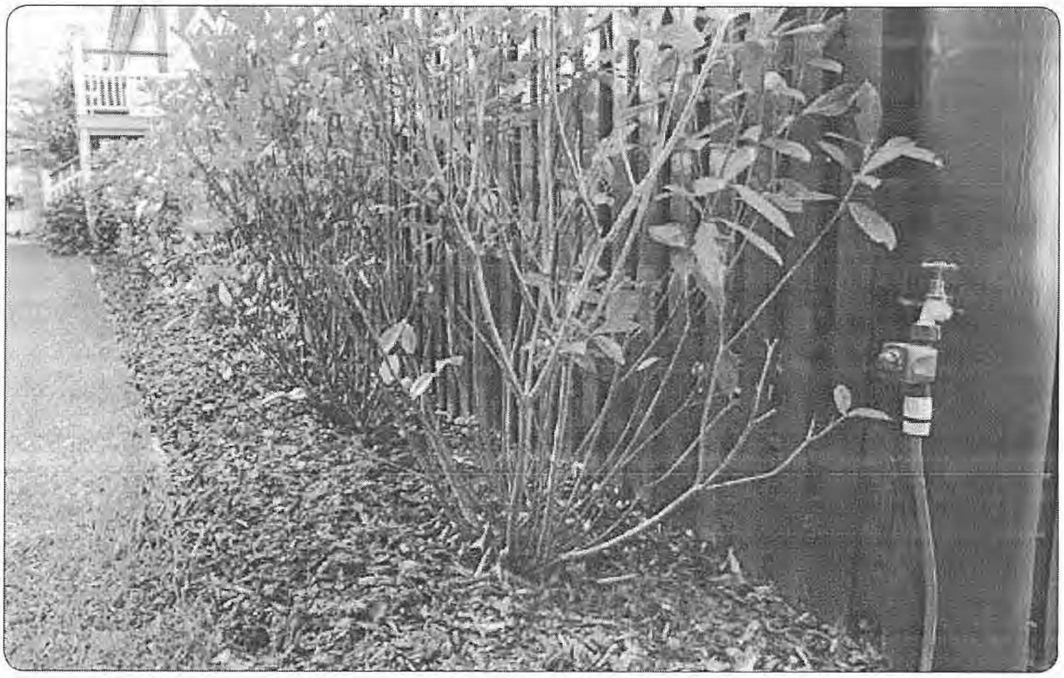
Water resources in SEQ will be managed sustainably, on a total water cycle basis.

Planning will be regularly reviewed, taking into account technological advances and changing demand patterns and attitudes.

Investments in the water supply system will be made with the objective that Medium Level Restrictions will not occur more than once every 25 years on average. The effect of these Medium Level Restrictions will be less onerous than the Extreme and High Level Restrictions applied during the recent drought.

Public health and safety will not be compromised.

These outcomes will be achieved at least cost to the community.



1.3.2 Embedding water efficiency

The Queensland Government will promote ways for residents of SEQ to value water and to use water efficiently without compromising quality of life.

There will be enough water to maintain our gardens, wash cars, top up swimming pools and fill paddle pools. As a water-wise community, we will water our gardens in the cool of the day, use efficient watering devices, such as drip irrigation, and minimise pool losses by using pool covers. Our houses will be fitted with water-efficient appliances, such as dual-flush toilets, so we can save water without thinking about it. Water conservation will be an important design aspect when building and renovating houses, and commercial and industrial buildings.

Our major commercial, industrial and government water users will have water efficiency embedded in their business. Once water efficiency is embedded, additional savings during drought will mostly come from residents reducing their outdoor use.

Our rural water users will be able to trade water and they will have efficient irrigation equipment and on-farm water use practices.

The SEQ Water Grid will be operated as efficiently as possible while achieving the LOS objectives, minimising operating costs and energy consumption.

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1.3.3 Water security through diversified and integrated water supplies

SEQ will have a water supply system that is increasingly diversified and interconnected, including dams and weirs, desalination and water recycling.

This combination will allow us to make the most of the rain we receive and, in combination with a pre-determined drought response plan, meet our water needs during future periods of prolonged drought.

Local supplies, such as rainwater tanks and stormwater harvesting, will be an integral part of all new developments, reducing the demand for water from the SEQ Water Grid and contributing to improved environmental outcomes.

Corridors and potential infrastructure sites will be identified and preserved, at appropriate triggers, so we are ready to build the water supply infrastructure required in the future.

1.3.4 Improving environmental outcomes

Water supply sources will be managed in a way that enhances the health of our waterway systems. Nutrient discharges into Moreton Bay will be reduced because more of SEQ's water will be recycled. Enough water will be released into rivers and streams from our dams to maintain flora, fauna and river health.

1.4 Working in partnership

The Strategy was developed in partnership with key stakeholders, initially with the Queensland Government, the Council of Mayors (SEQ) and the bulk water authorities. Input was sought from industrial and rural water user groups, specialist working groups, the SEQ Healthy Waterways Partnership and the community.

1.5 Results of consultation

Two versions of the Strategy have been released for public consultation.

The first version was released for public consultation from 26 March 2008 to 31 July 2008.

During the consultation period, the QWC ran a campaign to raise awareness of the draft Strategy and its key content. The QWC sent a direct-mail brochure to 1.1 million SEQ households outlining the key features of the draft Strategy and information was conveyed in press advertising in a range of newspapers in SEQ. More than 2600 copies were distributed to other members of the community and almost 1500 people attended Strategy presentations. Community members were also engaged through events such as World Environment Day and the Royal Queensland Show (the 'Ekka').

The QWC received 175 responses on this version, of which 117 came from residents. Feedback was also received from 10 local government agencies, state and federal members of parliament, 20 business groups and organisations, 13 community and environmental groups and four rural water user groups.

Feedback on demand issues generally related to the proposed planning target of an average regional residential usage of 230 litres per person per day, total water cycle management, and business water efficiency measures. Feedback on water supply issues generally related to the proposed Traveston Crossing and Wyaralong dams, purified recycled water and other types of recycling, desalination and alternative additional water sources.

Feedback was also received on a range of other issues, including LOS objectives, population management, water pricing, the SEQ Water Grid, rural water and environmental issues.

The revised draft Strategy was released for public consultation from 20 November 2009 to 12 February 2010. The revised draft Strategy incorporated feedback on the initial draft and policy decisions by the Commonwealth and state governments, notably the cancellation of Traveston Crossing Dam. In releasing the revised draft Strategy, the Minister and Commissioner specifically sought feedback on whether the regional average residential consumption target should be 200 or 230 litres per person per day.

The QWC received 3410 submissions on the revised draft Strategy, of which 3192 primarily related to identifying potential desalination sites on the Sunshine Coast.

The final Strategy responds to many of the issues raised during consultation. Key changes include:

- a voluntary regional residential consumption target of 200 litres per person per day (Target 200)
- more detail explaining the process by which the QWC will prepare advice on the next bulk water supply (Section 3.5)
- information about the framework for implementing total water cycle management in SEQ (Section 2.3)
- more detail in Section 4.6 to explain the role of local supply sources generally, and rainwater and stormwater specifically—including case studies for projects that are currently underway
- more explanation of how the LOS objectives will be achieved in communities with stand-alone water supplies (Section 6.5.1)
- more detail about the investigations into opportunities to increase the amount or reliability of water for rural production (Section 6.5)
- extensive revision of the section on the Strategy's energy implications, plus a new section on greenhouse gas impacts—including forecast greenhouse gas emissions for the operation of the SEQ Water Grid at full capacity and when supply equals demand (Section 6.8.4).

A consultation report has been released with the Strategy.

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Chapter 2

Our planning context and challenges

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This chapter describes the framework of plans, policies, strategies and programs that help to develop and manage growth and resources in SEQ. The chapter also describes the major challenges that affect how we plan for water for the future.

Key messages

- The Strategy will be reviewed on a five-yearly basis, aligned with the review of the Regional Plan, or in response to emerging issues that might be identified through the annual reporting process.
- The Strategy has been developed with consideration of the relevant laws, regulations, guidelines and agreements related to planning in SEQ.
- Key challenges facing SEQ include population growth and climate variability and change.
- Water supply planning must reflect a total water cycle management approach, contributing to improved outcomes for waterways and catchments.
- Water supplies for rural communities and rural irrigation should be enhanced.
- Potential sites for future water supply projects need to be identified, investigated and preserved.

2.1 Our legislative and policy frameworks

This section describes the legislative and policy framework for the Strategy.

Figure 2.1 shows some of the key state and regional plans that have influenced the development of the Strategy. Other policies and initiatives such as the National Water Initiative and the National Water Quality Management Strategy have also influenced its development.

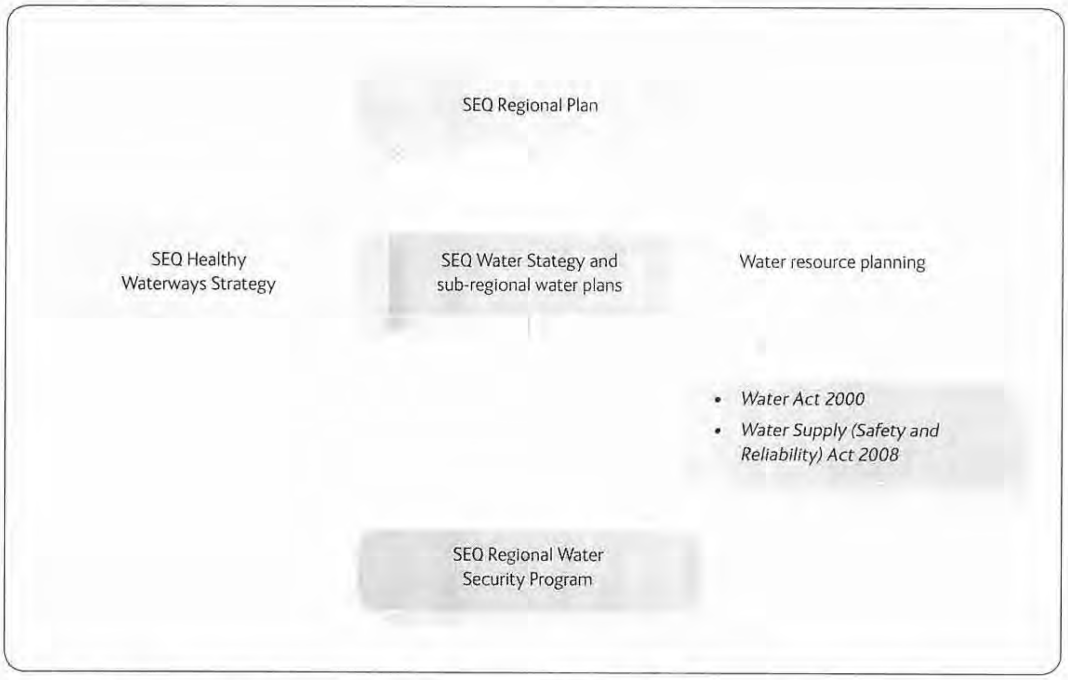

Figure 2.1 Relationship between the Strategy and other key planning processes

2.1.1 The SEQ Regional Water Security Program

The legislative and policy framework for water management in SEQ specifies a number of required (and enforceable) programs and plans. The Regional Water Security Program is one of these. The Regional Water Security Program is made by the Minister for Natural Resources, Mines and Energy and the Minister for Trade. It specifies, at a high level, how regional water security is to be achieved.

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The Regional Water Security Program was adopted on 13 November 2006, providing for the construction of significant infrastructure. This program was revised on 5 March 2010 following the completion of most of these projects and the significant increase in storage levels across the SEQ region.

The Strategy and its associated analysis will provide the basis for future advice that the QWC provides to the Minister for Natural Resources, Mines and Energy and Minister for Trade on regional water security options.

2.1.2 The South East Queensland Regional Plan

The *South East Queensland Regional Plan 2009–2031* (Regional Plan) provides a framework for sustainable growth to the year 2031. It describes management strategies, regional land use patterns and policies to address growth management issues.

The Regional Plan states that water is a valuable and finite regional resource that requires management on a total water cycle basis.

The Regional Plan requires that there are secure supplies of water to meet reasonable growth and development in the region, including meeting rural water needs. This must be done while minimising overall system costs and protecting and enhancing the ecological health of our groundwater and surface water systems. It supports targeted reductions in water consumption by efficient use of water and management of consumer behaviour. Under the Regional Plan, the Strategy is to examine alternative water sources and demand management options, and develop a strategic direction for water supply in the region through to 2056.

2.1.3 Water resource planning

Water resource planning provides a framework for the sustainable allocation of water resources. Together, water resource plans and resource operations plans specify:

- the proportion of water flows that are provided for the environment
- the volumes of water that have already been allocated as entitlements which may be used for urban, industrial or rural purposes
- what water, if any, might be available for future allocation and use.

Water resource plans provide a framework for the allocation and management of water in a specified area. They do this by:

- defining the availability of water in an area
- providing a framework for sustainably managing and taking water in an area
- identifying priorities and mechanisms for dealing with future water requirements
- providing a framework for reversing, where practicable, degradation that has occurred in natural ecosystems.

Water availability is mainly reflected as entitlements, which are specified following rigorous environmental, hydrologic, social and economic assessment processes.

Resource operations plans implement water resource plans by management rules and arrangements necessary to satisfy the water resource plans' objectives and outcomes. They establish rules for monitoring, water sharing and water trading, and processes for dealing with unallocated water, within a single catchment. In addition, they establish tradeable water allocations.

In SEQ, the water resource plans for the Mary, Moreton, Logan and Gold Coast catchments have been finalised (refer to Figure 2.2). Resource operations plans for the Logan, Gold Coast and Moreton have been completed, while the resource operations plan for the Mary catchment is currently in development. Figure 2.3 illustrates the relationship between water resource plans, resource operations plans and the System Operating Plan, which is described in Chapter 3. Separate plans address other aspects of water planning, such as demand management.

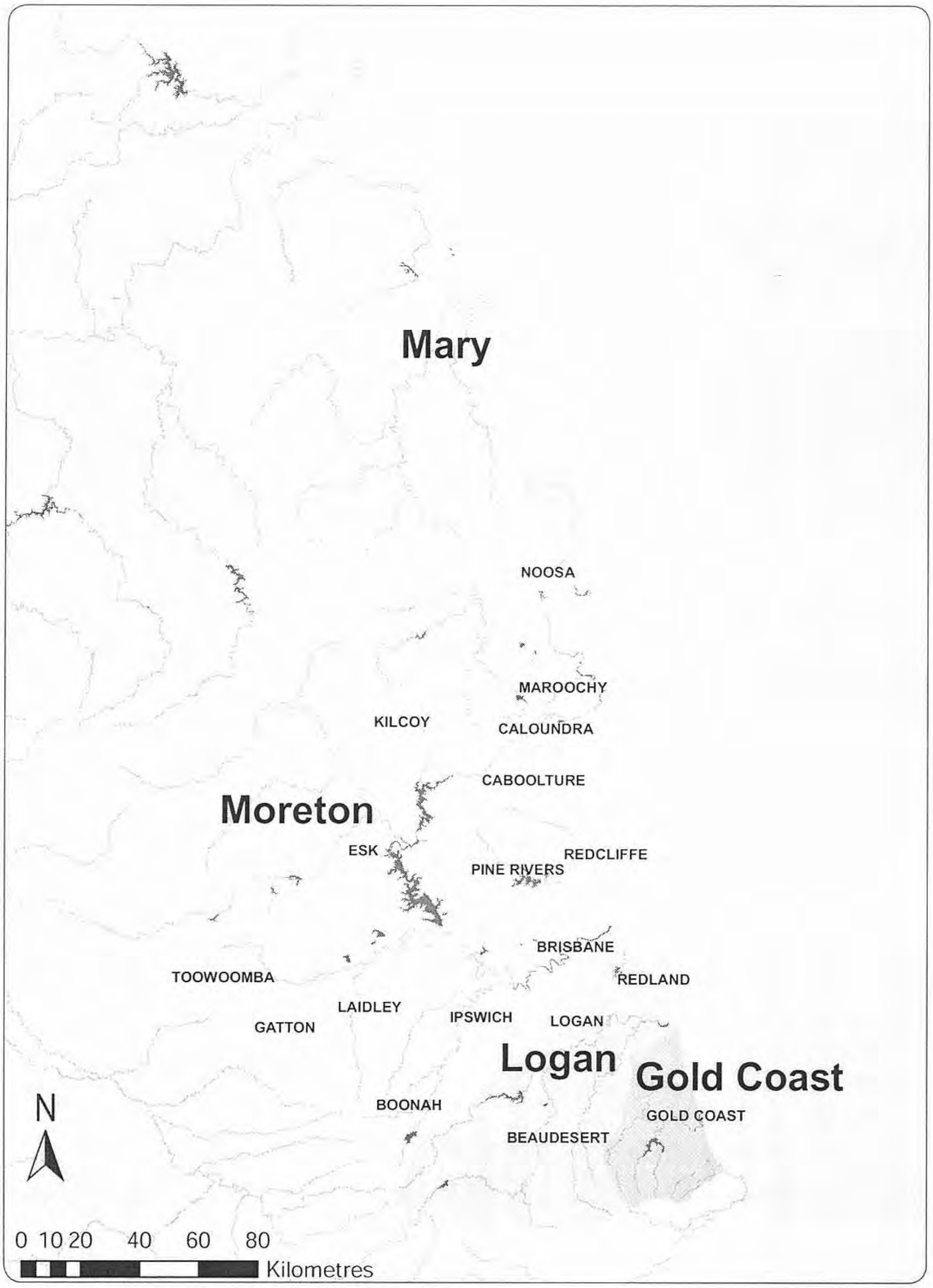

Figure 2.2 Water resource plan areas

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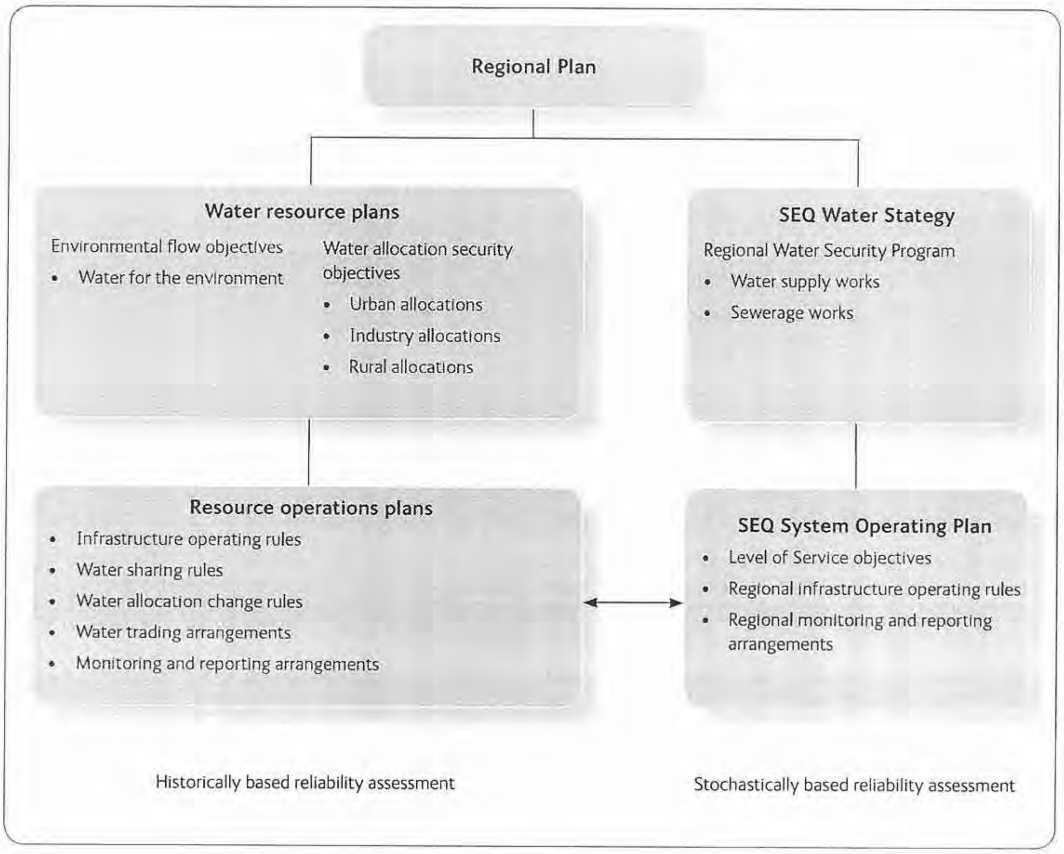

Figure 2.3 Relationship between water resource planning and the SEQ System Operating Plan

The water resource plans for the Mary Basin and Moreton are the only plans for SEQ that apply to groundwater. Declared sub-artesian areas, defined in the Water Regulation 2002, exist over Moreton Island and North Stradbroke Island.

The Strategy complies with the water resource plans. Section 3.1.3 discusses the importance of resource operations plans in achieving the desired supply reliability stated in the Strategy planning framework.

Water for the environment

Water resource plans specify a range of general and ecological outcomes. For example, some of the water resource plans for SEQ contain ecological outcomes that seek to minimise changes to the delivery of fresh water sediment, nutrients and organic matter to Moreton Bay. Monitoring and reporting programs will be established under the resource operations plans to assess whether or not water resource plans are achieving these outcomes.

In large part, the ecological outcomes are achieved by ensuring that actual flows meet or exceed specified environmental flow objectives. The environmental flow objectives are specified for high, medium and low flow regimes, and take into account seasonality. Wherever possible, environmental flow objectives attempt to mimic the natural flow regime of a catchment system.

In SEQ, environmental flows will exceed the minimum specified in water resource plans, because:

- each water resource plan identifies unallocated water that is available for urban or rural use. Until this water is fully granted, it would appear as surplus system flow (refer to Section 5.4.2)
- the SEQ Water Grid Manager will use less than the full urban water allocation to achieve the LOS objectives described in Chapter 3. This will increase the operating level of urban water supply dams, therefore increasing the potential frequency and volume of dam overflows to the environment.

The environmental flow objectives and water allocation security objectives included in the water resource plans are based on the historical record. The impacts of climate variability and change will be taken into account as part of future reviews of the plans.

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Water for urban and rural use

Water resource plans also provide a level of security to water allocation holders, by establishing water allocation security objectives. These objectives define minimum performance levels that should be achieved through the implementation of operational and management rules specified in the relevant resource operations plans. The water allocation security objectives take into account any unallocated water that may be released for urban or rural use in the future.

There are a range of high priority and medium priority water entitlements from supplemented water supply schemes and some unsupplemented water entitlements. A supplemented water supply is one that is made more reliable by releases of stored water, such as from dams. Supplemented water supplies are managed by water supply scheme operators, such as Seqwater. An unsupplemented supply is one that is not sourced by releases of stored water. Unsupplemented supplies are managed by the Department of Environment and Resource Management.

In SEQ, most water resource plans specify that supply reliability[1] for high priority water allocations must be at least 95 per cent. Medium priority water allocations will generally have a lower reliability of supply. These performance levels reflect the nature of the use, with high priority allocations being suitable for urban and industrial uses and medium priority allocations being appropriate for rural uses.

For supplemented systems, announced allocation rules will generally be used to share water between allocation holders. Water trading rules will be specific to each plan and will generally apply to only supplemented water allocations in the initial resource operations plans. Water trading is intended to encourage water use efficiency and business development by enabling water allocation holders to sell, lease or seasonally assign spare water.

Groundwater

The *Water Act 2000* is the primary tool for management of groundwater extraction in Queensland.

Regulated groundwater areas have recently been identified in the water resource plans for the Mary and Moreton catchments. These mainly affect existing irrigation supplies. Bores for domestic use in SEQ are regulated on an as-needs basis.

Water bores may require a development permit under the *Sustainable Planning Act 2009* before they can be constructed. This ensures that these works are constructed properly and do not pose a risk to public safety or to the groundwater resource. Generally, the permit is required for all purposes except for stock water and domestic use.

2.1.4 Waterway health

Environmental values for water are set under the *Environmental Protection (Water) Policy 2009*. Objectives are set for key water quality parameters to protect these values, such as the percentage of sea grass coverage in parts of Moreton Bay or levels of nitrogen or phosphorus. These values provide a common set of goals to help integrate planning and management decisions.

The SEQ Healthy Waterways Partnership is a whole-of-government, whole-of-community collaboration. It focuses on leadership, commitment and voluntary cooperation to understand, plan and manage the use of SEQ's waterways and catchments. The program aims to complement other strategies and plans, including the Regional Plan, the Strategy and natural resource management plans.

The SEQ Healthy Waterways Partnership released the final version of the *SEQ Healthy Waterways Strategy 2007–2012* in 2008. The Healthy Waterways Strategy includes separate issue-based action plans regarding point source pollution, non-urban diffuse pollution, water-sensitive urban design, coastal algal blooms and protection of high conservation areas.

The Queensland Government released the draft State Planning Policy for Healthy Waterways for consultation in November 2009. The policy is intended to ensure that urban development is planned, designed and managed in ways that protect the environment.

[1] This means the percentage of months of being able to take the full water allocation over the historical simulation period. Not being able to take the full water allocation in any month does not mean that no water is available in that month, but rather that the full water allocation could not be taken for that month.

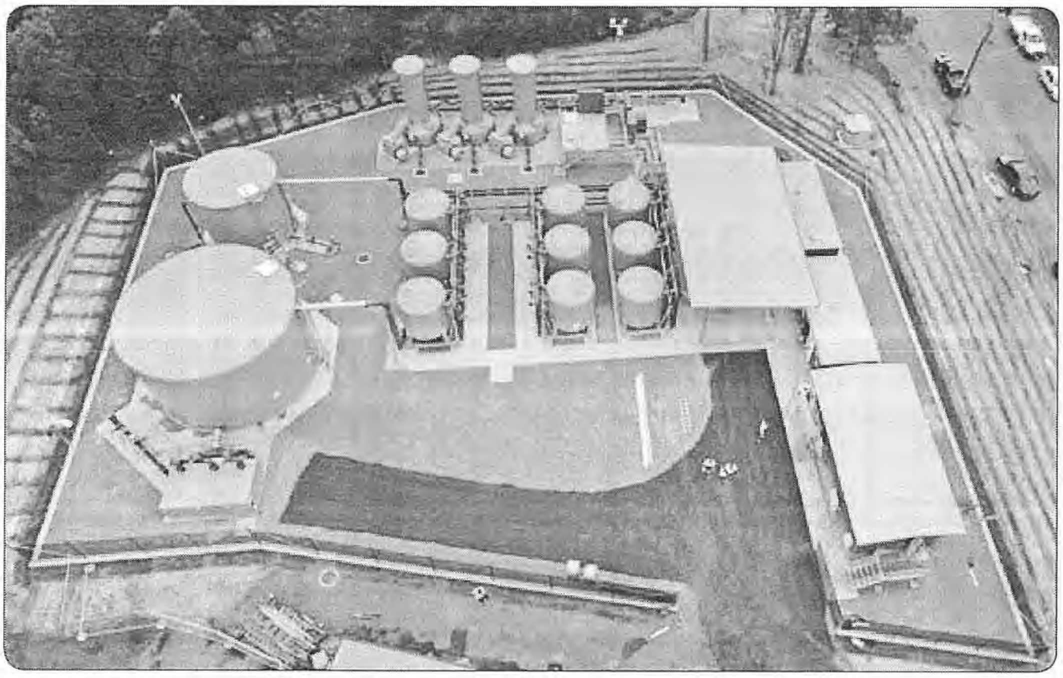
2.1.5 Drinking and recycled water quality

Drinking water quality in Queensland is regulated by the *Water Supply (Safety and Reliability) Act 2008*, the *Public Health Act 2005* and their accompanying regulations and guidelines. These Acts provide a framework for managing and ensuring the safety of drinking water supplies.

These regulations are based on the *Australian Drinking Water Guidelines*. The *Australian Drinking Water Guidelines* are designed to provide an authoritative reference on what defines safe, good quality water, how it can be achieved and how it can be assured. They address health and aesthetic issues and include guideline values for water quality parameters.

The *Water Supply (Safety and Reliability) Act 2008* and the *Public Health Act 2005* also establish a regulatory framework to ensure that recycled water schemes produce water of a quality that is suitable for its intended use. The Acts apply to all new and existing schemes across Queensland, including the Western Corridor Recycled Water Scheme.

These regulations are based on the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks*.



Brisbane Water, Runcorn Water Treatment Plant
Copyright 2007 Brisbane Caboolture Aquifuture Alliance
Photo courtesy of Brisbane City Council

2.1.6 National Water Initiative

The National Water Initiative (NWI) is an inter-governmental agreement between the Commonwealth of Australia and all states and territories. The overall objective of the NWI is to achieve a nationally compatible system of managing surface and groundwater resources for rural and urban use—a system that optimises economic, social and environmental outcomes and is based on markets, regulations and planning. In particular, the National Water Initiative seeks to:

- progressively remove barriers to water trading and to broaden and deepen the water market with the creation of an open trading market
- improve confidence for those investing in the water industry due to more secure water access entitlements; better and more compatible registry arrangements; better monitoring, reporting and accounting of water use; and improved public access to information
- return all currently over-allocated or overused systems to environmentally sustainable levels of extraction

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- make water planning more sophisticated, transparent and comprehensive to deal with key issues such as the interaction between surface and groundwater systems, and the provision of water to meet specific environmental outcomes
- more efficiently manage water in urban environments—for example, through the increased use of recycled water and stormwater.

2.2 Institutional arrangements

The Queensland Government is implementing wide-ranging institutional reforms in the water industry in SEQ.

The reforms were required in order to realise the benefits of the SEQ Water Grid, ensuring the efficient and effective operation of the diverse range of supply sources. The previous arrangements were fragmented, with bulk source, transport and treatment assets being owned by 25 different entities. Customer service standards and water pricing were variable, there was no means of equitably sharing the cost of new infrastructure across the beneficiaries, and there was minimal transparency in the structure and level of water pricing.

The first phase of reform implementation was completed on 1 July 2008 with the establishment of the four new entities that own and operate the SEQ Water Grid (refer to Figure 2.4). These entities are:

- Seqwater, which owns all dams, groundwater infrastructure and water treatment plants in SEQ
- WaterSecure, which owns the desalination plant at the Gold Coast and the Western Corridor Recycled Water Scheme
- Linkwater, which owns all major pipelines in SEQ
- the SEQ Water Grid Manager.

These entities are all Queensland Government–owned statutory authorities.

Figure 2.4 Institutional arrangements

The second stage of the reforms was completed on 1 July 2010, when three new council-owned distribution and retail entities commence operation. These entities own the water and sewerage distribution infrastructure and sell water and sewage disposal services to customers. The new entities are owned by the following councils and provide services within their areas (see Figure 2.5):

- Unitywater, servicing the Sunshine Coast and Moreton Bay areas
- Queensland Urban Utilities, servicing the Brisbane, Scenic Rim, Ipswich, Somerset and Lockyer Valley areas
- Allconnex Water, servicing the Gold Coast, Logan and Redland areas.

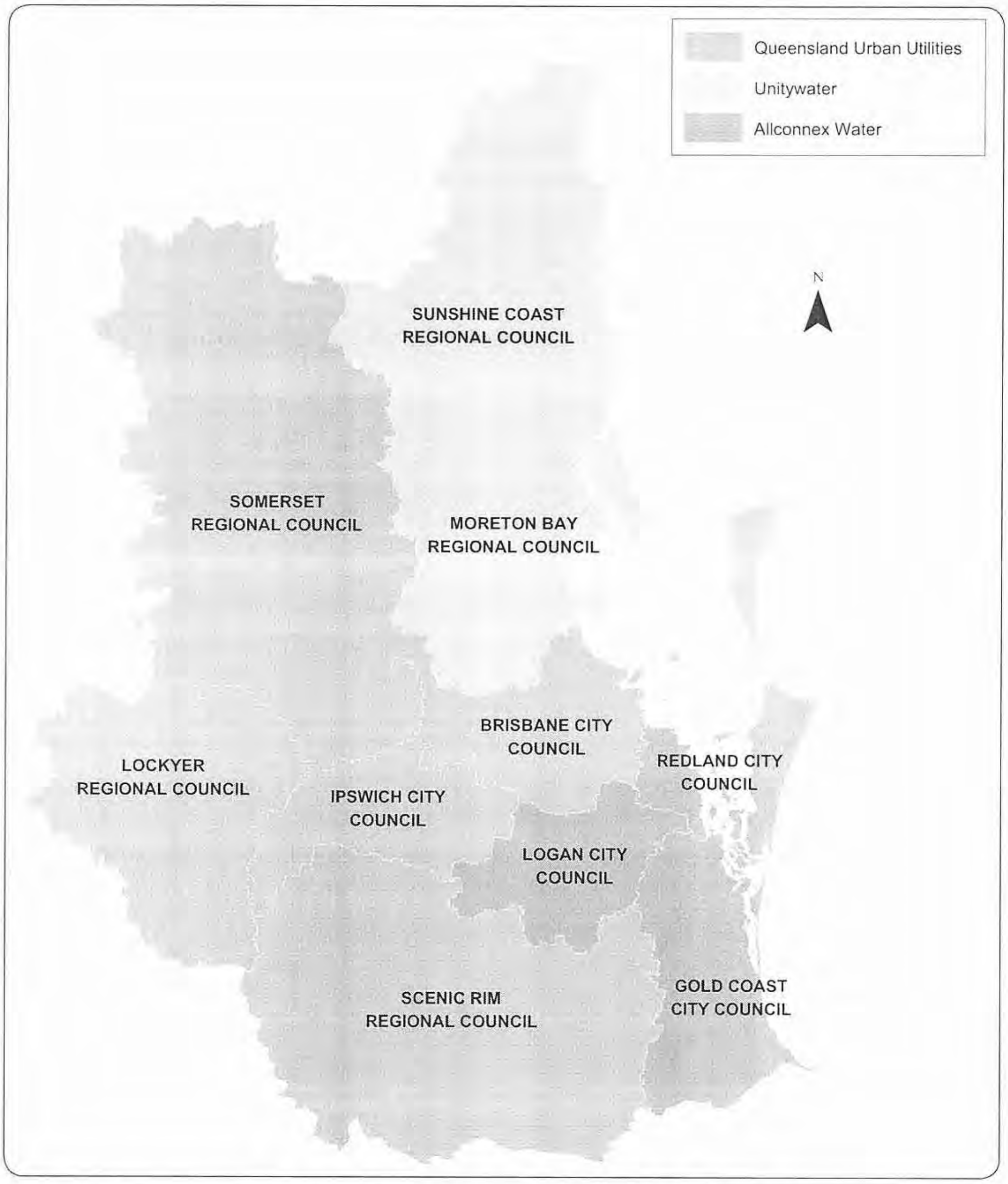

Figure 2.5 Boundaries of the three council-owned distributor-retailers

The SEQ Water Grid Manager is responsible for directing the physical operation of the SEQ Water Grid. The SEQ Water Grid Manager optimises the scheduling of supply from each source, taking into account a range of factors, including system reserves, dam inflows, operating costs, water quality and risk management.

The SEQ Water Grid Manager also provides a mechanism to share the costs of the SEQ Water Grid, by acting as the single buyer of bulk water services and the single seller of bulk water for urban purposes. It sells a wholesale 'pool' product, reflecting the portfolio cost of supplying retailers with a defined security and quality of supply at a defined bulk supply node.

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Case study: Regional approach to maintaining a quality water service

On 29 December 2008, the SEQ Water Grid Manager was notified that residents in the south and west of Brisbane and some parts of Ipswich were experiencing changes to the taste, colour and odour of their tap water.

This was due to high summer temperatures, intense summer storms and seven years of extreme drought conditions. In combination, these factors increased the amount of soluble and insoluble inorganic and organic compounds flowing into water supplies at Mt Crosby. This elevated the levels of naturally occurring organic compounds, such as manganese and geosmin in the water. These organic compounds altered the colour and taste of the drinking water from the Mt Crosby Water Treatment Plant; however, the tap water continued to meet the strict health requirements of the *Australian Drinking Water Guidelines*.

The SEQ Water Grid Manager worked with four Grid participants to manage the water quality incident. Actions included:

- increasing the production of water from North Pine Water Treatment Plant
- flushing the Mt Crosby Weir with fresh water
- transferring 50 million litres of water a day from the Gold Coast to blend with Mt Crosby water
- transferring 20 million litres of water a day from the Gold Coast to Logan.

These measures resulted in reduced manganese and geosmin levels, improving the taste and odour of the tap water for Brisbane and Ipswich residents.

By 14 January 2009, test results confirmed that the concentration of organic compounds and minerals in the water at the Mt Crosby Water Treatment Plant was back to normal levels and below the *Australian Drinking Water Guidelines* aesthetic threshold.

Beyond the physical operation of the SEQ Water Grid, the reformed institutional arrangements have the potential to deliver significant benefits to the community by:

- improving and simplifying business structures to deliver water services in a coordinated manner
- creating economies of scale and scope due to the reduced number of entities
- improving service delivery by specialist entities, with the amalgamation of technical skill sets
- clarifying the respective roles of state and local governments
- improving the transparency and accountability for bulk transport and distribution networks with a strong asset management regime
- enhancing economic regulation and pricing.

The ability to introduce competition was a consideration in developing the new arrangements. Scope for practical competition will be actively assessed as part of the significant policy and regulatory reform agenda being undertaken by the QWC. While the SEQ Water Grid Manager is a monopoly service provider in the short term, some scope for the sale of bulk water directly to SEQ Water Grid customers by suppliers will be established at an early stage. This bypass mechanism is likely to see the development of new supply sources, particularly for localised solutions such as dual-reticulation recycled water schemes.

The SEQ Water Grid Manager can also enter into urban and rural water contracts. The Queensland Government has previously announced that recycled water will be made available from the Western Corridor Recycled Water Scheme to Lockyer Valley irrigators when not required to meet urban supply requirements (refer to Section 6.6.3). Additional supplies could also be made available from the SEQ Water Grid for rural production when not required to meet urban needs, such as through temporary or seasonal supply. Temporary allocations would be made available through a competitively neutral and transparent process. Any sales would be required to recover the cost of supply and not disadvantage other system users.

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2.3 Total water cycle planning

The regional framework for total water cycle planning is set out in Section 11 of the Regional Plan. This section provides further detail on implementing this framework in SEQ.

The Strategy seeks to optimise total water cycle outcomes by:

- using and managing all water resources sustainably and within water resource plan limits
- introducing a demand management program to ensure that we continue to conserve our precious water resources
- considering all potential water sources, including possible future purified recycled water schemes and local recycling and stormwater schemes
- establishing new design standards for development, including for water efficiency and provisions of alternative supply sources
- recognising the importance of catchment management in protecting public and ecosystem health.

The following text box explains the framework for total water cycle management.

Framework for total water cycle management in SEQ

Total water cycle management (TWCM) involves the integration of land use and infrastructure planning across SEQ as a whole and for major development areas, local areas and specific sites. Key features of total water cycle management planning include:

- water efficiency and recycling
- integrated management of urban and rural water
- water-sensitive urban design in development
- stormwater management to improve water quality and water supply and to minimise the alteration to natural flow regimes
- a focus on catchment management to protect drinking water supplies and waterways from pollution.

Total water cycle management needs to be considered at a number of scales, with the planning process and the focus of investigations differing for each. For instance, regional planning focuses on regionally significant outcomes and infrastructure, such as the LOS objectives for water supply. At the other extreme, on-site development involves delivering built outcomes such as rainwater tanks, stormwater reuse or water-efficient devices.

Figure 2.6 illustrates the scales of planning and the key planning focus for each. At each scale, the planning requirement sets the context for planning at the scale below. At the more strategic levels, planning should not be unnecessarily prescriptive. Rather, target outcomes should be specified only where they are regionally significant.

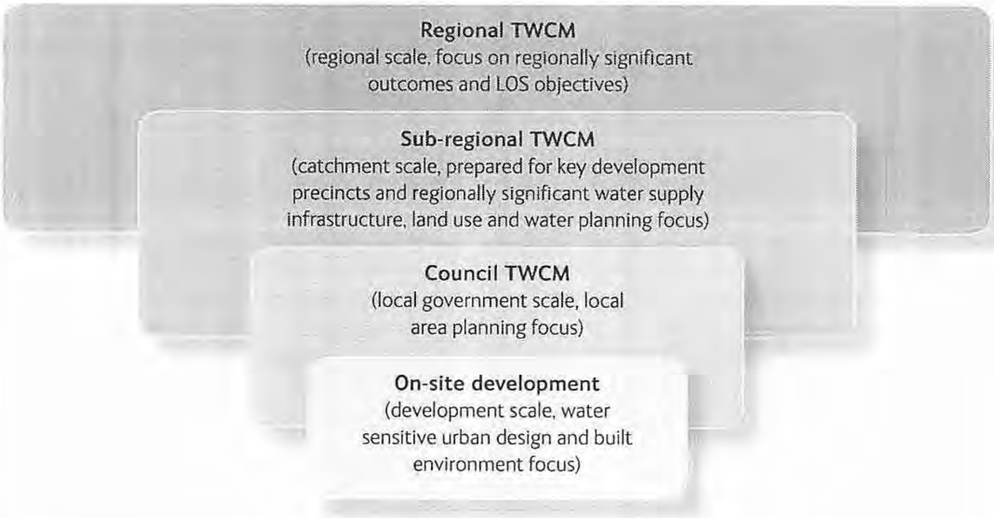

Figure 2.6 Framework for total water cycle management

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Regional scale

The Queensland Government is responsible for overarching water management in SEQ. This responsibility involves a range of regional policies and initiatives, including the *South East Queensland Regional Plan*, the Strategy and the *South East Queensland Healthy Waterways Strategy 2007-2012*. These policies and initiatives are reviewed on a regular basis.

Sub-regional scale

Sub-regional total water cycle plans will be prepared for key development precincts, and where regionally significant water supply infrastructure is located. The purpose of these plans is to integrate land use planning with planning for waterway health and urban and rural supply purposes.

Sub-regional total water cycle plans will be led by the QWC, in conjunction with the local distributor-retailer entity and local governments.

The plans will build on and integrate existing processes undertaken by a range of entities. The key processes are:

- water resource planning, led by the Department of Environment and Resource Management
- specification of environmental values and water quality objectives, led by the Department of Environment and Resource Management
- water supply planning, led by the QWC
- drinking water catchment protection, led by councils and Seqwater
- recycled and wastewater infrastructure planning, led by councils and the distributor-retailers
- overland flow and flood management, led by the Department of Environment and Resource Management and local governments
- land use planning and development assessment, led by the Department of Infrastructure and Planning and local governments
- rural community planning, led by the Department of Infrastructure and Planning and the Department of Employment, Economic Development and Innovation.

The plans will include key decisions about the scope of possible future purified recycled water schemes, local recycling for non-potable uses, development controls to protect water quality, and stormwater capture and use. The plans could lead to the imposition of requirements on the way in which development is delivered and on any local supply solutions, in order to achieve optimal overall outcomes.

The outcomes from sub-regional total water cycle planning will be recommended for inclusion into the Regional Water Security Program. The Program will list key infrastructure and outcomes that should be incorporated into planning schemes and supporting documents.

Local governments will continue to have a controlling influence over local water cycle management through the preparation of planning instruments such as priority infrastructure plans.

The QWC is finalising a sub-regional water cycle plan for key development areas located within the boundaries of the Logan City Council and Scenic Rim Regional Council. This plan is being undertaken in partnership with the two councils, the SEQ Healthy Waterways Partnership and relevant Queensland Government agencies. Water-related issues affecting the area, include:

- providing water supplies for existing and new land uses, including for rural production
- managing sewage and stormwater discharges from existing and new developments
- protecting water supply catchments.

The plan will assess local supply solutions, as addressed in Section 4.6 of the Strategy. It will also consider opportunities to minimise the cost of, and energy used by, water cycle infrastructure. These issues are not council area specific and involve a number of entities. Some need to be resolved quickly to enable urban development to proceed, while others are associated with the operation and health of the Logan River system and require a long-term commitment to improving the management of resource and catchment issues within that system.

Future plans will be prepared in the short term for the key development and identified growth areas within the Moreton Bay region, Caloundra South and Palmview within the Sunshine Coast region and Ripley Valley within the Ipswich region. Other sub-regional plans will be prepared for key development and growth areas within the Regional Plan on a progressive basis.

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Council scale

Under the *Environmental Protection (Water) Policy 2009*, local governments are required to develop total water cycle management plans that will guide their operating principles and decision making at the local level. Council total water cycle management plans must be developed in accordance with the guidelines being prepared by the Department of Environment and Resource Management. They will generally include provisions for integrating urban water services, including water supply, sewerage, trade waste and stormwater management. Among other things, they will address harvesting of rainwater and stormwater, wastewater recycling and water-sensitive urban design.

Council total water cycle management plans generally cover a larger spatial area than sub-regional total water cycle plans and will provide a higher level of detail to guide decision making for future planning.

On-site scale

At the on-site scale, development should comply with the planning framework outlined above and other requirements, such as the Queensland Development Code and state planning policies.

In recent years, some local governments in SEQ have incorporated water-sensitive urban design into these requirements, often in partnership with developers.

Water-sensitive urban design is a planning and design approach that integrates water cycle planning management into the built form of houses, allotments, streets, suburbs and master-planned communities. Among other things, water-sensitive urban design seeks to avoid or minimise the impacts of development by:

- protecting and enhancing the intrinsic values of the natural water cycle by minimising disturbance to natural landforms, wetlands, watercourses and riparian zones
- protecting surface and groundwater quality
- reducing downstream flooding and drainage impacts on aquatic ecosystems by managing stormwater run-off and peak flows
- promoting more efficient use of water by providing access to alternative local supplies of water, such as recycled water or stormwater
- minimising wastewater generation and ensuring treatment of wastewater to a standard suitable for wastewater reuse or release to receiving waters
- controlling soil erosion during construction and operational phases
- providing localised water supply solutions.

These initiatives complement Regional Plan requirements. The *Regional Plan Implementation Guideline Number 7* specifies design objectives for best practice urban stormwater management and describes how they should be adopted. The design objectives address three components of urban stormwater that affect water quality and waterway health:

- frequency of urban stormwater flows
- magnitude and duration of urban stormwater flows
- loads of sediment, nutrients and litter in urban stormwater.

The *Water Sensitive Urban Design Technical Design Guidelines for South East Queensland* describe appropriate methods for the detailed design of some common structural stormwater management measures.

2.4 The challenges we face

The Strategy seeks to ensure that SEQ has a safe and secure water supply. The social and economic consequences of an unreliable water supply or a failure of supply are unacceptable.

In providing this security, a balance needs to be struck between the outcomes sought by various stakeholders, which are not always well aligned. Some examples include:

- providing sufficient regional water security while minimising social, environmental and economic impacts
- providing sufficient water without over-capitalising on excess supply capacity
- improving water use efficiency while maintaining adequate supplies to support the SEQ community's lifestyle expectations

- providing improved access to water supplies for rural production while maintaining user-pays principles
- ensuring that the recommended infrastructure programs are sufficiently flexible to respond to uncertainty and, in particular, climatic risk.

Figure 2.7 illustrates the key considerations that have been taken into account in preparing the Strategy and the broad outcomes sought. The Strategy must specifically address the following key challenges.

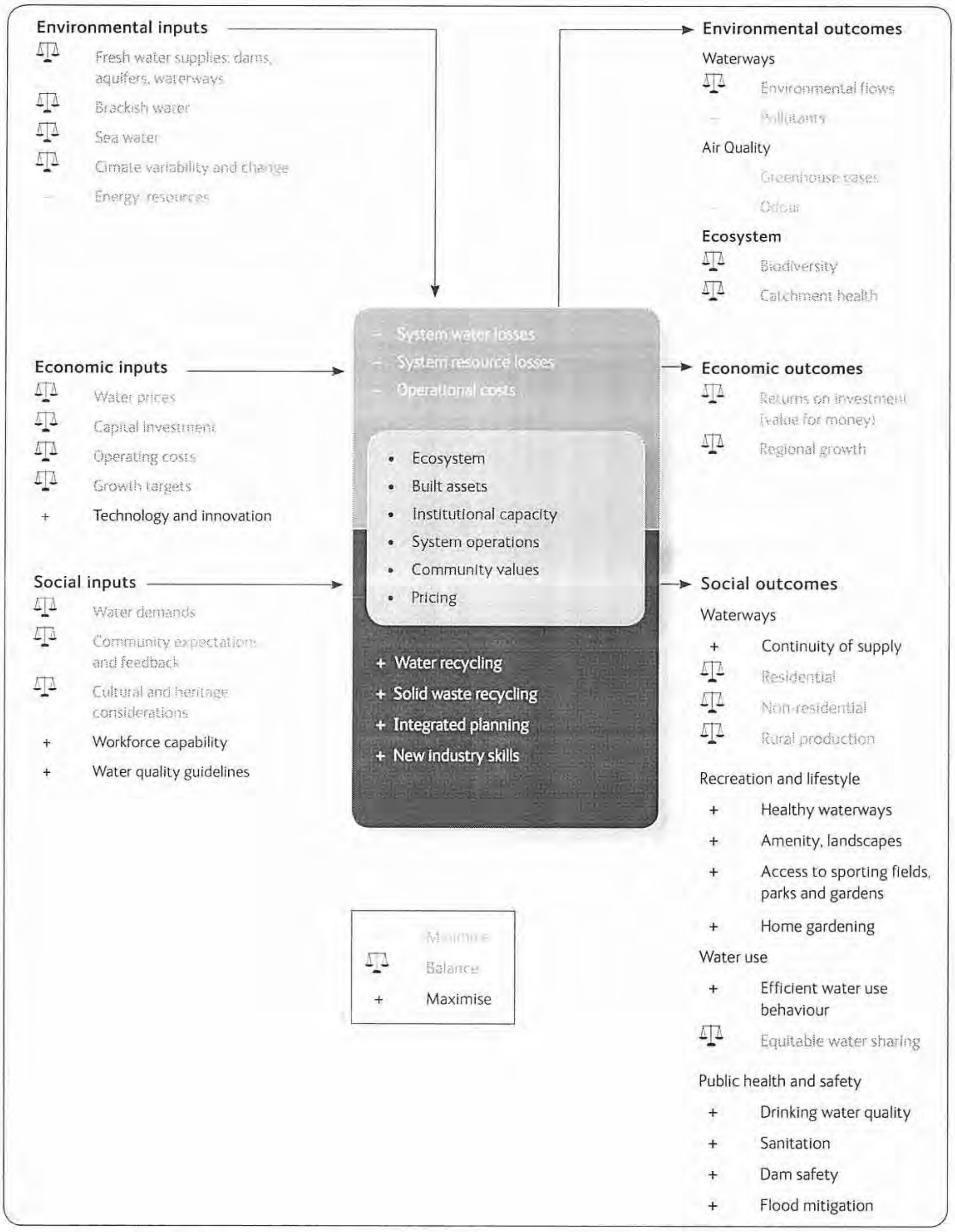

Figure 2.7 Key considerations and outcomes sought in preparing the Strategy

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2.4.1 Population growth and demand trends

SEQ is forecast to continue to grow (refer to Table 2.1). Given the past trends, the Strategy has been prepared on the basis that future population growth in SEQ will trend between the medium and high series projections. Based on a high series projection, the population of SEQ could surpass six million people by 2051.

If SEQ residents were to return to pre-drought water usage of nearly 300 litres per person per day, regional water demand would double within the next 30 years, based on high series population forecasts. However, the community's response to the current drought has demonstrated that implementing simple behavioural changes, supported by basic water efficiency devices, can result in substantial water savings—reducing and deferring the need for additional infrastructure.

Table 2.1 Medium and high population projection series

Year	Population	
	Baseline	
2008[1]	3 043 100	
	Medium series	**High series**
2011	3 214 700	3 290 300
2016	3 567 100	3 737 200
2021	3 898 100	4 179 900
2026	4 204 700	4 609 300
2031	4 495 700	5 024 200
2051[2]	5 492 200	6 636 200
2056[3]	5 696 300	7 014 700

1 Includes Toowoomba and Cooloola

2 Sourced from the Planning Information and Forecasting Unit (PIFU), Department of Infrastructure and Planning. SEQ forecasts from 2006 to 2051; Queensland's future population 2008 edition (2008)

3 SEQ forecasts 2051 to 2056: PIFU consultancy (2008) for all local governments but Toowoomba and extrapolation for Toowoomba; and Cooloola: Queensland's future population 2006 edition (2006)

2.4.2 Climate variability and change

The more we learn about the climate system, the more we are aware of its unpredictability.

Australian Bureau of Meteorology studies indicate that Queensland's climate is changing, becoming drier and hotter since 1910. Australian Bureau of Meteorology and CSIRO studies also suggest that the region is heading into a period of increased climate variability, potentially with drought occurring more often and for longer periods.

Research on the impact of climate change on inflows has been undertaken for the catchment areas in the western parts of SEQ, including Wivenhoe and Somerset dams. Case studies involving a number of global climate models and higher resolution regional climate models indicate a range of possible climate change outcomes by 2030. Mean temperatures in the western parts of SEQ could increase by between 0.8°C and 1.2°C, evaporation could increase by 2 per cent to 8 per cent, and annual rainfall could reduce by 5 per cent or increase by 20 per cent. The annual stream flow for the Brisbane River downstream of Mt Crosby Weir could be reduced by up to 28 per cent in a dry scenario or increased by up to 14 per cent in a wet scenario.

Even small changes in climate could have significant impacts for water security. Figure 2.8 shows the historical record for rainfall and combined inflows for two key storages in the SEQ region. It illustrates that, from the start of the Federation Drought through to the early 1950s, average rainfall was only slightly lower than during the second half of the century. However, inflows were, on average, substantially lower in the first half of the twentieth century than the second. This demonstrates the significant impacts of slight changes in rainfall on catchment wetting and drying and the effect of patterns of rainfall within a year, particularly the intensity of rainfall leading to run-off.

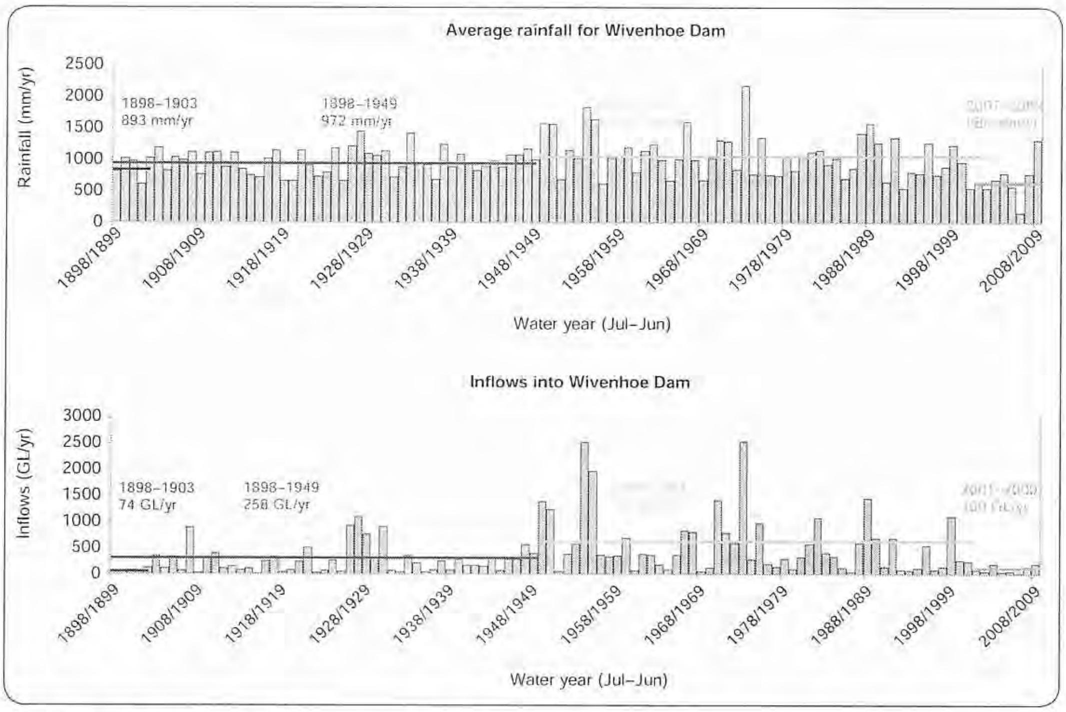

Figure 2.8 Rainfall and inflows into Wivenhoe Dam

Note: Average rainfall is the mean rainfall from the Wivenhoe and Somerset rain gauges.

Considerably more analysis is necessary to improve our understanding of climate change impacts, with the impacts expected to be highly variable across the region. Such work is being done by the Queensland Government Climate Change Centre of Excellence and the SEQ Urban Water Security Research Alliance.

The challenge is to ensure that water security planning accommodates drought impacts and maintains sufficient flexibility to adapt as climate change science improves. This is particularly important in SEQ, given our current high reliance on surface water supplies. The challenge for the SEQ community is to recognise that our regional water supply planning will continue to evolve as our understanding of climate change science improves.

The Federation and Millennium droughts

From 2001 to 2009, SEQ experienced the worst drought in the region's recorded history in terms of both length and reduced run-off: the Millennium Drought. On 20 May 2009, Wivenhoe, Somerset and North Pine Dams reached 60 per cent of their combined capacity, signalling an end to the water security crisis for SEQ.

Until the Millennium Drought, the Federation Drought was the worst drought in Australia's recorded history. Figure 2.9 illustrates the difference between the accumulated rainfall deficits across the catchment area to the west of Brisbane during the Millennium and Federation droughts. Accumulated rainfall deficit is the difference between rainfall over the drought period and average rainfall.

SEQ suffered the Federation Drought for five years from 1898 to 1903. At its worst, the accumulated rainfall deficit reached 1278 mm.

In comparison, the SEQ Millennium Drought ran for nearly eight years from 2001 to 2009. The maximum accumulated deficit during the period was 1530 mm.

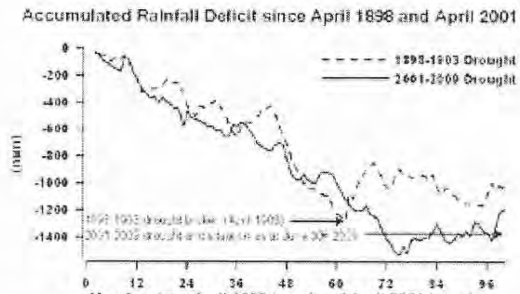

Figure 2.9 Accumulated rainfall deficit for the Federation and Millennium droughts

Source: Prepared by the Queensland Climate Change Centre for Excellence, July 2009

The El Niño-Southern Oscillation

The El Niño-Southern Oscillation (ENSO) phenomenon was a major contributor to the Millennium Drought, with El Niño events in 2002–03, 2004–05 and 2006–07.

ENSO is a global phenomenon that has a strong impact on Australian rainfall, particularly summer rainfall in Queensland. ENSO involves interplay between the ocean and atmosphere, which sets up a see-saw-like fluctuation in air pressure and sea surface temperature across the eastern and western Pacific. One extreme of this fluctuation is known as El Niño and the other extreme as La Niña. The fluctuation tends to lock into one mode (either El Niño or La Niña, or a more neutral mode) for several months—typically from spring through to the end of summer.

El Niño events tend to lead to dry summers in Queensland due to a reduced onshore flow, fewer tropical cyclones (particularly in southern Queensland) and a less active and less extensive monsoon system. Opposite conditions tend to occur during La Niña events.

ENSO has not been the only factor contributing to the dry conditions experienced in SEQ. Rainfall in SEQ is also influenced by both tropical systems from the north and fluctuations in the high-pressure ridge to the south. Interaction of these phenomena throws significant uncertainty around rainfall projections and long-term climate behaviour of the SEQ climate system. As a result, the impact of El Niño or La Niña differs somewhat from one event to the next. Another factor influencing the duration and intensity of drought, and the impact of ENSO, is variability in climate over long cycles. The SEQ Urban Water Security Research Alliance is undertaking research in this area, including a project on the Inter-decadal Pacific Oscillation.

Modified from: The South East Queensland Drought to 2007, Queensland Climate Change Centre of Excellence, 2007.

2.4.3 Efficient operation

The SEQ Water Grid provides the capacity to manage water supply on a regional basis. The challenge is to operate the SEQ Water Grid in a cost-effective and efficient manner for the SEQ community, while still achieving regional water security objectives.

Prior to the establishment of the SEQ Water Grid, the region was supplied as eight largely discrete water supply zones, with differing levels of reliability and, until recently, different owners and operators. Due to the lack of connectivity, restrictions were frequently applied in parts of the region while dams in other parts might have been full or overflowing. For instance, a severe drought was experienced on the Gold Coast in 2002, resulting in the application of severe restrictions and planning for the construction of a pipeline from Brisbane. A few years later, Brisbane was experiencing the most severe drought on record while dams on the Gold Coast were overflowing.

The SEQ Water Grid allows risk to be managed on a regional level, rather than on an individual storage or system basis. It allows optimal location of drought storage reserves and allows water to be moved from areas of surplus to areas that face a shortfall.

Conversely, when dam levels are high, the SEQ Water Grid Manager can reduce operating costs and energy consumption by:

- reducing production from expensive and energy-intensive sources, which are generally the climate resilient water sources
- 'mothballing' or reducing production from small supplies, such as aquifer projects
- altering the rate of transfer through major interconnections
- selling water to irrigators or adjoining areas on an interruptible basis.

2.4.4 Rural water supplies

The Regional Plan identifies around 80 per cent of the region as Regional Landscape and Rural Production Area. A portion of this area comprises protected national and conservation parks, water storages and state forests. However, the majority is privately owned farmland.

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For the rural production sector in SEQ, access to water and the cost of that water has proven to be a major challenge. This challenge has been compounded because:

- there are thirteen sub-catchments in SEQ, which fragment potential water delivery schemes and make movement of water from one area to another difficult and expensive
- rural producers are required to provide increasing levels of certainty to major purchasers, which is difficult to provide without secure water.

These characteristics create a unique set of challenges to be overcome when developing a rural water supply strategy that aims to meet the objectives of the Regional Plan.

With SEQ now out of drought, the QWC can investigate options to increase the availability of water for rural irrigation. These investigations will be a key focus for 2010 and 2011, and are described in Section 6.6.

2.4.5 Potential water supplies

Planning for future bulk water supplies presents several challenges.

Additional bulk water supplies to meet growth might be required in 2021, and most likely not until mid-2020s. However, as the population continues to grow, competition for land is rapidly increasing. Planning for future water infrastructure requires site investigation and preservation well ahead of future need. Sufficient land must be preserved for potential future water supply options, including interconnections, with the least possible impact on adjacent communities. Pre-planning can also reduce the time required to construct any new water infrastructure.

All remaining potential bulk water supplies must be investigated in detail, including climate resilient options such as desalination and purified recycled water. There are few sound opportunities for further development of major surface water storages in the region. This is due to the shortage of suitable sites in areas identified by the water resource plans as having reliable water inflows. Groundwater is also almost fully developed, apart from smaller opportunistic extractions.

Rainwater tanks and alternative local supplies must also be investigated in detail. Some of these alternatives have the potential to exceed the minimum savings required under the Queensland Development Code, or to deliver the minimum savings more efficiently. However, they must be compared to other options on a triple bottom line basis. More research is needed to quantify the benefits and costs of these alternatives, and to ensure that they are capable of consistently supplying fit-for-purpose water quality.

Finally, there is a need for a robust and transparent process by which the QWC will prepare advice for the Queensland Government regarding the nature, location and timing of the next augmentation.

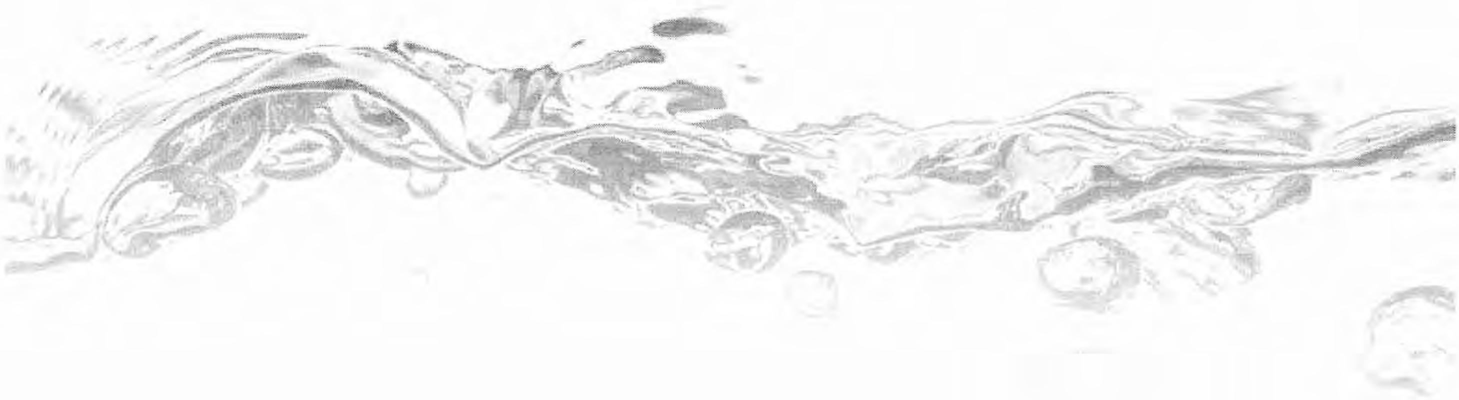
2.4.6 Our environment

SEQ contains some of the most valuable waterways and estuaries in Queensland. These waterways and estuaries are affected by a range of factors associated with human settlement, such as:

- altered environmental flows from water resource development and changes in land uses
- polluted run-off and degradation of riparian zones from urban or rural development
- point source pollution from wastewater treatment plants and industry
- in-stream sand extraction and erosion of river banks
- fishing.

The SEQ Healthy Waterways Partnership publishes an annual Report Card on waterway health. The Report Card demonstrates that these factors have caused degradation to a number of rivers and estuaries, despite some major achievements over the past decade, An increasing population, together with substantial industrial growth, will put more pressure on ecosystem health.

To restore our waterways, new development must be designed to protect water quality and flows, existing uses must be better managed, and degraded areas must be rehabilitated. These challenges highlight the importance of total water cycle management, as explained in Section 2.3. Section 4.6.3 describes some of the direct environmental benefits that can be achieved to reduce nutrients in waterways, through the use of well-planned water recycling.



Chapter 3

Striking the balance —Methodology

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This chapter provides an overview of the planning framework that underpins the Strategy. It explains the approach to water security planning in SEQ, and the Level of Service (LOS) objectives that have been adopted. It also provides an explanation of how the SEQ Water Grid will be operated to achieve the LOS objectives. Finally, the chapter provides an overview of the methodology for demand forecasting and comparing alternative demand and supply options.

Key messages

- LOS objectives provide a basis for planning and managing SEQ's water resources.
- LOS objectives include the duration, severity and frequency of water restrictions.
- The Strategy aims to achieve the LOS objectives for all communities with reticulated water supplies in SEQ. See Section 3.1.1 for the full list of LOS objectives.
- The potential impact of climate change has been analysed assuming an immediate 10 per cent decrease in the yield from dams and weirs.
- A drought response plan will be developed. The plan will require the introduction of Medium Level Restrictions and the construction of new climate resilient or climate independent water supplies, such as desalination plants, as necessary.

3.1 Urban water supply planning underpinning the Strategy

The SEQ Water Grid is an interconnected system of dams and weirs, groundwater, desalination and purified recycled water. Through optimal operations, the SEQ Water Grid provides a secure water supply. While the region will continue to have a high reliance on its surface water storages, the ability to introduce climate independent water into the system and draw on a variety of sources significantly improves the security of supply.

The Strategy adopts an analytical technique based on the LOS objectives approach, originally published by the Water Services Association of Australia in June 2005. This approach is reflected in the *Water Act 2000*, which requires the QWC to provide advice based on desired LOS objectives.

The LOS approach is intended to ensure that the community has a safe and reliable water supply, and that this is communicated to consumers. Water supply planning achieves this purpose in three ways:

1. The system has the capacity to maintain an adequate level of water supply over most periods in the long term.
2. When droughts occur, a drought response plan protects against water shortages through the planned implementation of Medium Level Restrictions and the construction of new climate resilient or climate independent supplies, such as desalination, as necessary.
3. In cases of extreme drought or critical water shortage, a contingency or emergency plan ensures that basic water needs for a community can be met for the duration of that situation.

The LOS approach involves:

- stochastically[1] generating longer time sequences of hydrologic data that have similar statistical characteristics to that of the historical record—this provides better information about climate variability and the potential for droughts worse than have occurred on record
- analysing climate models to assess potential reductions in surface water availability due to climate change
- reducing demand through cost-effective measures
- planning for future droughts as a core element of the planning process
- defining a yield for the SEQ Water Grid as a whole, such that water can be supplied at the specified LOS objectives.

[1] A stochastic model is a tool for estimating probability distributions of potential outcomes by allowing for random variation in one or more inputs over time. The random variation is usually based on fluctuations observed in historical data for a selected period using standard time-series techniques. For our model, the historical record was used to generate 1000 replicates of data with each replicate representing more than 100 years of inflow data

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3.1.1 Level of Service objectives

LOS objectives provide a basis for establishing a secure water supply. The objectives define:

- the desirable maximum frequency, duration and severity of water restrictions
- the average amount of water per capita that must be supplied in normal times.

The objectives are used to determine the volume of water that can be supplied from the SEQ Water Grid, on average, every year—this is the LOS system yield. The LOS system yield is used, together with the projected demands, to ensure that supply and demand initiatives are put in place to meet future water needs.

When the LOS system yield exceeds demand, there is a lower likelihood of triggering restrictions than is specified in the LOS objectives. When demand exceeds the LOS system yield, there is a higher likelihood that restrictions will be triggered.

LOS objectives should reflect community expectations about water restrictions and the community's willingness to pay for improved security of supply. The LOS approach acknowledges that future severe droughts will occur, and that water restrictions are an effective and efficient way of managing the impact of these droughts—but restrictions can have a significant impact on the community. The LOS objectives make clear the assumptions made by water supply planners, and will inform investment decisions by the community.

The LOS objectives for SEQ have been developed on the basis that, in order to maintain a comfortable lifestyle, the community would prefer to use Permanent Water Conservation Measures coupled with Medium Level Restrictions in times of drought. In normal times, this means that water will be used wisely. In periods of drought, Medium Level Restrictions will be introduced early enough and at such a level that they avoid negative impacts on community amenity and the regional economy. For instance, in future droughts, it is expected that restrictions would not require a ban on handheld hosing and water-efficient sprinklers.

The LOS objectives are listed below. The objectives will be targeted across all SEQ communities with reticulated drinking water supplies.

Level of Service objectives

- During normal operating mode, sufficient water will be available from the SEQ Water Grid to meet an average regional urban demand of 375 litres per person per day (including residential, non-residential and system losses).
- Sufficient investment in the water supply system will occur so that:
  - Medium Level Restrictions will not occur more than once every 25 years, on average
  - Medium Level Restrictions will only reduce consumption by 15 per cent below the total consumption volume in normal operating mode
  - drought response infrastructure will be not be required to be built more than once every 100 years, on average
  - combined regional storage reserves do not decline to 10 per cent of capacity more than once every 1000 years, on average
  - regional water storages do not reach 5 per cent of combined storage capacity
  - Wivenhoe, Hinze and Baroon Pocket dams do not reach minimum operating levels.
- It is expected that Medium Level Restrictions will last longer than six months, no more than once every 50 years on average.

On the basis of the LOS objectives, the community can expect to experience water restrictions no more than once every 25 years, on average. Such restrictions would reduce regional urban demand by an average of 15 per cent, across the entire community. In setting future Medium Level Restrictions, the QWC will consider the likely impact of the measures, community preference and the existing level of efficiency for residential and non-residential customers. Once business and industry have implemented best practice water efficiency, it is likely that additional savings will be made by the residential sector curtailing outdoor use. The QWC expects that residential consumption may be curtailed to a regional average of about 185 litres per person per day.

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The QWC considers that these objectives represent appropriate planning assumptions, given the current variation in consumption across SEQ and the high level of uncertainty regarding population growth, impacts of climate change and a range of other factors. In particular, the QWC recognises the risk that consumption may rebound over a relatively short period of time, compared to the time required to plan and construct new sources of supply.

The LOS objectives will be reviewed as part of future reviews of the Strategy, taking into account a range of factors including the level of residential water use and community acceptance of continued water efficiency measures. For example, the QWC would consider reducing the overall demand planning assumption if average regional urban consumption remains significantly below 375 litres per person per day and community acceptance of continued water efficiency measures remains strong. An annual performance review of the Strategy provides the opportunity to review the overall demand planning assumption.

The planning assumptions are discussed in more detail in Section 4.3.

Establishing the LOS objectives has involved trade-offs between financial costs, environmental impacts and the willingness of the community to accept restrictions on a periodic basis. Information gained from managing the Millennium Drought has been used in the formulation of the LOS objectives. The experience of managing regional water security during the Millennium Drought has provided useful evidence about practical issues and community expectations. Feedback on the draft Strategy indicated that residents of SEQ generally support ongoing water efficiency measures and planning to ensure that water supplies are secure during extreme droughts.

3.1.2 Drought response planning

A drought response plan is required to achieve the LOS objectives. The purpose of the drought response plan is to ensure continuity of supply regardless of climatic conditions or failures of the water supply system.

The drought response plan will contain the pre-determined response to droughts, including trigger levels for implementing and exiting water restrictions, water efficiency measures and construction of new climate resilient water supplies. The drought response plan will also include the introduction of purified recycled water to Wivenhoe Dam to supplement drinking water supplies. If Medium Level Restrictions and purified recycled water are introduced and the combined regional storage levels continue to decline, then the construction of projects identified in the drought response plan will be triggered. The trigger points for various aspects of the drought response plan are discussed in the following sections, together with the size and placement of the drought storage reserves.

Preparation for the construction of infrastructure in response to a drought will commence no later than when restrictions commence. However, it may be prudent to commence preparation for construction in advance of the commencement of restrictions, depending on the time of year, the rate of decline of regional storages and the level of preparedness of alternative options under the drought response plan.

The construction of drought response infrastructure is expected to occur not more than once every 100 years on average. Once constructed, this infrastructure will become part of the permanent water supply arrangements and would delay the need for future planned augmentations of the system.

While the drought response plan projects will be completed within a nominal period of 30 months, the water restrictions will only be lifted if:

- the drought conditions ease—that is, following one or more major rainfall events resulting in significant inflows,
  or
- the commencement of construction of additional pre-planned infrastructure that increases the volume of climate resilient or climate independent water supplies is brought forward.

The drought response plan will also contain contingency or emergency measures to manage extreme risk events, such as if one of the drought response projects is delayed or an extremely poor inflow sequence occurs. The measures will reflect the circumstances of the event, and may only be determined when Medium Level Restrictions have been introduced. One option is the introduction of a second tier of water restrictions—emergency restictions. Such restrictions would involve reducing average regional residential consumption to 140 litres per person per day. This is equivalent to approximately 25 per cent reduction from the planning assumption of a regional urban consumption of 375 litres per person per day under normal operating mode. For comparison, during the most critical water supply period of the Millennium Drought, residents in the restricted area of SEQ used an average of 129 litres per person per day. The likelihood that

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emergency measures such as these would need to be implemented is sufficiently low that it is not considered appropriate to warrant their inclusion as an LOS objective, but rather to embed them in the drought response plan as emergency restrictions.

3.1.3 SEQ Water Grid operations

The Strategy partitions the water storage compartment in SEQ dams both individually and as a combined total SEQ system into:

- working volume
- drought storage reserve
- minimum security volume
- minimum operating volume (dead storage).

Figure 3.1 illustrates the partitioning of the water storage compartment of the region's dams. These partitions apply both to individual dams and across the SEQ Water Grid as a whole. Many individual dams are also constructed with a flood storage compartment that sits above the water storage compartment.

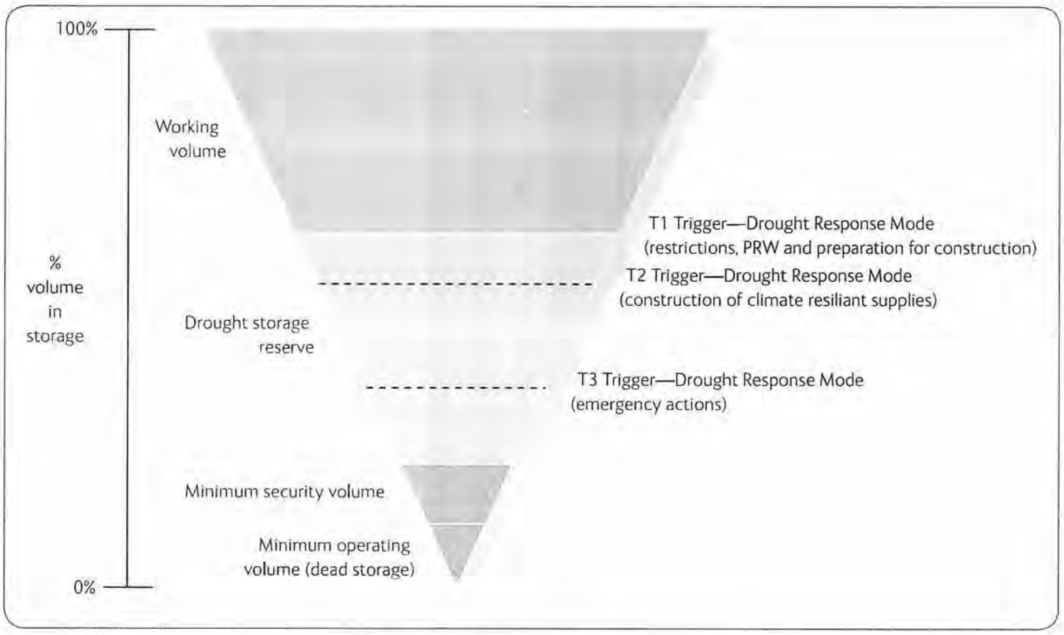

Figure 3.1 Partitioning of key SEQ Water Grid storages

The normal operating mode applies when the SEQ Water Grid is within the working volume. This mode will apply over most periods in the long term, consistent with the LOS objectives.

Below the working volume is the drought storage reserve. The combined SEQ Water Grid drought storage reserve underpins the drought response plan. The drought storage reserve is sized to provide, in conjunction with climate resilient sources, a minimum of 36 months' supply of water at a restricted demand. The actual volume of the drought storage reserve will vary over time according to the mix of supplies and the demand for water.

Calculation of the drought storage reserve requires consideration of:

- the restricted demand
- climate resilient dam inflows
- system losses, including evaporation and transport losses
- access to climate resilient and climate independent supplies, such as purified recycled water and desalination.

The drought storage reserve will only be held in the dams included in the definition of the key Water Grid storages.

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Section 5 lists the region's surface water supplies. The following supplies are included in the definition of key SEQ Water Grid storages used to calculate the critical triggers—Baroon Pocket Dam, Ewen Maddock Dam, Cooloolabin Dam, Wappa Dam, Lake McDonald, Somerset Dam, Wivenhoe Dam, North Pine Dam, Lake Kurwongbah, Leslie Harrison Dam, Hinze Dam and Little Nerang Dam. This list includes all storages in SEQ owned by Seqwater, but excludes:

- weirs and off-stream storages that are too small to contain significant drought storage reserves
- storages that predominantly supply rural users, since these will not be required to be operated in accordance with the urban storage rules
- storages that supply a community that has no existing or committed SEQ Water Grid connection.

It is noted that drought storage reserves may still be specified for some of the predominately rural dams. For example, Moogerah Dam will include a volume to ensure security of supply for Boonah and connected towns. However, these reserves will be based on local considerations, rather than on the methodology outlined below.

At this time, the partitioning of individual dams defined as key Water Grid storages will be the same as the partitioning of the overall SEQ Water Grid. That is, the working volume of each dam will be between 40 per cent and 100 per cent of storage capacity. This partitioning may be reviewed over time, once the operation of the SEQ Water Grid has been refined.

The SEQ System Operating Plan describes the rules for operation of the SEQ Water Grid. These rules will influence the take from, and level of, specific dams. The rules establish acceptable levels of short to medium-term risk associated with triggering water restrictions and constructing new climate resilient water supplies. The LOS objectives also provide for the average expected performance of water supply over the long term. The rules balance short-term operational cost and efficiency benefits with maintenance of the long-term security objectives. This is achieved by understanding the real operational risks over shorter timeframes. Importantly, short-term financial gains should not be realised at the expense of long-term water security.

Within the combined SEQ Water Grid drought storage reserve there are three trigger levels:

- T1 is the trigger to enter the drought response mode (preparation phase). It applies when regional storage volumes drop down into the drought storage reserve. Pre-planned Medium Level Restrictions will be introduced and purified recycled water will be added to Wivenhoe Dam at this time. This phase provides time to prepare for construction, in the event of continued drought conditions.
- T2 is the trigger to enter the drought response mode (construction phase). It applies when construction of new climate resilient or climate independent water supplies, such as desalination plants, is required to commence to ensure that the restricted water demands for the community can be met for the duration of a long, severe drought.
- T3 is the trigger to enact emergency measures.

The trigger levels are stated in the SEQ System Operating Plan and will be reflected in the drought response plan.

For the SEQ Water Grid, the risk of drawing down to operationally significant storage levels, such as T1 or T2, will depend on the current storage volume within the system. Larger storage volumes, coupled with the increased opportunity for conjunctive system operation (transfers, desalination, or use of purified recycled water), result in a reasonably long period over which supply can be maintained with below-average inflows without drawing down to these trigger levels. However, operational decisions made when storage volumes are relatively high can still have a significant effect on regional water security (and potential infrastructure expenditure) if extended periods of low inflows are experienced.

Essentially, rules in the SEQ System Operating Plan enable timely modification of system operation to ensure that these risks are maintained within acceptable levels to the extent that is possible.

T1 has been set at 40 per cent of the combined capacity of the key Water Grid storages in SEQ. This aligns with advice to the Queensland Government from the QWC regarding the appropriate trigger to commence the introduction of purified recycled water in Wivenhoe Dam as an emergency source of supply.

T2 has been set at 30 per cent of the combined capacity of the key Water Grid storages in SEQ. This is determined by the need to allow a nominal 30 months for the construction of infrastructure in response to a drought, and by the LOS objective that the frequency of triggering drought response infrastructure will be not more than once every 100 years, on average. If the drought response plan identifies a critical project that requires more than 30 months to implement, then the time and associated trigger point for T2 will need to be reassessed. It is essential that both the T1 and T2 triggers are appropriate for the type and scale of response planned.

T3 will be set in the drought response plan. It is likely to vary depending on factors such as the period of time until drought response infrastructure is completed. It is expected to be set at 20 per cent or less of SEQ Water Grid storage capacity.

All the trigger levels may change over time, as new sources of supply are constructed and demand increases.

The minimum security volume is set at 5 per cent by the LOS objective that regional water storages must not be permitted to reach 5 per cent of combined storage capacity.

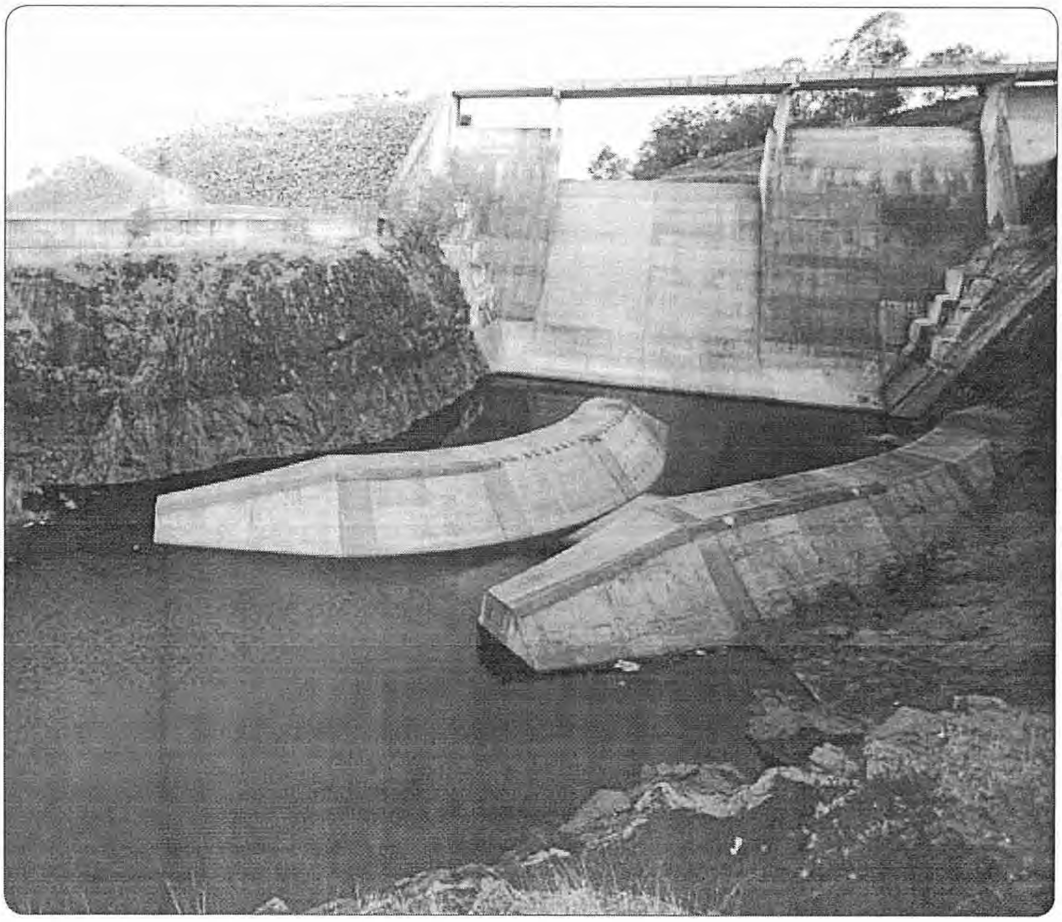
The minimum operating volume for any storage is included in the appropriate resource operations plan and may be referred to as the dead storage level. Water below the minimum operating level cannot be accessed with existing infrastructure.

3.1.4 Drought response exit

To exit the drought response mode, the combined SEQ Water Grid storage levels will need to increase beyond the T1 trigger level. The exit level will need to be set sufficiently above the drought storage reserve to minimise the risk of re-triggering water restrictions within an appropriate period. The actual exit level would be determined following consideration of:

- climate forecasts
- the existing mix of climate dependent and climate resilient supplies
- the status of any infrastructure projects in construction
- current policy on the use of purified recycled water
- short-term limitations on system capacity due to water quality
- managing the risk of use rebounding above consumption targets once the drought response mode is exited.

Ultimately, the capacity above T1 that is selected will need to strike a balance between the cost of staying in drought response mode unnecessarily, and the economic and social cost of moving out too early, and being forced to re-enter shortly after, if dam levels decline back to T1.



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3.1.5 Determining the yield of the SEQ Water Grid

The LOS objectives are performance objectives for the delivery of bulk water supplies from the SEQ Water Grid.

The LOS system yield is the volume of water that can be supplied from the SEQ Water Grid every year and still achieve the LOS objectives. Until recently, estimating the system yield of a suite of integrated sources of supply has been based on an aggregation of yields of individual sources of supply, treated as unconnected. The modelling undertaken for this Strategy incorporates assessments of the LOS yield of specific dam systems and of the SEQ Water Grid as a whole. Future water availability has been estimated following consideration of:

- the LOS objectives
- environmental flow objectives and associated releases needed to maintain riverine, estuarine and marine ecosystem health
- water allocation security objectives
- resource operations plans
- total water storage capacity in the SEQ Water Grid
- inflows to the SEQ Water Grid storages over the period of the historical record
- estimated variability in inflows based on synthetically generated datasets that have the same statistical inflow characteristics as the historical record
- the possible impacts of climate change on inflows
- supply from climate resilient sources
- the volume of the regional drought storage reserve, and its distribution across individual dams.

Under the Strategy, less water is proposed to be used than is permitted under water resource plans and resource operations plans. This is because, in order to achieve the LOS objectives, water must be 'banked' in the wetter periods so that it is available during droughts that may be worse or more frequent than has occurred in the last 100 years. Fully using the available allocation could place the urban community at risk of supply failure during extended drought, especially from droughts worse than those that have been experienced since records were kept.

However, while the LOS system yield of the SEQ Water Grid is less than the sum of the allocations held by the SEQ Water Grid Manager for urban use, it is larger than the sum of the LOS yields of the individual systems.

Using less urban water than permitted under water allocations issued in compliance with water resource plans generally results in dam levels being higher than would otherwise be the case, because additional reserves are held in storage. In turn, this results in an increased likelihood of overflows from dams with associated environmental benefits and higher announced allocations for rural irrigation. The benefits for rural users of this arrangement are described further in Section 6.6.

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For the purposes of water supply planning, modelling focused on the quantity of water. In practice, considerations such as water quality and other physical operational constraints will affect the performance of the SEQ Water Grid. However, these influences, though important in the short-term management of our water supplies, do not significantly impact on the overall LOS system yield of the SEQ Water Grid.

The regional water balance model has informed the development of broad operating rules for the SEQ Water Grid. These rules seek to balance the short-term operational costs and efficiency benefits of SEQ Water Grid operation with long-term water security objectives.

Operating rules for optimal use of the region's urban water supplies will be addressed in the SEQ System Operating Plan (refer to Chapters 5 and 7). Optimising the use of any surplus water supplies might include supplying rural production or transferring water to areas outside of the SEQ region or those areas not covered by the SEQ System Operating Plan. This could include supplying surplus water to the Tweed Shire in northern New South Wales, if appropriate.

3.1.6 Determining the climate resilient yield of the SEQ Water Grid

Some inflows will be received into the region's dams and weirs even in the most severe droughts. These inflows are referred to as climate resilient, as distinct from climate independent water supplies such as desalination. For example, during the most severe period of the Millennium Drought in 2006–2007 35 000 megalitres of inflows was recorded into the Wivenhoe–Somerset system, compared to an average of 615 000 megalitres per year in the preceding twenty years.

Assumptions about the level of climate resilient inflows influence the size of the drought storage reserve as well as the capacity of the climate resilient infrastructure that is constructed as part of the drought response plan. Assumptions must be based on a clear understanding of the risk of future drought inflow sequences occurring.

The 30-month construction period represents a critical component of the drought response plan. The trigger level for commencing construction depends on the assumed level of inflows over this 30-month period. If lower inflows occur during this period than were assumed in calculating the trigger level, then the volume of water in storage will be drawn down to critical levels before contingency infrastructure is completed. This could compromise regional water security. Planning for new infrastructure that might be required can shorten the construction time and is therefore an important part of drought response planning.

Stochastic modelling has been undertaken to determine the severity of potential droughts in SEQ. The modelling shows that SEQ should be prepared for droughts that are significantly worse than what was experienced during the Millennium Drought. However, the likelihood of these extreme events occurring is less than one in 10 000 years, on average.

The sequence used to calculate the climate resilient inflows was 30 months of inflows equivalent to a drought with a severity of between a one in 1000 and one in 10 000 year occurrence. The emergency plan provides a way of responding in the unlikely event that a drought is more severe than this.

3.1.7 Achieving the Level of Service objectives

The LOS objectives are performance objectives for the delivery of bulk water supplies from the SEQ Water Grid.

The statutory instrument for achieving the LOS objectives in SEQ is the SEQ System Operating Plan. The SEQ System Operating Plan specifies rules for how the SEQ Water Grid is operated to achieve the LOS objectives, within the bounds of the resource operations plans. The SEQ System Operating Plan directs how water can be supplied to meet the water needs of urban consumers and any other contracted customers in SEQ. This includes the supply of manufactured water sources, such as purified recycled water.

LOS objectives form part of the product definition for bulk water supplied in accordance with the SEQ System Operating Plan by the SEQ Water Grid Manager to any bulk transport node, ready for local distribution. Figure 3.2 illustrates where the LOS objectives apply under the SEQ institutional arrangements.

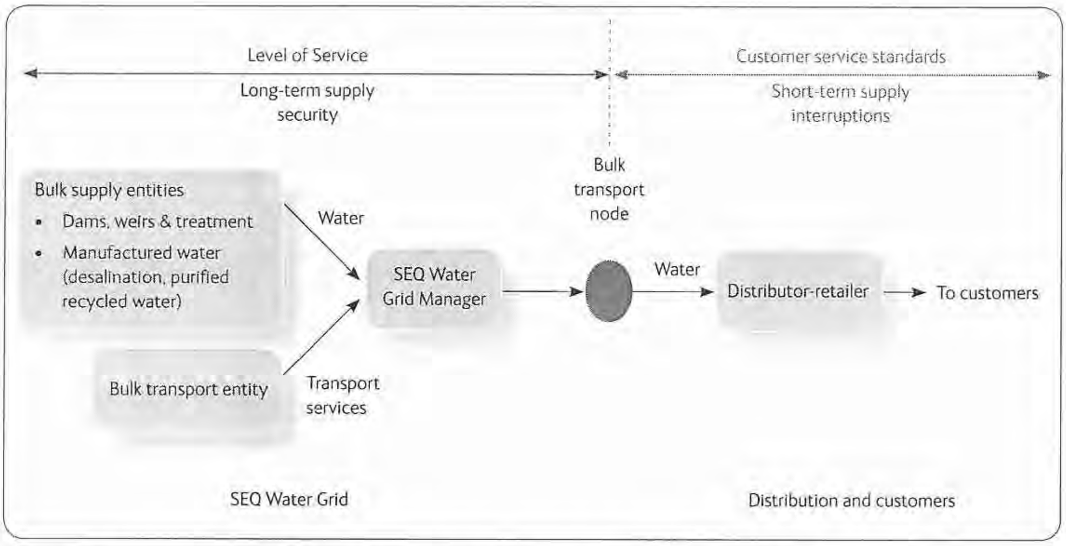

Figure 3.2 Application of LOS objectives and customer service standards

LOS objectives should not be confused with customer service standards. Customer service standards describe the level of service that a customer can reasonably expect from their distributor-retailer—for example, the response time to a breakdown or an interruption to supply. Each distributor-retailer will have the primary interface with customers, particularly through reading meters and issuing water and wastewater bills. Over the next three years, customers will move from local government area customer service standards under the *Water Supply (Safety and Reliability) Act 2008* to a Customer Water and Wastewater Code and regionally consistent service standards, and finally to guaranteed service standards. Customers will have input into the type of guaranteed service standards they want. A distributor-retailer will be required to compensate a customer if a guaranteed service standard is not met.

3.2 Planning for climate change

Climate models are used to forecast possible short- and longer-term climate change and likely impacts. They simulate oceanic and atmospheric processes and the important connections between land, oceans and the atmosphere. A factor affecting the usefulness of the climate models is the resolution, with most global climate models typically using a grid of between 150 and 300 kilometres.

There is considerable uncertainty about the accuracy of climate change projections and this uncertainty increases with the length of the projections made.

Regional climate models have been developed that increase the resolution of global climate models. This process is called 'downscaling' and requires enormous computing power. These models have reduced the uncertainty associated with the low resolution of global climate models. Work is underway to improve climate change estimates in terms of impact on stream flows. As already indicated in Section 2.4.2, case studies indicate that by 2031 the annual stream flow for the Brisbane River downstream of Mt Crosby Weir could be reduced in a dry scenario by up to 28 per cent or increased by up to 14 per cent in a wet scenario. Such impacts are expected to be highly variable across the whole of SEQ. Climate research indicates that, as a conservative estimate, a 10 per cent reduction in surface water availability is likely to occur by 2030.

The majority of climate modelling results for SEQ catchments indicate that the region is likely to become drier, with increases in average temperature and evaporation rates. This suggests that climate change may dramatically impact on regional water supplies. Consequently, less surface water is likely to be available for water catchments and dams. These changes are expected to occur over the medium to long term. This contrasts with Perth, where there is evidence that a change in inflows has already occurred.

More analysis is necessary to improve our understanding of climate change impacts. Such work is being progressed by the Queensland Government Climate Change Centre of Excellence and the CSIRO, through the SEQ Urban Water Security Research Alliance. Over time, this work will downscale the CSIRO global model simulations, and simulations from six other international modelling groups, to a 14 to 20 kilometre resolution for SEQ. It will result in a better integration between the climate change models and hydrologic modelling.

In Chapter 6, a scenario analysis has been undertaken assuming a 10 per cent reduction in the LOS yield of surface storages due to climate change. If there was an immediate climate change impact, the earliest date for supply augmentation could move forward from 2022 to 2017 (refer to Section 6.4.2). However, this impact is likely to occur over decades and the true impacts of climate change are currently difficult to quantify.

The scenarios adopted in the Strategy will be reviewed annually and revised as our understanding of the likely impacts of climate change in SEQ water supplies becomes better informed.

3.3 Planning for rural production

The Strategy includes significant initiatives to improve supply to the rural sector, as discussed in Chapter 6.

Rural water entitlements are defined through the water resource planning processes. In supplemented schemes, rural water allocations are generally specified as medium priority water, with a reliability of supply less than high priority (urban or industrial) water. This approach enables larger volumes of water to be made available during periods when dam levels are high. A significant portion of rural water entitlement exists from unsupplemented supplies—that is, water not supplemented by releases from dams or weirs.

In SEQ, water supply schemes exist in the Mary, Logan, mid-Brisbane, Lockyer and Warrill valleys. These supplemented schemes have historically operated with varying degrees of performance success and irrigators have sought ways to further enhance water security. Irrigators currently do not pay for the full cost of running these schemes. Chapter 6 discusses options to improve the reliability of supply within these schemes.

Additional water for rural use has also been made available due to the construction of the SEQ Water Grid, especially the Western Corridor Recycled Water Scheme. This additional water will be supplied to Category B (refer to Section 5.3.1) customers as an interruptible source. It will be available when the SEQ Water Grid is in normal operating mode, and is intended to cease when a drought response plan is implemented. Chapter 6 contains further information about these opportunities.

3.4 Profiling future demand

The Strategy is based on a comprehensive assessment of current and forecast water demands across SEQ. The methodologies and modelling will continue to be refined to actively monitor demand assumptions.

For this version of the Strategy, forecasting of urban water demands in SEQ has been based on:

- medium series population growth projections derived from the Queensland Government population projections—high series population forecasts have been used for sensitivity testing
- assessment of historical patterns of water use
- assessment of the historical effectiveness of existing and potential water-saving programs, including analysis of the costs and benefits of different water conservation and source substitution options at the end-user level
- aggregation of the forecast demands in each local government area to produce demand trend forecasts based on the continuation of existing policy in 2006—that is, assuming that water use continues into the future without savings from any additional demand management initiatives other than those that were already in place
- aggregation of the forecast demands in each local government area based on high, medium and low savings scenarios. The savings scenarios differ in terms of number and scope of demand management measures.

Population forecasts were revised in 2008, following the release of the first draft Strategy. The population forecasts contained in this Strategy have been adjusted based on these forecasts.

The potential reduction in demand from savings measures was estimated based on a range of complex considerations and assumptions. These included:

- structural water-saving measures implemented during the Millennium Drought
- the effectiveness of potential demand management measures, including participation rates and the number of water-efficient devices installed
- changing demographic patterns—in particular, the trend towards smaller households
- ongoing compliance with rules and regulations.

Demand forecasts are outlined in Chapter 4. Growth in demand for water for rural production is addressed in Chapter 6. To ensure that demand assumptions underpinning the Strategy remain current, ongoing demand monitoring and management will be undertaken using a water accounting framework, known as the Waterhub.

Increasing supply or reducing demand?

Some components of the supply and demand balance could be considered as either increasing supplies or reducing demand. The Strategy defines any new water source that contributes to the SEQ Water Grid as an increase in supply. For example, purified recycled water is considered to increase potable supply as it is added to the SEQ Water Grid. Water from rainwater tanks and other types of recycled water reduces demand on drinking water supplies from the SEQ Water Grid.

3.5 Process to select future supplies

The QWC proposes the use of an objective and transparent process to develop its advice to the Minister about the need for regionally significant augmentations of the SEQ Water Grid. This process is intended to:

- ensure the timely delivery of capital expenditure
- promote total water cycle planning
- provide an opportunity for parties other than the QWC to nominate innovative solutions for consideration
- ensure that options are compared on an objective, transparent and like basis, regardless of scale or type
- ensure that market participants receive information in a structured and equitable manner.

The process will consider demand and supply options, and options at a number of different scales. It will build on the detailed investigations outlined in Chapter 7, while also providing opportunities for the community and stakeholders to have input. The process may also provide opportunities for third parties to propose alternative solutions for assessment.

The key elements of the process will be:

- review of the Strategy
- a Statement of Needs
- a project selection process
- advice to the Minister on regional water security options.

The proposed process is illustrated in Figure 3.3.

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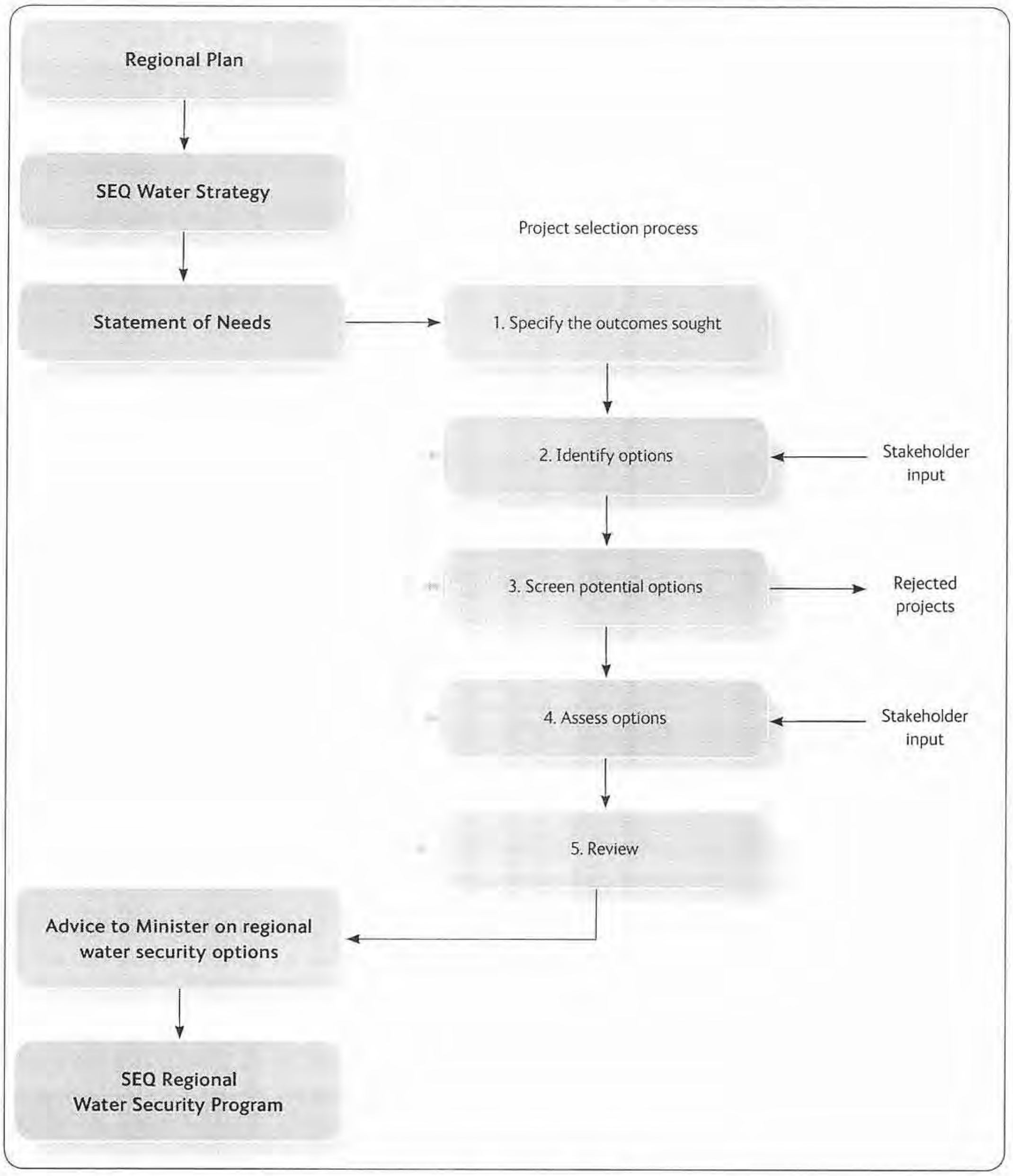

Figure 3.3 Statement of Needs and proposed project selection process

This process applies to development of new regionally significant projects only. Regionally significant projects generally involve expansion of the capability of the SEQ Water Grid to ensure that the LOS objectives can be achieved throughout the region, while operating in accordance with all relevant legislation.

Water service providers will undertake a range of other projects that are planned and regulated through separate processes. This includes projects such as renewal of existing infrastructure, the construction of new infrastructure for local needs, or improvements to the efficiency of service delivery. In some locations, planning for this infrastructure may be informed by a total water cycle plan, as explained in Section 2.3.

3.5.1 Review of the Strategy

The QWC will coordinate the review of the Strategy at appropriate times. The Strategy will be reviewed on a five-year cycle aligned with the review of the Regional Plan. Demand will be monitored as part of the assessment of the water balance, which will be reported on annually (refer to Section 7.1.2), and could result in a review of the Strategy being undertaken earlier.

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3.5.2 Statement of Needs

Following the Strategy review, the QWC will prepare and publish a Statement of Needs that will clearly describe strategic requirements over the short to medium term. The Statement of Needs may identify the following types of regionally significant needs:

- an improvement to water quality within the region, such as feed water or treated water quality
- an augmentation of the water supply system, including broad identification of the scale and location of the augmentation
  or
- an improvement to system performance, such as the coverage of the SEQ Water Grid or the degree of interconnectedness.

The Statement of Needs may also include reference to institutional arrangements required to facilitate regional water security.

The Statement of Needs will be developed on the basis of the Strategy, including the water balance models that underpin it, and input from the SEQ Water Grid Manager and the water entities.

The QWC will seek endorsement of the Statement of Needs by the Queensland Government, to ensure it is aligned with current policies and strategies for SEQ.

3.5.3 Project selection process

In undertaking the project selection process (shown in Figure 3.3), the QWC will seek input to the process from professionals with appropriate expertise, as well as from a stakeholder reference group. This group will be established from key community and government stakeholders in SEQ who are likely to have an interest in the outcomes sought.

The assessment of projects will be based on the incremental benefits they could provide for the SEQ Water Grid as a whole. For example, an assessment could consider the benefits of increasing the operating level of Wivenhoe Dam in terms of the yield of the SEQ Water Grid as a whole, rather than the yield of the dam operating on a stand-alone basis.

3.5.4 Advice on regional water security options

The QWC is required to provide advice to the Minister on regional water security options. The advice must address the following issues:

- the desired LOS objectives
- demand management for the region
- water supply or sewerage works for achieving the desired Level of Service objectives
- an assessment of the likely costs and pricing implications of the works
- the preferred ways of sharing the cost of the works.

After completing the options selection process, the QWC will provide advice to the Minister on the outcomes sought, options considered and the recommended projects to be adopted in the Regional Water Security Program.

3.6 Potential portfolio

For this Strategy, a long-term water balance was constructed for the entire SEQ region and for the northern, central and southern sub-regions. This water balance was prepared on the basis of:

- projected regional demands
- the LOS objectives described earlier in Section 3.1.1
- purified recycled water being used to supplement supplies in Wivenhoe Dam when SEQ Water Grid storage levels fall to 40 per cent of capacity.

The water balance was used to identify approximately when and where supply gaps would occur in the future on a whole-of-grid basis. This preliminary assessment was conducted for the case of medium series growth, with ongoing demand management embedded. Further work will be required considering sub-regional and local needs when the Statement of Needs is produced.

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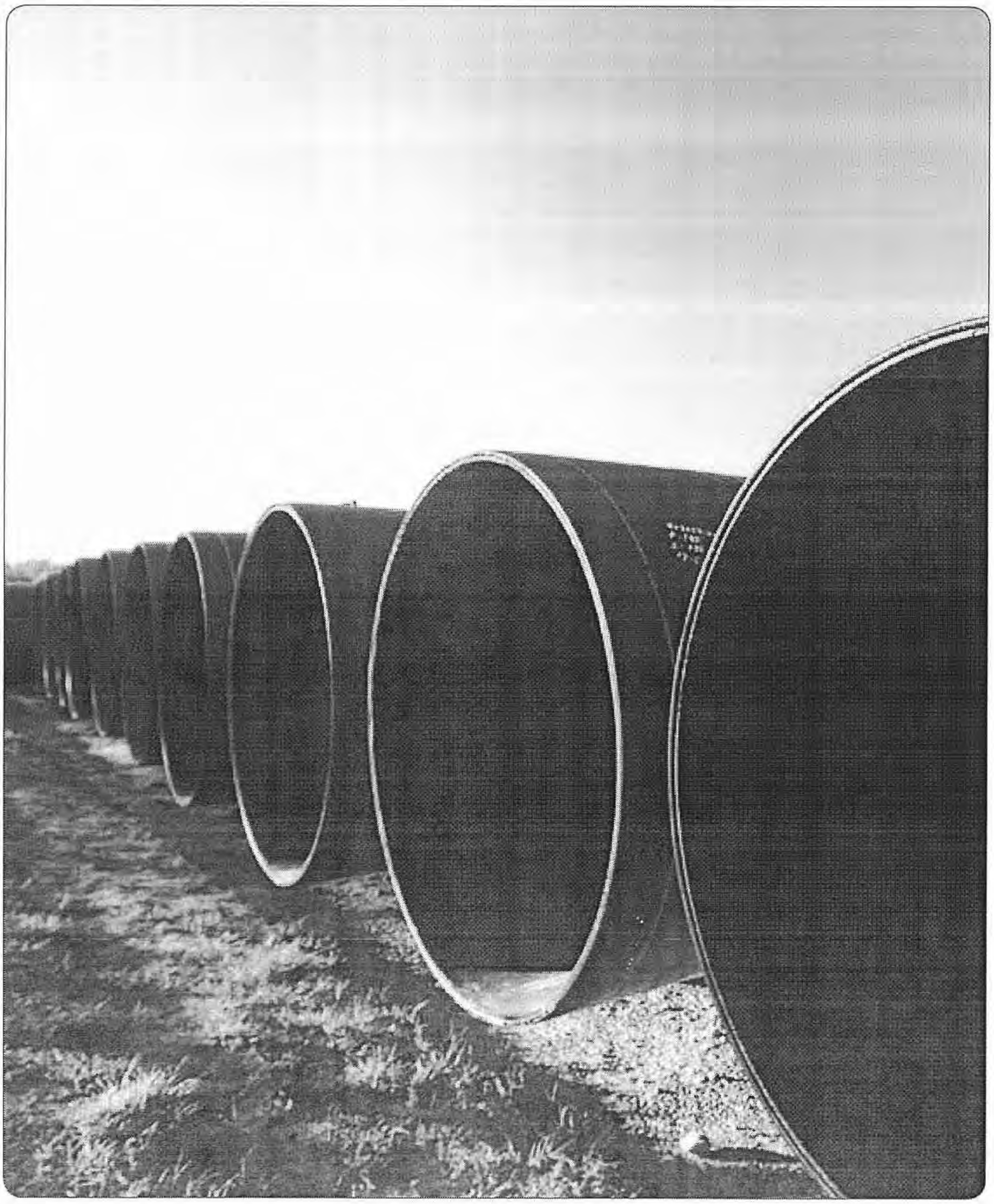
Current and potential water supply sources are described in Chapter 5. As noted above, these projects will provide the base case supply solutions against which any alternatives can be assessed following the Statement of Needs process.

Chapter 6 includes a number of potential portfolios based on these projects. These portfolios demonstrate that the potential sources are sufficient to ensure a secure water supply for SEQ to 2056 and to indicate the potential portfolio of future supplies based on currently identified sources and technologies. The portfolios do not pre-empt or pre-judge the outcomes of the selection process outlined above.

A potential base case portfolio was identified to be the medium series base case portfolio for the region. Building on this, a second portfolio was identified that could be used to fill the supply gap if high series demands emerge. A range of sensitivity analyses were conducted to understand the impact of key assumptions on the possible timing and scale of infrastructure that might constitute the future portfolio of projects.

The base case portfolio will be used to assist in the development of the region's drought response plan and as a standard for comparing future water supply options on either a bulk or local scale within the region. The base case portfolio will be reviewed and updated over time, utilising the assessment methodology as required.



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Chapter 4

SEQ's future water demand

This chapter discusses water consumption trends as well as initiatives and projects being implemented to reduce water demand and increase efficiency of use. It also describes demand management strategies to support the LOS objectives for water supplies during normal times.

Key messages

- All sectors of the community should use water efficiently.
- A wide range of demand management programs have been implemented.
- The Strategy is based on maintaining demand for SEQ Water Grid water at least 24 per cent below pre-drought trends. By 2056, this will save about 241 000 megalitres per year based on medium series population growth.
- A conservative planning assumption of a maximum average regional urban consumption of 375 litres per person per day of SEQ Water Grid water underpins the Strategy. In 2004–05, average consumption was about 450 litres per person per day.
- Planning assumptions will be reviewed on a regular basis.
- Large non-residential water users, including business and industry, will be required to continue to keep moving towards best practice water efficiency.
- Businesses with reasonable access to the Western Corridor Recycled Water Scheme will be encouraged to use recycled water.
- Power stations will be required to use recycled water rather than other supplies when using water from the SEQ Water Grid.
- All building development applications lodged for the construction of new homes in SEQ must meet mandatory water savings targets. Internally plumbed rainwater tanks are one option to achieve the water savings target.
- Rainwater tanks and stormwater harvesting in new developments are forecast to reduce demand on bulk water supplies by about 7 per cent by 2056.

The demand management program that will support the achievement of the LOS objectives for water supply in normal operating mode is described in Section 6.1.

Water demand information

Water accounting data for the Strategy has been collected at a billing level from the 10 local government authorities listed in Section 1.1. Demand analyses were conducted on a local and regional basis, historically and out to 2056. Demand has been forecast for the residential, commercial and industrial sectors, and system losses. Forecasts have been prepared with and without demand initiatives and climate change impacts being applied.

4.1 Pre-drought water consumption

Prior to the Millennium Drought, there were very few drivers for urban and industrial users to reduce consumption. During periods of poor inflows, Wivenhoe Dam had previously contained sufficient storage reserves to maintain unrestricted supplies across most of the region. There have always been limitations on supply for rural water users, which have resulted in some inherent self-regulation of use.

Unrestricted consumption provides a starting point for water planning. In SEQ, the most recent unrestricted consumption occurred prior to May 2005. Table 4.1 summarises water use patterns in 2005.

Table 4.1 SEQ water consumption in 2005

Sector	Water consumption (megalitres per year)	Proportion urban demand (per cent)	Total demand (per cent)
Urban	277 459	65	
Residential	91 426	21	
Non-residential	59 808	14	
Total urban	**428 693**	**100**	**69**
Power generation	38 000[1]		6
Rural communities	5 703[1]		1
Rural production	150 000		24
Total	**622 396[2]**		**100**

1 Historical information that includes estimated consumption for Rosalie, Jondaryan, Crow's Nest and Cooloola.

2 Excludes recycled water supplied to industry, golf courses and parks.

About 75 per cent of water consumed in SEQ in 2005 was used for urban purposes and power generation. The remainder was used for rural purposes. This pattern differs from the overall Australian consumption pattern. In 2000, Australia used 83 per cent of its water for rural applications and only 17 per cent for urban and industrial applications.

System losses accounted for about 14 per cent of the water used for urban purposes, including fire services, metering errors, leakage and theft (refer to Section 4.3).

Average total urban consumption in SEQ varied between local government areas, from 300 to 500 litres per person per day with an average of 450 litres per person per day. On average, residents of SEQ with reticulated drinking water supplies consumed approximately 300 litres per person per day. As shown in Table 4.2, this rate of consumption was comparable with that in other capital cities in Australia.

Table 4.2 Average residential water consumption in Australian cities (2004–05 to 2008–09)

City	2004–05 (litres per person per day)	2008–09 (litres per person per day)
SEQ[1]	282[1]	143[1]
Sydney	215	202[2]
Canberra	255	195[2]
Melbourne	195	157[2]
Adelaide	265	228[2]

1 Average residential consumption in all local government areas in SEQ.

2 Estimates calculated from National Water Commission and Water Services of Australia (2010) *National Performance Report 2008–2009*, and Australian Bureau of Statistics information. Consumption in some cities was affected by water restrictions.

4.2 How the Millennium Drought changed our thinking

From 2005, as the extent and impacts of the Millennium Drought became evident, the Queensland Government introduced a range of demand management measures. Many of these measures have been made permanent.

Following implementation of these measures, there was a significant improvement in water efficiency coupled with a substantial reduction in demand. In the central SEQ and Gold Coast region, average urban consumption dropped from 450 litres per person per day in 2005 to approximately 230 litres per person per day from mid-2007 to mid-2009 (refer Figure 4.1). It has remained below 260 litres per person per day since mid-2009, despite the easing of restrictions.

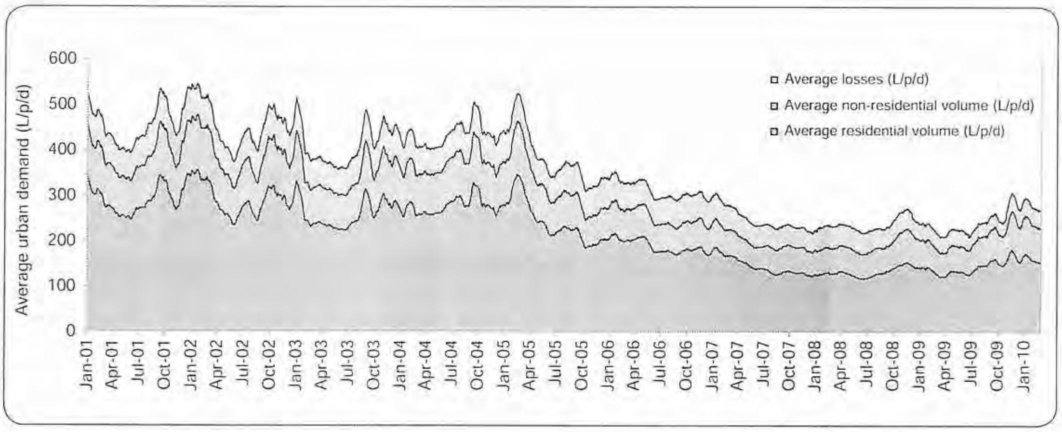

Figure 4.1 Average total per person consumption since 2001 in central SEQ and Gold Coast

Residents achieved most of the savings. Average residential use in those regions of SEQ that were under QWC restrictions was 131 litres per person per day from mid-2007 to mid-2009 (refer to Figure 4.2). In mid-2010, with Permanent Water Conservation Measures and Target 200 in place, residential consumption in the same region continues to be low, averaging around 165 litres per person per day. This indicates that the water-efficient habits developed by residents during the height of the drought are being maintained.

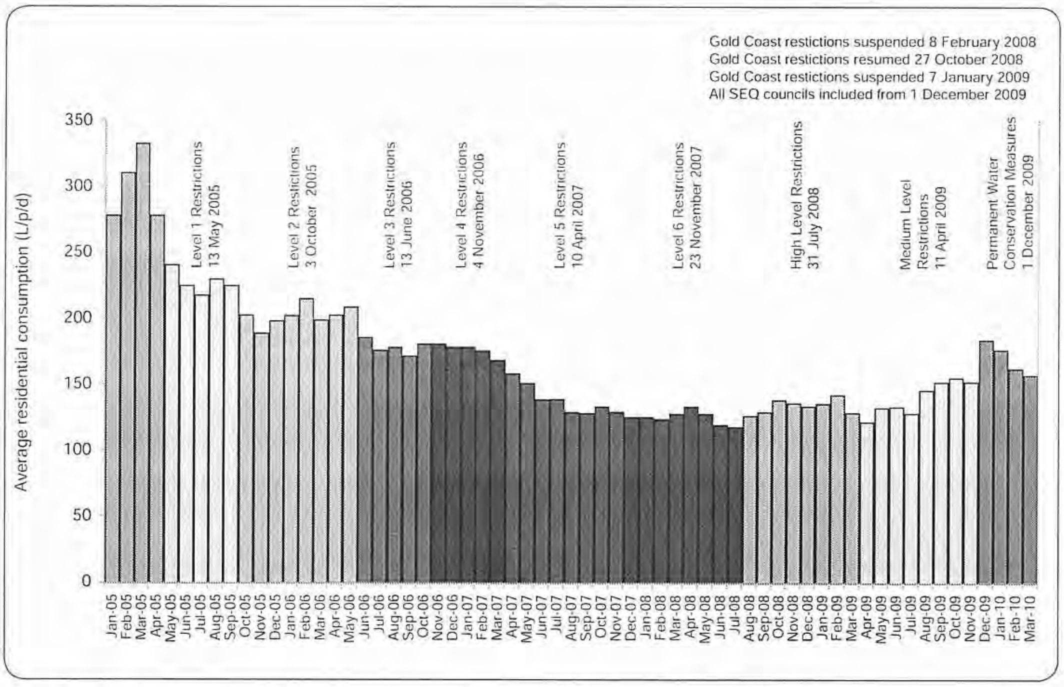

Figure 4.2 Average residential consumption for SEQ regions under QWC restrictions since 2005

Residents in other parts of SEQ have also reduced consumption, but not to the same level as central SEQ. For instance, residents on the Sunshine Coast reduced average consumption from about 317 litres per person per day in 2004–05 to about 224 litres per person per day over the six months to the end of May 2010. Gold Coast residents used an average of 206 litres per person per day over the same period. While these residents were not subject to QWC water restrictions until 1 December 2009, these areas had access to the same rebate and retrofit schemes as central SEQ.

Non-residential water use has also decreased. In 2009, 32 per cent less water was used by the non-residential sector than in 2004–05, saving 76.6 megalitres per day. These savings have been achieved despite the total number of businesses increasing by 16.9 per cent. Figure 4.3 illustrates the savings achieved by sector for moderate and major water users. Aside from irrigation, which was curtailed through temporary banning of outdoor watering, the most dramatic reductions were achieved by the public sector, followed by the commercial and other industrial sectors.

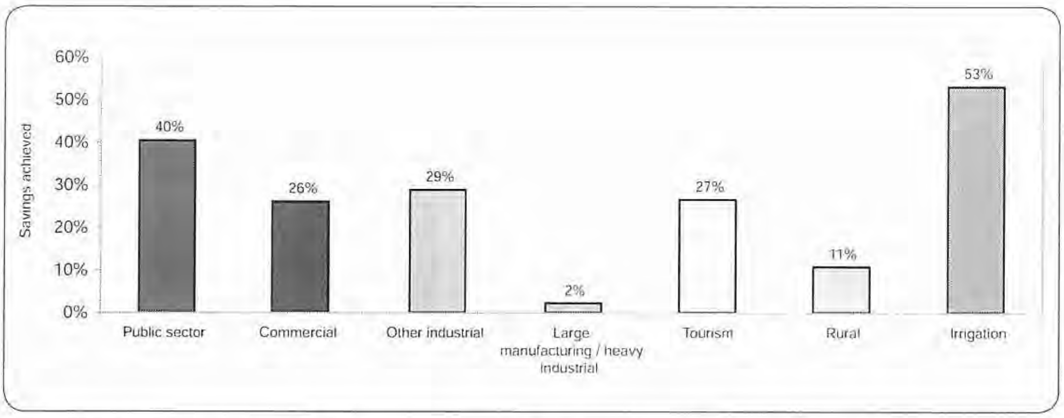

Figure 4.3 Savings achieved by non-residential sectors (2004–05 to the end of 2009)

4.3 Planning assumptions

The LOS objectives for normal operating mode include that sufficient SEQ Water Grid water be available to meet a regional average urban demand of 375 litres per person per day (including residential, non-residential and system losses).

The LOS objectives are the planning assumptions that are the basis for regional water supply planning, including detailed design of pipeline networks and water treatment plants. The assumptions are conservative, ensuring that new infrastructure can be constructed in sufficient time.

More detailed planning assumptions for residents, business and industry and system losses are specified in the remainder of this section. Chapter 6 outlines the demand management program that will contribute to the achievement of these assumptions, including the voluntary residential consumption target.

Residential planning assumption

Residential consumption is the largest sector of urban water use in SEQ (refer to Section 4.1). The community response to the Millennium Drought demonstrates the significant influence that this sector has on water security in SEQ.

The planning assumption of regional urban consumption of an average of 375 litres per person per day includes an allowance of up to 230 litres per person per day for residential use. This level of water use is considered to be comfortably sufficient to maintain the outdoor amenity and lifestyle that characterises SEQ.

This is a conservative assumption, and a prudent approach for water supply planning, taking into account the timeframes for delivering bulk water supply infrastructure and the level of uncertainty regarding:

- the extent of permanent behavioural changes by the community
- population growth
- climate variability
- the potential impacts of climate change.

However, the Strategy challenges residents to use less, voluntarily maintaining a regional average residential consumption below 200 litres per person per day. By maintaining consumption below this level, the need for new supplies could be deferred by at least five years. This challenge is described in Section 6.2.

Non-residential planning assumption

The planning assumption for non-residential water use is a regional average of 145 litres of water per person per day from the SEQ Water Grid.

Business, industry, government and other large users of water need to conserve water by being more efficient water users. The QWC has implemented Permanent Water Conservation Measures, which require these users to use water efficiently while minimising the risks to economic production and employment. The measures focus on businesses using more than 1 megalitre per year, and particularly those using more than 10 megalitres per year. The businesses in these categories comprise almost 90 per cent of existing non-residential water consumption in SEQ.

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Through these permanent measures, business and industry will continue to move towards best practice water efficiency. Given this embedded best practice approach, it is expected that if there is another drought that requires the introduction of water restrictions, there will be minimal impact on water use associated with business activities.

Power generation planning assumption

Power stations are required to use recycled water when available, if accessing water from the SEQ Water Grid.

Consistent with this assumption, the SEQ System Operating Plan directs that purified recycled water from the Western Corridor Recycled Water Scheme must be the primary source of supply for any water being taken from the SEQ Water Grid to the Swanbank, Tarong and Tarong North power stations. The SEQ System Operating Plan is discussed in Section 7.2.1.

System losses planning assumption

System losses include losses from authorised uses such as fire fighting and maintenance, as well as unauthorised uses such as theft and leakage. System losses comprised 14 per cent of urban demand in 2005.

Bulk transport and network distribution system loss targets have been set at no more than 8 per cent of total urban water use. This target will be achieved through universal metering, better understanding and management of the operation of the system as a consequence of the pressure and leakage reduction project, and the design and management of new distribution infrastructure.

4.3.1 Basis for the residential planning assumption

The planning assumption of an urban consumption of a regional average of 375 litres per person per day includes a conservative allowance of 230 litres per person per day for residential consumption. The basis for this allowance is explained below. These considerations have also informed the level of the voluntary regional residential consumption target (refer to Section 6.2).

The residential planning assumption will be reviewed as part of the review of the Strategy, which will be at least every five years in line with the Regional Plan. It will also be reviewed at any point in the intervening period if it becomes clear that demand remains low, or is significantly increasing. This review of the planning assumption might be undertaken as part of preparing the annual report on the implementation of the Strategy (refer to Section 7.1.2).

Scenario assessment

The Strategy has been informed by a detailed assessment of future water demand (refer to Section 3.4). The assessment forecast the impact of individual measures upon 2004–05 trends, taking into account a range of factors including interactions between measures. For instance, shorter average shower times reduce projected savings from water-efficient showerheads.

A high savings scenario was derived, based on:

- education programs
- pricing and tariff design
- retrofit and rebate programs
- building audit programs
- irrigation management and controls
- sub-metering programs
- building code amendments
- pressure and leakage management
- dual-reticulation recycled water schemes in major new residential and industrial developments.

The high savings scenario forecast that average regional residential consumption would reduce by about 25 per cent, from 300 litres per person per day to slightly below 230 litres per person per day. The structural measures that have been implemented as part of the drought response were forecast to result in an immediate saving of 13 per cent, increasing to a saving of more than 20 per cent over time. The remainder of the savings was due to assumptions made about sustained behavioural changes. Greater savings may be able to be achieved with more sustained long-term behavioural changes (refer to Section 6.2).

Drought rebound assessment

There are limited precedents against which to assess how much of the behavioural changes made during the Millennium Drought will be sustained in the future. Until the late 1990s, water supply authorities in Australia did not generally seek to maintain savings that had been achieved during drought.

The information available for recent droughts in Australia and overseas indicates that the rebound back to this level of consumption can be expected to occur gradually over a minimum of two years with maximum savings of 10 to 15 per cent. The period of time over which the rebound occurs depends on a range of factors, including the amount of rainfall in following years and the extent of communications to the public to maintain water efficiency.

The extent and duration of demand reduction in SEQ exceeds that experienced in other major cities during severe drought. On this basis, the demand forecasts contained in Section 4.5 and Chapter 6 are based on consumption increasing gradually from actual levels at the end of 2009 to equal the planning assumptions by 2018.

Rebound from the Gold Coast drought

The Gold Coast experienced a severe drought during the period between June 2002 and January 2004. Water restrictions included total outdoor watering bans, with a high level of public awareness of these bans. Average regional urban consumption reduced from 440 litres per person per day to 360 litres per person per day at the height of the restrictions. In the 18 months after restrictions were lifted, regional urban demand increased to 400 litres per person per day and continued to rise. Restrictions were then imposed and demand reduced again. The effect of the 18 months of severe drought and restrictions was equivalent to an ongoing saving of less than 10 per cent.

This rebound occurred despite Gold Coast Water introducing an active demand management program that continued after restrictions were eased. Household retrofits, pressure and leakage management and volumetric pricing were all implemented after the restrictions eased.

The same drought affected northern New South Wales, where restrictions were in place in for more than 12 months and reached Level 7. During the drought, average total consumption reduced from 440 litres per person per day to as low as 300 litres per person per day. Average total demand remained at about 370 litres per person per day after the drought, a reduction of 16 per cent over the long-term average. Changes to water prices may also have contributed towards the saving.

Building block assessment

A building block approach was used to test the average lifestyle impacts of the proposed combination of measures across SEQ.

The Millennium Drought has shown that SEQ residents can reduce average residential consumption to below 140 litres per person per day compared to about 300 litres per person per day in 2005. However, for some members of the community, this may be unacceptable or unachievable over the longer term.

The allowance in the planning assumption of an average regional residential use of 230 litres per person per day represents an increase of 90 litres per person per day over the drought consumption levels. This represents around two hours of outdoor water use per household per week, if indoor use remained at approximately the same level as achieved under Target 140. In practice, some rebound in internal water use is likely to occur and some water will be used for other external uses, including topping up pools and washing cars.

By comparison, prior to the Millennium Drought, residents of SEQ used on average more than 120 litres per person per day for outdoor irrigation.

The reductions in outdoor water use are being achieved through a combination of structural and operational measures, as well as by sustained behavioural change (refer to Section 6.1).

High water users

A small proportion of households using a large volume of water have a major impact on average consumption. Since 2005, in the central SEQ and Gold Coast region, there has been a major reduction in the number of households using more than 800 litres per day and a significant increase in the number of households using between 300 and 600 litres per day. Prior to 2005, about 4.6 per cent of households in central SEQ used more than 2000 litres per day and about 36 per cent used more than 800 litres per day. In comparison, over the last three months of 2009, only 0.6 per cent of households used more than 2000 litres per day and 10.5 per cent used more than 800 litres per day (refer to Figure 4.4).

These savings have underpinned the significant reduction in average residential consumption in these areas. However, a significant rebound in the number of high water using households would have a major impact on average residential consumption across SEQ.

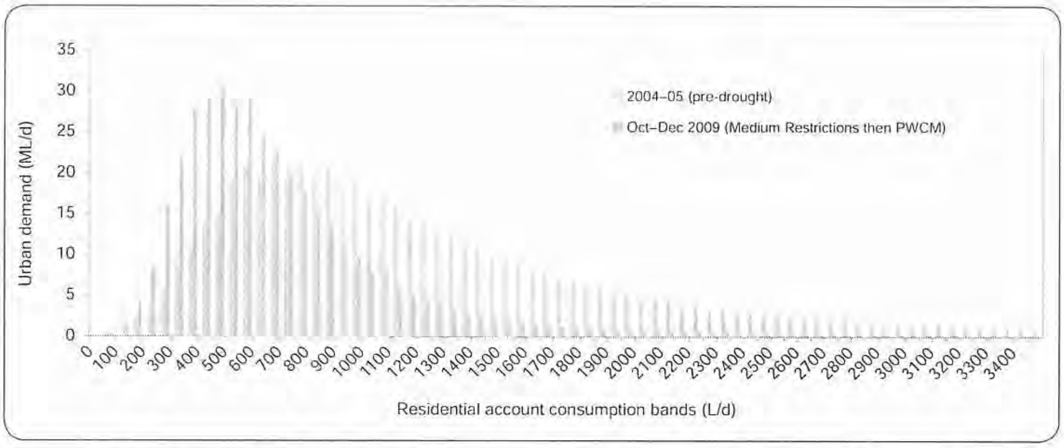

Figure 4.4 Residential consumption by consumption band for the central SEQ and Gold Coast region

Regional and household variation

The residential planning assumption and Target 200 are regional averages. Actual consumption varies considerably between households and across SEQ due to the type and age of a home, the number of occupants, the location of the home (in terms of climate and soil type conditions), and many other factors. In particular, it is forecast that:

- residents of new dwellings will use less water than residents of existing dwellings, due to water-efficient devices, rainwater tanks or other water supply alternatives. On average, residents of new dwellings are expected to use about 150 litres per person per day

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- residents of units will generally use less water than residents of detached dwellings with gardens. The size and type of a garden, as well as access to tank water will influence the additional water requirements for such detached houses
- households with more people will continue to use less water per person than smaller households. For example, on average, a two-person household may use 200 litres per person per day (a total of 400 litres per day) while a six-person household may use 140 litres per person per day (a total of 840 litres per day)
- differences in rainfall will result in daily variations in external water use between locations, seasons and years, as illustrated in Figure 4.5.

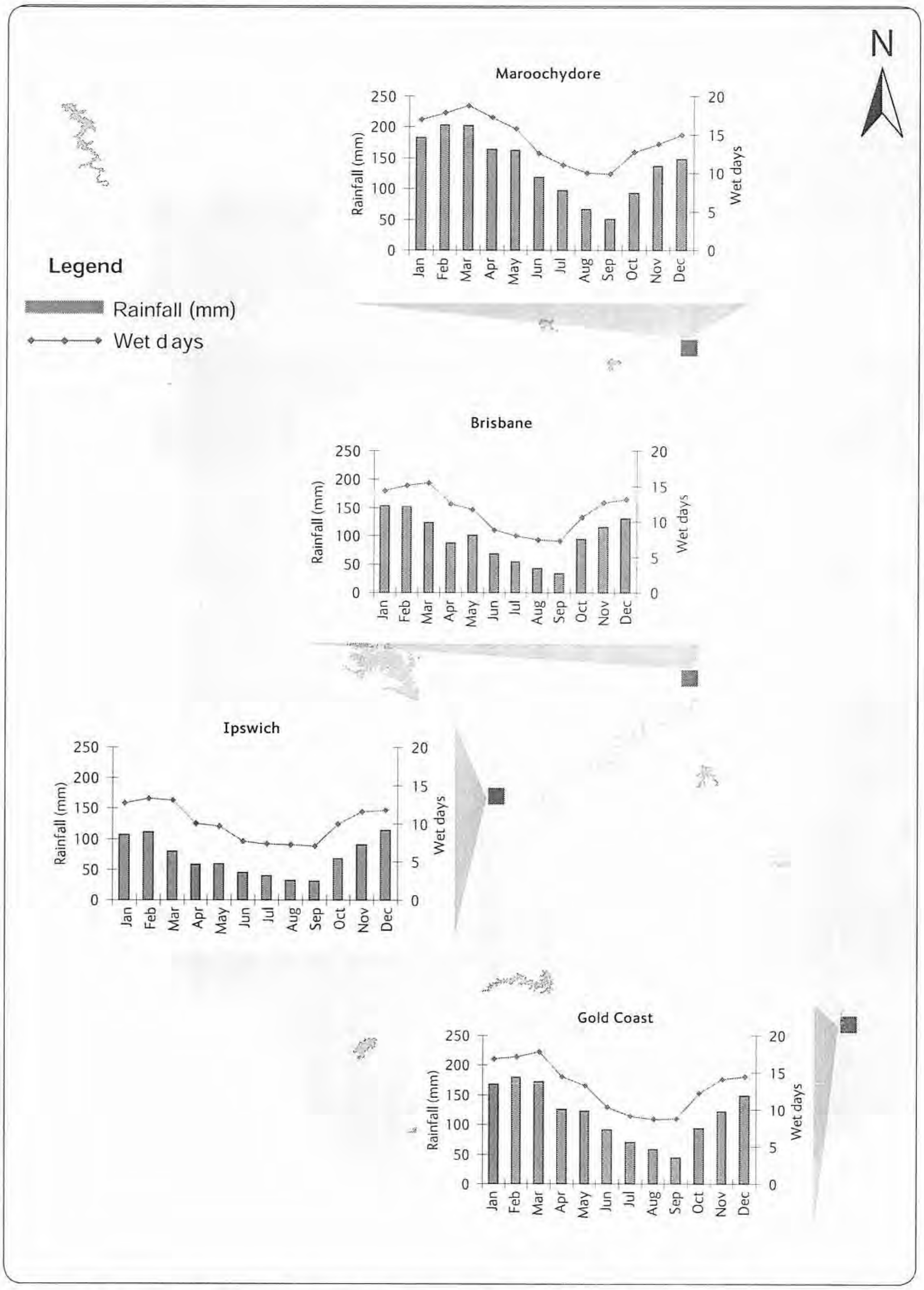

Figure 4.5 Regional variation in rainfall and rainfall days (data from 1957 to 2008)

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External water use

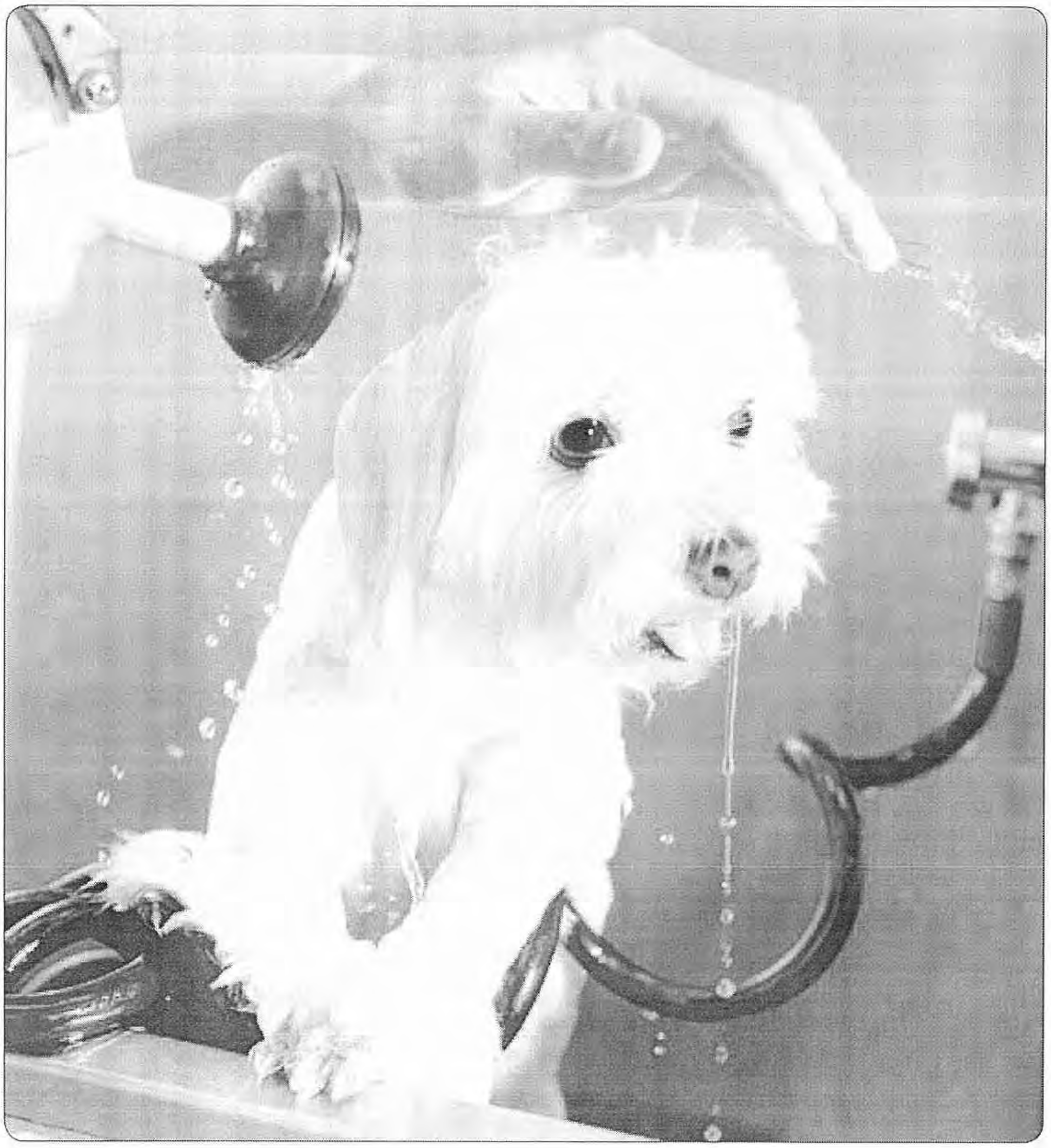
Water is used outside the home for watering gardens, filling pools, washing cars and general cleaning activities.

Actual external water use will vary significantly depending on regional differences, such as rainfall and soil type. The greatest variation will relate to watering of gardens. Figure 4.6 shows the predicted water needed, on average, each month for a number of locations within SEQ, based on climate information, soil type and a range of other factors. Figure 4.7 predicts the number of times a garden needs to be watered for the same locations, on average. Both figures are based on an assumption that residents use efficient irrigation, watering only when necessary.

Together, these figures illustrate that:

- residents in coastal locations should use less water on their gardens, on average, than similar residents located in inland regions, due primarily to rainfall patterns
- soil conditions should significantly affect the frequency of watering, as distinct from the volume of water used.

For instance, Ipswich has generally loamy soils. In an average September, it is predicted that a gardener in this location would need to water their garden twice in a month, delivering the equivalent of 160 litres per person per day. By comparison, Maroochydore has very sandy soils and more rainfall, meaning that the same gardener would need to water their garden four times in the month but only use the equivalent of about 140 litres per person per day.



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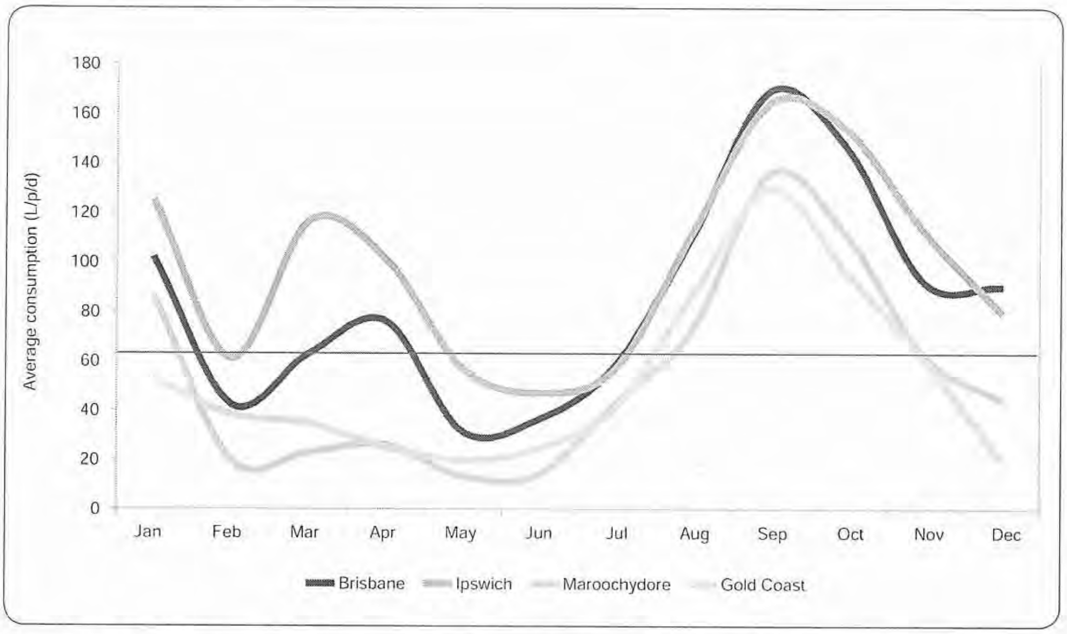

Figure 4.6 Forecast average external water use by location and month

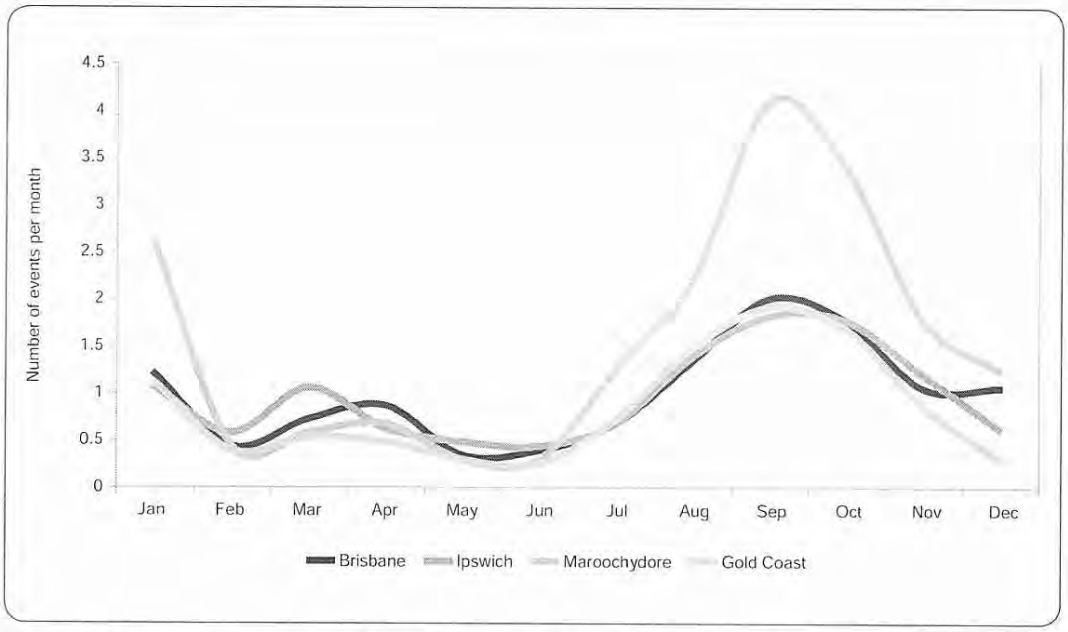

Figure 4.7 Forecast average number of watering events by location and month

4.4 Measures currently being implemented

Responses to the Millennium Drought included a number of demand management measures.

There are three categories of water efficiency measures:

- structural—making sure that our homes and businesses have water-efficient devices, appliances and equipment installed
- operational—making sure that water-efficient equipment is used correctly to achieve efficient outcomes
- behavioural—encouraging good use water behaviours and ensuring that the community understands the benefits of conserving water.

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Table 4.3 gives information about the measures that have been implemented and factored into demand forecasts. These measures are long-term, as explained in Chapter 6.

Section 6.3.2 contains further demand management measures for investigation, to support achievement of the LOS objectives. Ongoing monitoring and review of water usage will be needed to determine the effectiveness of the program, including the potential to further reduce regional water consumption without significantly affecting our lifestyle, environment, or business and industry.

Drought response measures were identified during the early phases of Strategy development. A detailed and comprehensive assessment was conducted of some 100 potential measures across all customer sectors and involved a range of implementation mechanisms. Potential demand management measures were screened based on the following criteria:

- significance of water savings from a regional perspective
- sustainability of water savings from a regional perspective
- reductions in energy use
- improved public awareness
- likely public acceptance
- equity across customer base
- regulatory obstacles
- life cycle cost to customers
- life cycle cost to water service providers.

The annualised cost of potential measures was compared to the cost of potential sources of supply. Annualised cost is the cost of the measure divided by the amount of water that it will save each year. On this assessment, the measures proposed in the Strategy were generally cost-effective relative to potential sources of supply. Figure 4.8 illustrates the annualised cost of some of the potential demand management measures, based on the initial planning assumptions. More detailed economic analysis was undertaken for significant measures, including levelised[1] cost assessments and portfolio analysis, which is explained in Section 6.3.2.

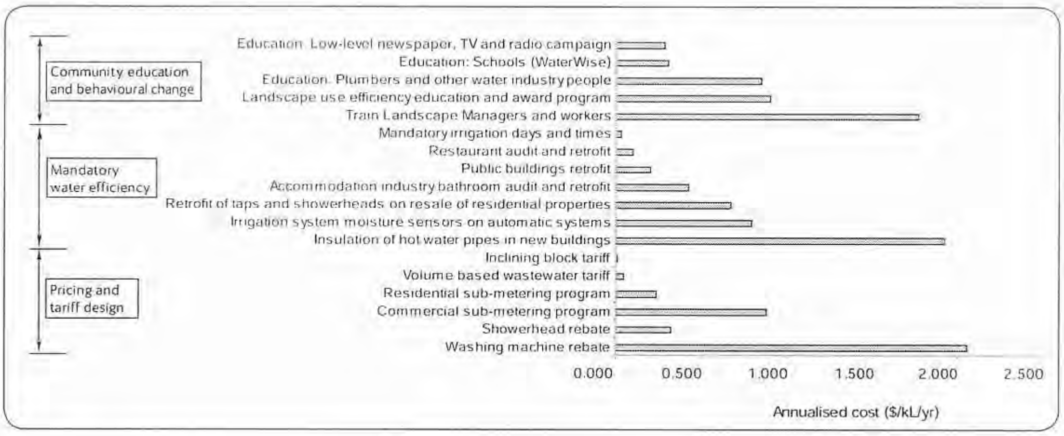

Figure 4.8 Annualised cost of potential demand management measures

[1] Levelised cost is calculated as the ratio of the present value of projected capital and operating cost of an option to the present value of the projected annual demand supplied or saved by the option.

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Table 4.3 Permanent efficiency measures

Structural water efficiency measures
Water efficiency management plans Water efficiency management plans (WEMPs) are required to be prepared for large water-using businesses and other non-residential activities. Under a WEMP, businesses must assess their current water use and identify and implement water savings. The plans demonstrate if a water user is already at best practice in water efficiency, or how a user is planning to become water-efficient in the near future. All businesses using 10 megalitres per year or more must prepare, submit and comply with a WEMP. WEMPs are also required for public swimming pools, nurseries, turf farms and market gardens, and premises with cooling towers. WEMPs are a long-term measure. Businesses that are subject to a WEMP are required to review and update their WEMP at least every five years, with the aim of achieving business best practice water efficiency. All businesses must ensure that their urinals and cooling towers are efficient, and businesses using 1 megalitre per year or more must ensure that all internal water fittings on the premises are water-efficient.
Queensland Development Code Part 4.1—sustainable buildings Since 1 March 2006, new houses in Queensland are required to use water and energy more efficiently. Detached houses, terrace houses and townhouses must contain water-efficient showerheads and toilets, and water pressure limiting devices. Units must have water-efficient showerheads and toilets. Homes undergoing bathroom renovations must include water-efficient showerheads and taps.
Queensland Development Code Part 4.2—water savings targets Since 1 January 2007, all building development applications lodged for the construction of new homes in SEQ must meet mandatory water savings targets. Detached houses must target savings of 70 000 litres per year, while terrace houses and townhouses must aim to achieve savings of 42 000 litres per year. Internally plumbed rainwater tanks are one option to achieve the water savings target. Alternative solutions to achieve the water savings target include communal rainwater tanks, stormwater harvesting, dual-reticulation recycled water schemes, and the treatment and reuse of greywater.
Queensland Development Code Part 4.3—alternative water sources, commercial buildings From 1 January 2008, most new commercial and industrial buildings are required to have alternative water sources. Options include internally plumbed rainwater tanks and treated greywater.
Topping up swimming pools Water from the reticulated supply system may be used for topping up swimming pools only if a rainwater tank or downpipe rainwater diverter is installed. The pool must also be an accredited ecopool or the premises must comply with three of four water efficiency measures, namely the use of: • a swimming pool cover • water-efficient taps and showerheads • water-efficient toilets • water-efficient washing machines.
Pressure and leakage reduction program The Queensland Government has collaborated with local governments to reduce supply pressure and distribution system leakage losses by 60 megalitres per day by 2012. As at March 2010, a reduction of 52 megalitres per day had been achieved.
Expanded use of greywater Allowable uses for greywater have been expanded where appropriate, through setting treatment standards and amending the types of buildings eligible to install greywater use facilities. Commercial and industrial building owners are allowed to reuse greywater captured within their buildings. These provisions commenced on 1 January 2008 and allow treated greywater to be used for toilet flushing, laundry use, vehicle washing, washdown of paths or walls, and spray irrigation of lawns and gardens.
Installation of water meters Accurate water usage data is a critical factor for effective water use management. Individual water meters must be installed in all new residential and commercial multi-unit developments. In addition, businesses must install sub-meters: • on the supply line of any process or equipment that uses a significant portion of the total water use on the site • on the supply line of an irrigation system that irrigates an area greater than 500 square metres.

Operational water efficiency measures

Guidelines for business

Working with industry, the QWC has developed water efficiency guidelines that identify water-efficient equipment and practices to assist businesses and commercial operators. The guidelines cover a range of business and sporting operations, from fixed commercial vehicle washing to playing surface management. Generally, operators must:

- use water-efficient equipment, appliances, accessories and products that enhance water efficiency
- undertake activities in a water-efficient manner in accordance with manufacturers' instructions and equipment and training requirements
- check for leaks and, when a leak is found, undertake immediate repairs
- improve processes and upgrade to water-efficient equipment when it becomes economically feasible
- ensure that performance targets are met and equipment is maintained in good condition.

Active Playing Surfaces Guidelines

The Active Playing Surfaces Guidelines set out rules for irrigating grassed active playing surfaces to ensure that water is used efficiently while surfaces are maintained in a safe and playable condition. Over 620 registered active playing surfaces in SEQ use water in accordance with these guidelines.

Efficient Urban Irrigation Program

Irrigating outdoor areas can consume large amounts of water. The QWC has introduced the Efficient Urban Irrigation Program to improve the efficiency of outdoor water use for establishing and maintaining gardens and lawns around homes and businesses.

Irrigation systems must operate with a timer and a soil or rainwater moisture sensor. Irrigation must also be supported by efficient gardening practices. For business and commercial applications, a sub-meter must also be installed.

Residents and businesses operators are encouraged to choose landscaping elements that are appropriate to the climate and require minimal water to flourish.

The Efficient Urban Irrigation Program is based on the *Efficient Irrigation for Water Conservation Guideline*. The guideline has been granted the Smart Approved WaterMark and links to the use of efficient products which can be identified by the Smart Approved WaterMark.

Mobile commercial operator training and registration programs

Water is the primary input to the businesses of many mobile commercial operators, such as mobile car washing businesses, external cleaners and pet washers, making it important that these businesses operate in a water-efficient manner. The QWC developed Water Efficiency Guidelines to ensure operators are trained in efficient water use practices. By the end of 2009, 1130 operators were registered, trained in efficient water use, and operating according to the QWC guidelines.

Behavioural water efficiency measures

Rebate schemes

The Queensland Government and a number of local governments have provided rebates for installing rainwater tanks and water-efficient devices, including dual-flush toilets, showerheads, washing machines and swimming pool covers. In some instances, increased rebates were offered for rainwater tanks that had been plumbed to internal fixtures.

More than 580 000 rebates were paid under the Queensland Government's WaterWise Rebate Scheme, with a total estimated value of almost $330 million. Rebates were paid to retrofit rainwater tanks to 236 000 houses and to provide water-efficient showerheads and other fittings.

Water-efficient showerheads continue to be available through the Queensland Government's ClimateSmart Home Service.

ecoBiz is a Queensland Government program that provides rebates to help businesses save money through reduced energy and water consumption, and reduced waste.

Public education and communication

The QWC implemented successful public education and communication campaigns, including Target 140, Target 170 and Target 200, to encourage residents of SEQ to reduce their water use and to use water efficiently. A separate campaign, Water at Work, promoted water efficiency in the workplace. Further community and business education campaigns will be undertaken as required and to support the voluntary Target 200.

WaterWise

The WaterWise program targets particular sectors of the community and seeks to establish efficient lifetime water consumption habits. *Water: Learn it for life!* has been developed for preparatory and primary school children. The program is administered by the Department of Environment and Resource Management.

Council water savings and efficiency education programs

Many local governments provide educational information and water savings tips and toolkits for households and businesses. Some local governments also offer water efficiency rebates.

Behavioural water efficiency measures (continued)

Water use information to residential tenants

This measure requires water service providers to give water use information to occupiers of residential rental properties. The advice states the volume of water supplied to the premises during each meter-read period so residents can monitor their water use.

Water efficiency calculator

The QWC has developed a water efficiency calculator to help residents and business operators become more water-wise. The calculator determines water usage volumes in and around the household or premises, using information provided by the user. The calculator suggests water savings tips and enables residents to compare estimated water usage with metered water usage.

Water-efficient technologies display

A water-efficient technologies display has been established at the Home Ideas Centre in Brisbane. The display features a range of water-efficient devices, appliances and fixtures and promotes water-efficient technology to people building or renovating a home.

4.4.1 Role of rebate schemes

The demand management program focuses on structural measures that will continue to provide cost-effective savings well beyond the time when additional sources of supply are required. The main focus is for new houses and commercial and industrial buildings to be water-efficient—for example, by using water from rainwater tanks to flush toilets or for other purposes. Unless many of these measures are undertaken now, the opportunity could be lost and the future cost of retrofitting would be prohibitive.

With these requirements in place, substantial water savings will be achieved through natural replacement of the building stock, either when constructed or as part of renovation.

Most of the rebate schemes have now been discontinued. They were effective in bringing forward demand savings as part of a drought response. However, they are less cost-effective when LOS system yield exceeds demand, and when similar demand savings will be embedded over time through regulation and the natural replacement of fittings and fixtures.

Refer to behavioural water efficiency measures in Table 4.3 for more information on rebate schemes.

Examples of measures implemented by non-residential users

Industrial water recycling—BP and Caltex refineries

Since 2000, the BP Amoco Refinery at Bulwer Island in Brisbane has been using an average of 3650 megalitres per year of recycled water. Since May 2008, the Caltex refinery at Lytton has been receiving 1600 megalitres per year of high-quality recycled water from the nearby Wynnum Wastewater Treatment Plant. Both of these projects use the recycled water for boilers and cooling towers, and are examples of recycled water substitution that will directly reduce the demand on drinking water supplies.

Industrial water management—Dairy Farmers, Ipswich

Dairy Farmers is one of the largest dairy manufacturers in Australia. Recent improvements at the Booval Dairy Farmers plant have led to greater recovery and reuse of water, allowing the plant to reduce water consumption by 25 per cent. An additional benefit is that wastewater discharge from the plant has been reduced.

Commercial water management—Conrad Jupiters Casino

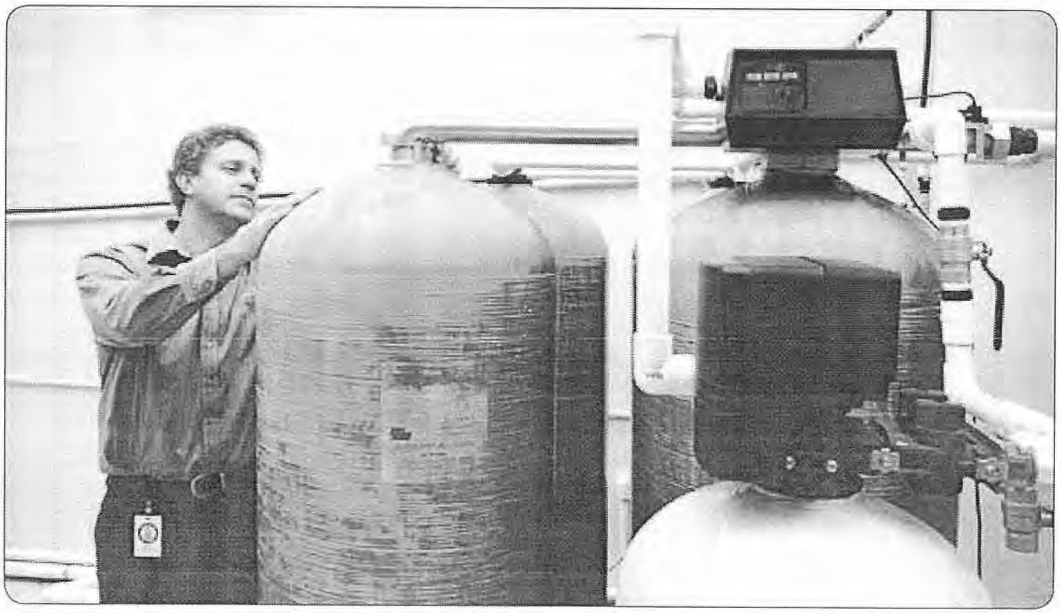
Conrad Jupiters Casino on the Gold Coast has reduced its potable water consumption by 37 per cent. Key initiatives include installing water-efficient fittings on showers, taps and urinals; a recycled water treatment facility for garden irrigation; dual-flush toilets; and rainwater tanks for topping up swimming pools.

Government buildings—Water SMART Buildings

This program reduced water consumption in Queensland Government–owned commercial buildings, facilities and parks. High water use facilities were targeted with a program of works to improve their water efficiency. Projects included replacing single-flush toilets and installing water-efficient tapware, showerheads and flow restrictors. A reduction in potable water consumption of approximately 55 per cent was achieved in 37 government buildings in SEQ when comparing 2004–05 and 2008-2009 annual water usage data.

Rural water use efficiency—SEQ Irrigation Futures

The SEQ Irrigation Futures project was established to improve the efficiency and off-farm impacts of irrigation. Participating industries include horticulture, dairy and fodder, turf, flora, and nursery and garden sectors. A key objective is to provide research and development, which has underpinned a 12 per cent improvement in water use efficiency as at the end of 2009—equivalent to an estimated 21 000 megalitres per year. Technologies and management practices for improved irrigation practice have been developed, trialled and evaluated through water balance models, spatial variability assessments, zonal irrigation management and 'tool kit' support for industry consultants.



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4.5 Forecast demand

Based on 2004–05 trends, demand for water for urban uses and power generation would have increased from around 467 000 megalitres per year in 2005 to approximately 985 000 megalitres per year in 2056. With high series population growth, demand would have increased to around 1 196 000 megalitres per year.

Overall, a reduction in demand of 24 per cent compared to 2004–05 patterns is forecast by 2056. Table 4.4 contains the current demand forecasts, based on the planning assumptions outlined above. It also takes into account projects and initiatives currently being implemented and the demand management program described in Section 6.3.

Table 4.4 Forecast SEQ urban and power generation demand (excluding rural allocations)

	2005 estimated water consumption (megalitres per year)	2026 forecast demand (megalitres per year)	2056 forecast demand (megalitres per year)
Medium series population projections			
Pre-drought trends	466 693	690 000	985 000
Strategy forecast demand management program	–	533 000	744 000
Per cent saving	–	23 per cent	24 per cent
High series population projections			
Pre-drought trends	466 693	749 000	1 196 000
Strategy forecast demand management program	–	577 000	914 000
Per cent saving	–	23 per cent	24 per cent

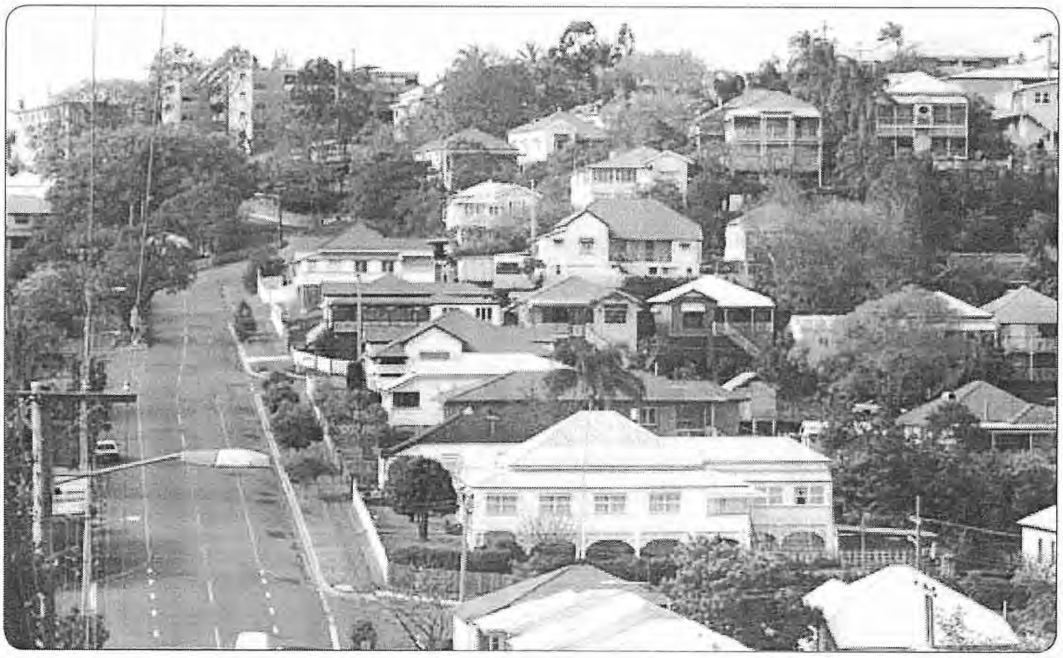

Figure 4.9 illustrates forecast demand over time, in total and for key sectors. A demand range has been prepared to ensure that the Strategy is flexible enough to respond to changes in population growth or consumption trends. Cases where water savings initiatives within the high series forecast are slower to come into effect, or do not fully materialise, are expected to be within the range.

The Toowoomba and Cooloola local government areas are not part of SEQ. However, the pipeline connecting Wivenhoe Dam to Cressbrook Creek Dam provides the capacity to supply up to 10 000 megalitres per year of untreated water to Toowoomba Regional Council. This potential supply has been included in the modelling of future demand.

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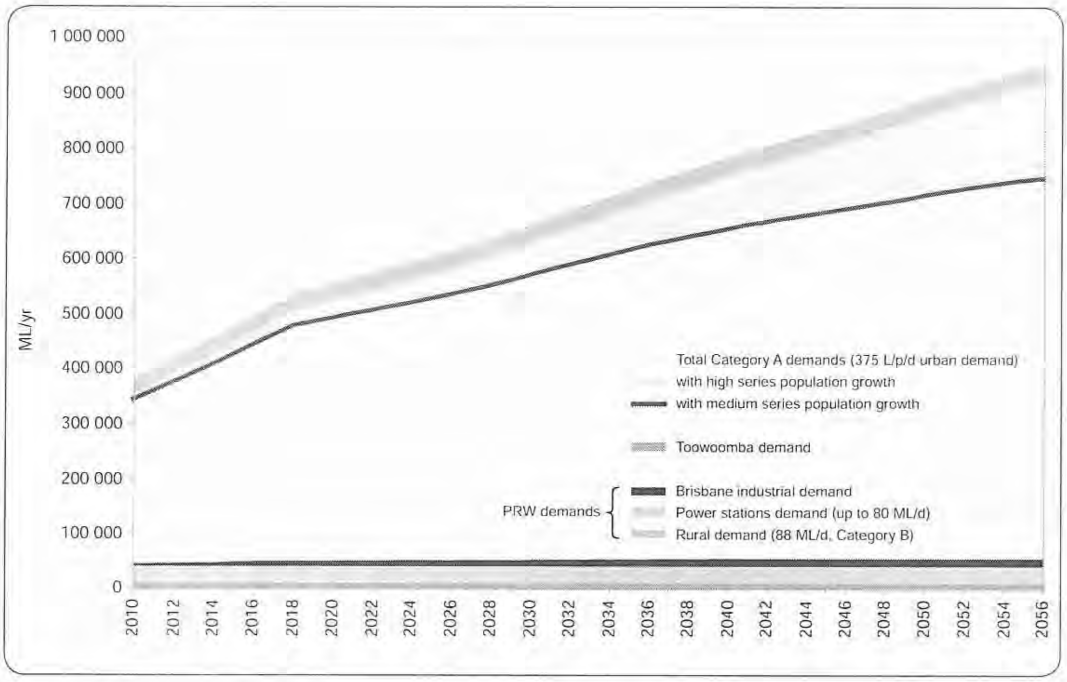

Figure 4.9 Forecast demand

4.5.1 Forecast urban demand

Before 2005, residential use accounted for around 65 per cent of urban demand. The relative proportion of residential water use is projected to decline slightly to about 58 per cent of urban water use by 2056.

Non-residential water use (excluding system losses and power generation) represented approximately 21 per cent of total urban water use in 2005. Non-residential demand is forecast to increase from about 91 000 megalitres per year in 2005 to about 117 000 megalitres per year in 2026 and about 172 000 megalitres per year in 2056, based on medium series population growth. At these rates, non-residential water use is forecast to comprise about 24 per cent of urban demand in 2056.

4.5.2 Forecast power generation demand

In 2005, about 38 000 megalitres was used for power generation in SEQ, equivalent to 6 per cent of total consumption. Most of the water was used in coal-fired power stations.

Since 2005, SEQ power stations have implemented a range of water-saving measures that have permanently reduced demand on the SEQ Water Grid. At the Swanbank B and E power stations, these measures include stormwater collection to supplement cooling water. At the Tarong and Tarong North power stations, the measures include installation of a reverse osmosis plant to recycle stormwater, boiler blowdown water and ash dam water.

Demand will also be reduced by the progressive closure of the Swanbank B power station over the period to mid-2012. Potentially offsetting this, CS Energy has long-term plans to build another gas-fired power station at the site. Power stations may also be built elsewhere in the region at some stage.

Taking these factors into account, the Strategy allows for supply to power generation of up to 29 500 megalitres per year. This is a conservative assumption, based on existing contracts. Actual consumption in any year may be lower, due to lower demand for electricity or to the Tarong power station taking water from Boondooma Dam rather than from the SEQ Water Grid.

When accessing water from the SEQ Grid Water, the Swanbank, Tarong and Tarong North power stations will use purified recycled water from the Western Corridor Recycled Water Scheme. For the Swanbank and Tarong North power stations, purified recycled water is the primary source of supply. For the Tarong power station, the primary source of supply will continue to be Boondooma Dam, with purified recycled water being used when supply is unavailable from the dam.

4.5.3 Forecast rural community demand

In the future, demand for water in rural communities with stand-alone supplies is expected to remain at approximately 1 per cent of total SEQ demand.

These demand forecasts were derived from the October 2006 population growth forecasts from the former Department of Local Government, Planning, Sport and Recreation. An assumption has been made regarding the proportion of future connected and unconnected properties in each local government area.

Section 6.5 provides more information on securing water supplies for all rural communities, both with and without reticulated supplies.

4.5.4 Forecast rural production demand

The growth in rural activities in SEQ is limited by the availability of water, with some restrictions on land use. With the current allocations of water available under the water resource plans, there are only limited opportunities for growth in the rural sector in terms of hectares under irrigation. Within this area, there may be changes to the types of crops and rural activities driven by the national water reforms and other initiatives.

Section 6.6 explains commitments made regarding additional water for rural production. If this water is not taken into account, rural water consumption is likely to remain at around 150 000 megalitres per year, which is the amount used in 2005.

4.5.5 Supply to areas outside SEQ

A pipeline between Wivenhoe Dam and Cressbrook Creek Dam was completed in early 2010. Through this pipeline, the SEQ Water Grid can initially supply up to 10 000 megalitres per year to Toowoomba Regional Council. The conditions of supply have been specified in a contract with Toowoomba Regional Council. This supply is allowed for in water balance models.

Supply to other areas outside SEQ may be considered subject to appropriate terms and conditions, including that the security of supply to SEQ is not reduced below the LOS objectives (refer to Section 6.1).

4.6 Local water supplies

Local water supplies are an integral part of the Strategy. These local supplies will complement supply from the SEQ Water Grid, helping to reduce the amount that needs to be supplied from bulk water supplies and the distance over which it is transported.

Development of local water supplies is required under the Queensland Development Code's water savings targets for new residential, commercial and industrial buildings. As noted in Table 4.3, since 1 January 2007 all building applications in SEQ for detached houses must target savings of 70 000 litres per year, while terrace houses and townhouses must aim to achieve savings of 42 000 litres per year. These local supplies must be internally plumbed to provide water for, at a minimum, toilet flushing and washing machine cold water taps, as well as for outdoor use.

The water savings target is forecast to apply to about 500 000 new houses by 2026 and about 800 000 new houses by 2056. At this rate, local supplies in new houses are forecast to reduce demand for the SEQ Water Grid water by about 35 000 megalitres per year by 2026 and 60 000 megalitres per year by 2056. The actual number of new houses depends on a range of factors including population growth and household size. The forecast takes into account variations in the yield of rainwater tanks across the region. These forecasts are based on the minimum requirements.

Internally plumbed rainwater tanks are one option to achieve the water savings target. Other options to achieve the water savings target include communal rainwater tanks, stormwater harvesting, greywater, and dual-reticulation recycled water systems. These options can benefit other elements of the water cycle, as described in Section 2.3.

The most appropriate solution to the water savings target will vary depending on local circumstances, and should be determined as part of the planning processes described in Section 2.3. In key development areas, the optimal solution may be specified as part of sub-regional total water cycle planning. In other locations, it may be considered on a site-specific basis by developers or as part of local government total water cycle planning.

In some circumstances, local water supplies may be able to deliver savings above the minimum required under the Queensland Development Code. These opportunities should be investigated and pursued when the incremental benefits are cost-effective compared to alternative sources of supply. Potential economic benefits of these options include:

- reducing and deferring the need for major supply augmentation
- reducing or avoiding the need for upgrades to the water distribution system
- reducing whole-of-system operating costs
- reducing the overall demand for water.

These opportunities should be assessed on a total water cycle basis, taking into account environmental and social considerations (refer to Section 3.5). Local water supplies can have significant benefits for the local environment. For example, local recycled water schemes can significantly reduce nutrient discharges from wastewater treatment plants, improving the health of receiving waterways and estuaries. These benefits vary between schemes, depending on a range of factors including the treatment process and the other flows in the receiving waterway. Other issues, such as energy intensity, must also be taken into account—local supplies can be more or less energy-intensive than bulk water supplies (refer to Section 6.8.3).

Demand for SEQ Water Grid water will be further reduced by existing tanks including those retrofitted to existing houses during the drought response and tanks on new industrial and commercial buildings.

With few exceptions, local supplies will be insufficient to achieve the LOS objectives described in Chapter 3. As a result, the water balance takes into account the amount of water that will be required to augment supplies from rainwater tanks during severe droughts.

4.6.1 Rainwater tanks

Rainwater tanks were installed in 236 000 homes in SEQ as part of the Queensland Government's WaterWise Rebate Scheme. This represents a penetration rate of almost one in four detached and semi-detached dwellings. These tanks enabled residents to reduce the impact of the drought on gardens while maintaining average consumption below 140 litres per person per day for over a year.

A large proportion of development in SEQ is located in coastal areas that receive higher rainfall than existing major dam catchments. Rainwater tanks and stormwater harvesting provide a way to capture some of this rainfall. Rainwater tanks are able to collect inflows from light rainfall, whereas dams may require 50 millimetres or more of rainfall in the catchment area before run-off commences.

The minimum requirements specified in the Queensland Development Code ensure that rainwater tanks are cost-effective compared to desalination and purified recycled water. This cost effectiveness is due to:

- cost being minimised by installing the tank and internal plumbing connections during construction
- yield being maximised by regulating the minimum size of the tank, connected roof area and plumbing into toilets and washing machines.

The savings that could be achieved for similar costs in existing homes are estimated to be considerably lower. Retrofitted rainwater tanks are generally less cost-effective due to smaller tanks, smaller connected roof area and fewer, if any, internal connections such as to toilets or washing machines. Further work is planned to improve the yield, energy efficiency and cost-effectiveness of rainwater tank systems installed in new dwellings.

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4.6.2 Stormwater harvesting

Stormwater harvesting involves collecting and storing stormwater, then treating and using it at a later time. The appropriate use depends on the quality of treatment. Undertaken as part of water-sensitive urban design, stormwater harvesting has the potential to reduce the impacts from urban development on local waterways, rivers and Moreton Bay. These benefits relate to:

- reducing the quantity of pollutants entering waterways, by trapping and filtering pollutants before discharge and use
- reducing the volume, intensity and frequency of stormwater run-off and stream flow, which helps to maintain in-stream habitats and bank stabilisation.

Stormwater harvesting can vary from on-site scale, such as a shopping centre or industrial development, to regional scale. At the on-site scale, stormwater harvesting may involve capturing and reusing water for use in toilets and for outdoor irrigation. Storage could be provided in underground tanks under car parks or internal roads.

At the local scale, run-off from a new development area might be collected in a wetland for treatment and used for outdoor irrigation or through a dual-reticulation system. At the sub-regional or regional scale, stormwater harvesting might involve collecting run-off from a large catchment area that includes urban and rural areas. The water may be treated to a high standard and used to supplement drinking water supplies.

In a number of greenfield development scenarios, stormwater harvesting could deliver water supply to meet or exceed the water savings targets at a cost comparable to or lower than rainwater tanks.

It is most likely to be cost-effective in developments where:

- the density of development is high, increasing the demand for water and decreasing the unit cost
- the development is large, providing the opportunity for economies of scale
- land is available for surface water storage that does not reduce lot yield, such as low-lying land that would be drainage reserve or passive parkland
- moderate to steep catchments allow for drainage and storage to limited areas.

Similar to rainwater tanks, it is generally more cost-effective to install stormwater supply systems as part of new developments.

Stormwater harvesting could more efficiently achieve both the water savings targets and water-sensitive urban design requirements than if these requirements were addressed separately.

The QWC will also consider opportunities to use managed stormwater harvesting to augment:

- bulk water storages, such as occurs in Orange in New South Wales
- recycled water flows as part of the detailed investigations of potential purified recycled water schemes. Such schemes could have significant benefits for waterways, due to capturing the first-flush stormwater.

The Queensland Government is undertaking more detailed research to assess opportunities for stormwater harvesting in SEQ, as explained in Section 7.4. This includes investigating where large stormwater harvesting schemes could be developed. Much of the research also relates to the health risks that must be managed due to the variation in the quality of stormwater between locations and over time. At present, the cost of meeting regulatory requirements for stormwater use will be a significant factor in determining the viability of such schemes.

The Queensland Government is investigating a number of potential demonstration projects, as summarised in the following text box.

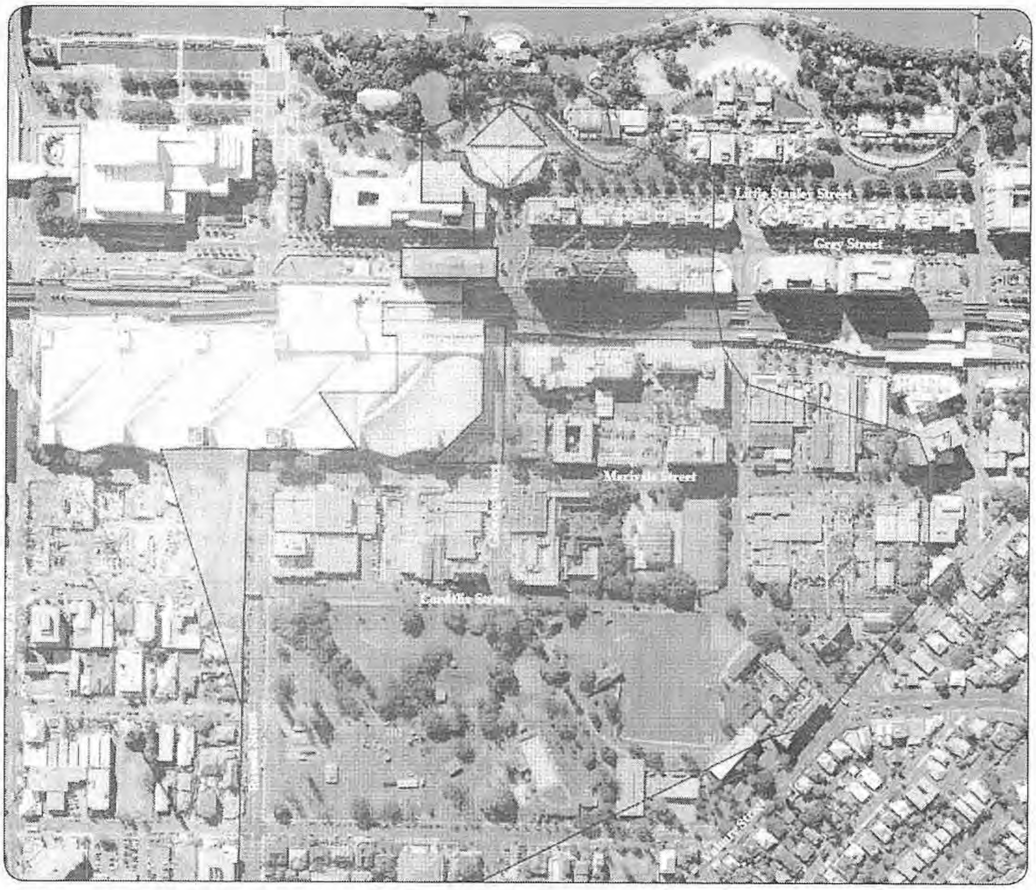
Stormwater harvesting at South Bank

The South Bank Stormwater Harvesting and Recycling Centre (SHARC) will harvest water from a highly urbanised catchment, providing a basis for research. Construction is scheduled to be completed by late 2010.

The scheme involves harvesting stormwater run-off from a 30 hectare urban catchment extending from South Bank into West End. Water will be extracted from a diversion pit in front of the Suncorp Piazza. The water will be treated before being pumped into an underground storage tank and again before distribution. The plant room will include opportunities for community viewing and education.

The SHARC project is expected to supply approximately 77 megalitres per year of treated stormwater. Initially, the water will be used for irrigation, water features and toilet flushing. Once potential water quality issues have been investigated, the water could be used to top up the South Bank pools.

The Queensland Government is contributing $3.3 million to the project. The Australian Government is contributing $4.6 million.



Catchment feeding the South Bank stormwater harvesting scheme

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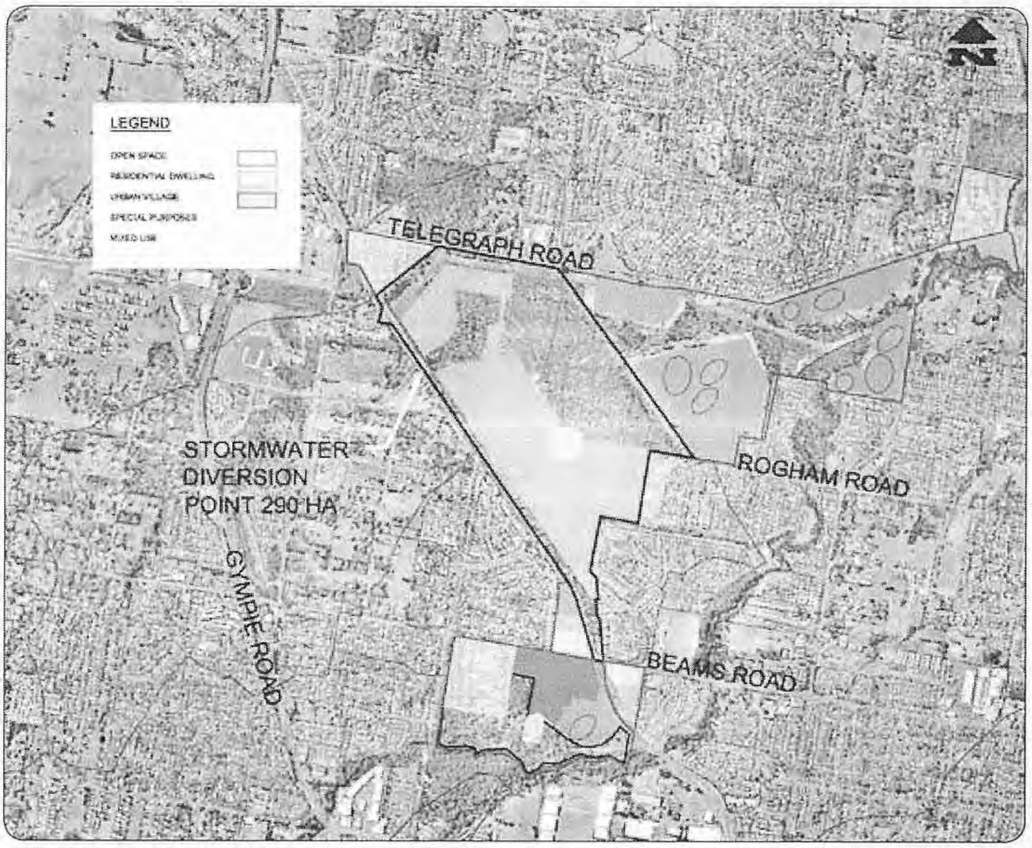
Fitzgibbon Chase

The Fitzgibbon Chase development is an innovative housing affordability initiative, combining recreational, cultural, education, business and medium-density residential development. The Urban Land Development Authority, in partnership with the QWC, is investigating whether a stormwater harvesting scheme could be constructed within the development.

The proposed Fitzgibbon Stormwater Harvesting (FiSH) scheme would divert urban stormwater run-off from an adjacent 290 hectare urban catchment, storing the water in a 5 megalitre urban lake. Stormwater would be treated and distributed to houses and units through a dual-reticulation system. Treated stormwater would be used for toilet flushing, cold laundry taps, garden irrigation and outdoor use.

The FiSH scheme would supply about 89 megalitres per year—about 84 per cent of the development's non-potable demand.



Fitzgibbon Chase stormwater harvesting catchment

4.6.3 Local recycling

Local recycling is an option to achieve the Queensland Development Code's water savings requirement for new dwellings. As with stormwater harvesting, local recycling is more appropriate for offsetting demand from larger scale greenfield industrial or residential developments rather than single properties or brownfield sites.

Apart from purified recycled water, other types of water recycling may provide additional water supplies for the region. Such recycling opportunities may involve:

- wastewater from a wastewater treatment plant that is not part of a purified recycled water scheme
- excess wastewater from a wastewater treatment plant that is surplus to the requirements for any local purified recycled water scheme
- water that is extracted from the sewerage system and treated locally
- greywater.

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A feature of recycled water is that the treatment process and water quality can be tailored to suit the use, optimising the capital and operating costs. Where treated wastewater is not fully upgraded to purified recycled water, it might still be of a suitable quality to be used for:

- agricultural applications such as irrigation
- parkland irrigation
- industry activities
- toilet flushing and outdoor irrigation in residential developments, through a dual-reticulation system.

The optimal type of recycling in a particular location, if any, will be considered as part of the total water cycle planning process outlined in Section 2.3. Sub-regional total water cycle plans will incorporate a receiving water load-based analysis, taking into account the costs and benefits of recycling and reuse across the study area. Local recycling will be a key consideration in the first sub-regional total water cycle plan for key growth areas in Logan City Council and Scenic Rim Regional Council areas.

Dual-reticulation recycled water schemes

Dual-reticulation recycled water schemes involve constructing separate distribution systems for drinking water and recycled water. In residential areas, the recycled water is plumbed to homes for flushing toilets and outdoor irrigation. Dual-reticulation recycled water schemes can result in a high percentage of recycled water reuse and potentially reduce the impact of any future water restrictions.

A permanent reduction in average outdoor water use could have a negative effect on the economic viability of dual reticulation recycled water schemes. The amount of water supplied would reduce without equivalent savings in terms of the cost of constructing and operating the scheme. As with stormwater, the viability of dual-reticulation systems need to be assessed based on the characteristics of a specific site.

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Pimpama Coomera WaterFutures Master Plan

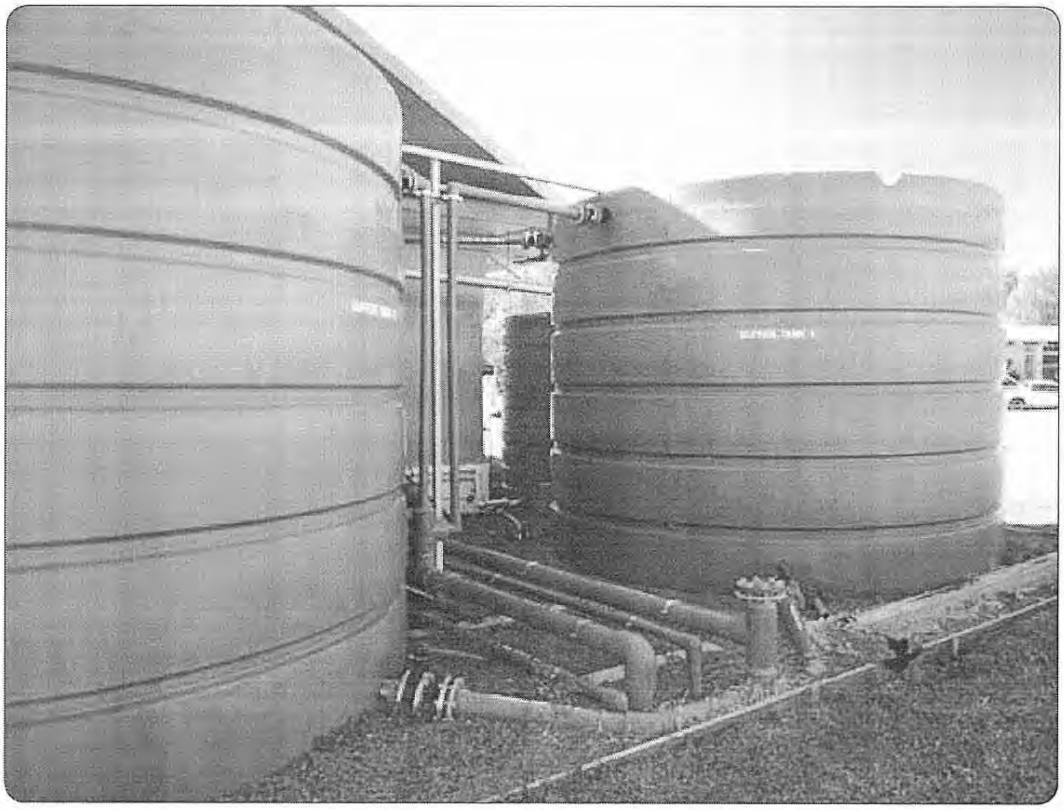
The suburbs of Pimpama and Coomera at the northern end of the Gold Coast are expected to grow from approximately 15 000 people to around 120 000 people by 2056[2]. The Pimpama Coomera WaterFutures Master Plan has been developed by the Gold Coast City Council and is the largest integrated water cycle management program in Australia.

The Master Plan aims to reduce the use of potable water in new homes by up to 84 per cent. Under the Master Plan, all new homes will be supplied with recycled water for toilet flushing and outdoor use. Rainwater tanks will be installed to supply washing machines.

Greywater systems and wastewater mining

Greywater systems can help to reduce demand for potable supplies. These must be carefully managed, due to potential health risks. The Queensland Government introduced new laws in March 2006 to broaden the use of greywater. Under this legislation, anybody is allowed to manually bucket greywater from the laundry and bathroom, or to connect a flexible hose to divert it from the washing machine to the garden. An application to the local government is required for more sophisticated systems, such as a diverter unit or treatment plant. Such systems must be installed by a plumber licensed in Queensland and must meet Australian standards.

Wastewater mining (where wastewater is pumped directly from the sewer, treated and used on-site) is a minor element of the Strategy, due to cost. With advances in technology, wastewater mining may become more economically viable and schemes may be developed where treated wastewater is available.



2 Source: http://www.goldcoastwater.com.au/t_gcw.aspx?PID=7994

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Chapter 5

South East Queensland's water supplies

This chapter describes existing and committed water supply sources for SEQ. It explains the yield of these sources using the Level of Service (LOS) approach outlined in Chapter 3, including the benefits of the SEQ Water Grid and the potential impact of climate change. It also describes the opportunities identified for future water supplies, including potential desalination and purified recycled water schemes, as well as surface water and groundwater opportunities.

Key messages

- The SEQ Water Grid is operational, including the desalination facility at Tugun, the Western Corridor Recycled Water Scheme and major interconnecting pipelines.
- A number of other projects are currently underway, including the Hinze Dam upgrade and the construction of Wyaralong Dam.
- Operating the SEQ Water Grid as a single system increases the system yield by about 14 per cent compared to a disconnected system.
- The desalination facility and Western Corridor Recycled Water Scheme provide security of supply as standby facilities. They do not need to be operated at capacity at all times.
- The projects currently underway, including the Western Corridor Recycled Water Scheme, will increase the LOS system yield to 525 000 megalitres per year of high reliability (Category A) water around 2011, rising over time to its maximum capacity of 545 000 megalitres per year .
- An additional 32 000 megalitres per year of recycled water is available for rural irrigation when not required for urban supply.
- The climate change scenario adopted for planning analysis would reduce the yield of surface water storages and groundwater supplies by 10 per cent.
- The Strategy will be revised at least every five years as information on climate change impacts, population growth and water demands improves.
- Based on existing technology and identified alternative water source options, desalination is currently the only practical supply to fill a regionally significant supply gap.
- Priority desalination sites have been confirmed at Lytton and Marcoola. Reserve sites are at Tugun and Bribie Island.
- There are limited opportunities to substantially increase supply by developing new dams in SEQ, beyond those already committed.
- Groundwater in the SEQ region is considered to be almost fully utilised.

5.1 Existing water sources

In August 2006, the Minister for Infrastructure and Planning introduced a range of measures in response to the Millennium Drought in SEQ, including the construction of major new water assets. The measures are set out in the Water Regulation 2002 (Part 8) (Emergency Regulation). This program includes about 20 infrastructure projects, ranging from the first purified recycled water scheme in Australia to a number of local groundwater schemes and SEQ's first desalination plant.

Construction of the projects set out in the Emergency Regulation is almost complete. This section describes the existing bulk water supplies and major interconnections in SEQ as at mid-2010.

Figure 5.1 shows the current bulk water supplies in the SEQ Water Grid. The major surface water sources are:

- the Brisbane River system, comprising the Wivenhoe and Somerset dams, Lake Manchester and the Mt Crosby Weir
- North Pine Dam
- Hinze and Little Nerang dams
- Baroon Pocket Dam.

Borumba, Moogerah and Maroon Dams supply significant quantities of irrigation water. Lake Dyer, Lake Clarendon and Atkinson Dam are small dams that have been constructed specifically to deliver irrigation supplies.

The Cedar Grove Weir and Bromelton Off-stream Storage were operational from July 2008 and are being used to enhance the performance of the Logan River Water Supply Scheme for current entitlement holders. From 2012, these supplies will be operated in conjunction with Wyaralong Dam (refer to Section 5.2).

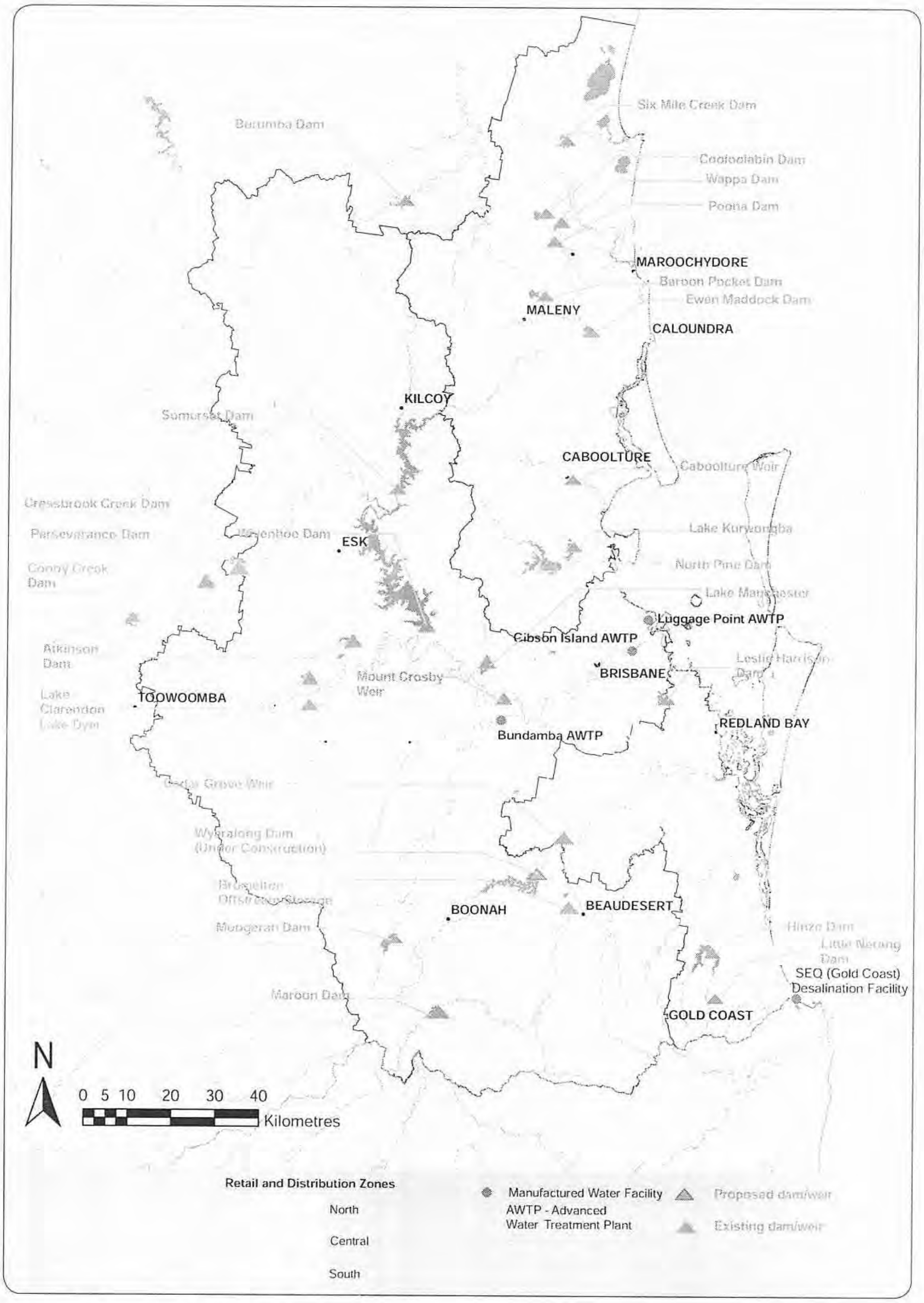

Figure 5.1 Existing bulk water supplies

Groundwater aquifers generally provide relatively high-quality water that, under the right circumstances, requires little treatment before use. In SEQ, water from groundwater aquifers currently supplies:

- significant quantities of drinking water to Bribie Island, Redlands, Toowoomba and some southern suburbs of Brisbane
- drinking water to small communities, such as those on North Stradbroke Island
- irrigation water to the Lockyer and Warrill valleys.

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Private bores provide small quantities of water, mainly for garden irrigation. On Tamborine Mountain, some residents use private bores for drinking water supplies.

Two major new climate resilient water supplies have been constructed as part of the response to the Millennium Drought, namely the Western Corridor Recycled Water Scheme and the SEQ (Gold Coast) Desalination Facility, located at Tugun.

The Western Corridor Recycled Water Scheme is now the primary source of supply for water being taken from the SEQ Water Grid to the Swanbank, Tarong and Tarong North power stations. If insufficient purified recycled water is available for the power stations, backup supplies can be sourced from Moogerah Dam and the Brisbane River system. The Tarong Power Station also obtains supplies from Boondooma Dam, which is outside the SEQ Water Grid.

Cressbrook Creek, Perseverance and Cooby Creek dams supply water to Toowoomba and are owned by Toowoomba Regional Council. These dams, and the council-owned groundwater schemes, are not part of the SEQ Water Grid.

Bulk water interconnections

Bulk water interconnections are a key feature of the SEQ Water Grid and are at the core of future water security for the region.

Prior to the Millennium Drought, SEQ was supplied from eight largely discrete water supply zones, with differing levels of security and reliability and, until 2008, different owners and operators. Due to the lack of connection, restrictions were applied in some parts of the region while dams in other parts were full or overflowing. For instance, the Gold Coast experienced a severe drought in 2002, resulting in severe restrictions as well as plans to construct a pipeline from Brisbane. A few years later, while dams on the Gold Coast were overflowing, Brisbane was experiencing the most severe drought on record with the lowest recorded inflow into water storages.

Following the completion of most of the Emergency Regulation projects, there are now bulk water interconnections between most of the region's major water treatment plants. Figure 5.2 shows the new grid of interconnecting pipelines, featuring:

- the Southern Regional Water Pipeline, two-way between Brisbane and the Gold Coast
- the Eastern Pipeline Inter-connector, two-way between Redlands and Logan
- the Northern Pipeline Inter-connector Stage 1, between the Sunshine Coast at Caloundra and Brisbane.

These interconnections enable the coordinated management of treated water supplies across SEQ, allowing:

- water to be moved from areas of surplus to areas that face a shortfall
- risk to be managed on a regional level, rather than on an individual storage or system basis
- supply costs to be optimised, taking into account a range of factors including demand, storage levels and the variable costs of treating and transporting water.

In addition, a 38-kilometre pipeline connecting Wivenhoe Dam to Cressbrook Creek Dam has been completed. The pipeline became operational in January 2010, initially providing the capacity to supply up to 10 000 megalitres per year of untreated water to Toowoomba.

5.2 Projects currently underway

A range of catchment management works will soon be undertaken throughout the Logan River Basin. These works will be integrated with a total water cycle management plan for the Logan and Beaudesert areas, which seeks to optimise the overall outcomes for water supply, waterway health and wastewater management. The total water cycle management plans will incorporate the other projects currently underway, which are detailed below.

Wyaralong Dam is scheduled for completion by the end of 2011. Detailed planning of the Wyaralong water treatment plant is being led by a joint Seqwater—Department of Infrastructure and Planning project team. This planning will provide an accurate assessment of the construction timeframes and costs for the water treatment plant. In the latter half of 2010, the QWC will make a recommendation to the Queensland Government on overall timeframe for the water treatment plant based on the regional water balance and the construction timeframes and costs. The goal is to ensure that the water treatment plant is available to meet growth in demand in the most cost-efficient way.

Planning and preliminary design works have commenced for two interconnecting pipes to bring water from the Logan River system (Cedar Grove Weir, Bromelton Off-stream Storage and Wyaralong Dam) into the SEQ Water Grid. These are:

- the Cedar Grove Connector, from the proposed Wyaralong water treatment plant to the Southern Regional Water Pipeline
- the Karawatha Inter-connector, from the Southern Regional Water Pipeline to Kuraby in Brisbane.

The pipelines will enhance the operating flexibility of the SEQ Water Grid by allowing water to be transferred from the Logan River system into the Brisbane area, Beaudesert and parts of the Logan City Council area.

The Cedar Grove Connector is expected to be built at the same time as Stage 1 of the Wyaralong water treatment plant, to connect to the SEQ Water Grid. The Karawatha Inter-connector will be built, if required, to improve the operational efficiency of the SEQ Water Grid.

Work is progressing on Hinze Dam Stage 3, which is scheduled to be completed by December 2010. This involves raising the dam wall by 15 metres, which will increase water supply from Hinze Dam by at least 6000 megalitres per year and provide additional flood mitigation for downstream communities.

The Northern Pipeline Inter-connector Stage 2 will provide a two-way connection within the Sunshine Coast. As part of the project, reverse flow capacity will also be installed onto the Stage 1 Inter-connector. The project is scheduled to be completed by the end of 2011.

The Northern Pipeline Inter-connector Stages 1 and 2 will ensure that the same level of security can be provided to the Sunshine Coast as to the rest of SEQ. Without connection to the remainder of the SEQ Water Grid, dams on the Sunshine Coast would remain vulnerable to severe drought. Although usually reliable, these dams are relatively small, with a storage-to-yield ratio of less than half that of the Brisbane River system. As a result, drought response plans for the Sunshine Coast region, as a stand-alone system, would need the ability to be implemented within a relatively short period of time—less than 18 months. By comparison, a desalination facility requires at least three years to construct; although this time might be shortened by pre-planning for a preferred site, it would be unlikely to be shortened by more than about six months.

The Northern Pipeline Inter-connector Stages 1 and 2 will also ensure that adequate supplies are maintained in normal conditions, regardless of the location and timing of the next supply on the Sunshine Coast. Without the pipeline, an additional supply capacity of between 10 000 and 40 000 megalitres per year would have been required for this area by 2026, depending on population growth and the extent to which average consumption remained below pre-drought trends.

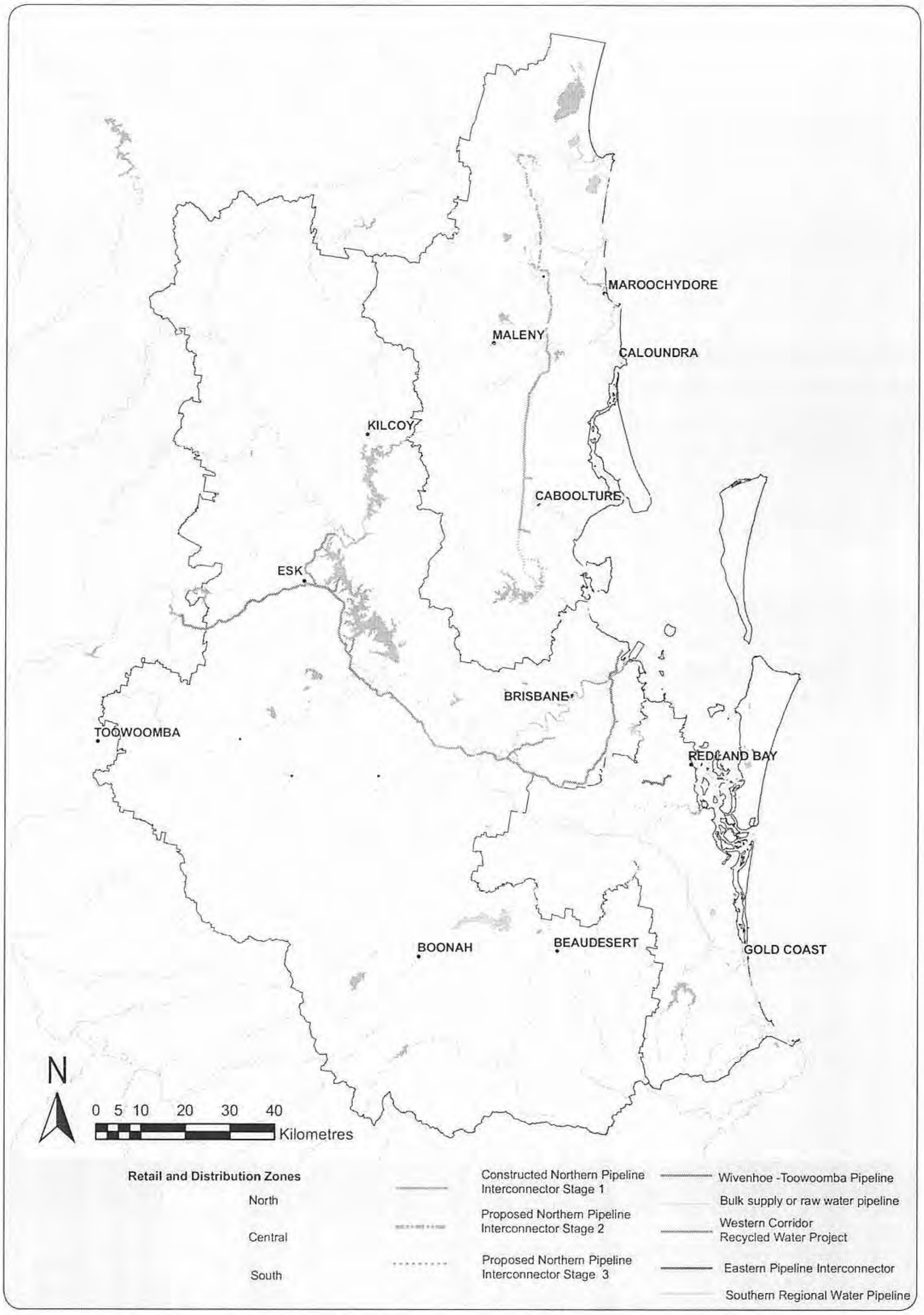

Figure 5.2 SEQ Water Grid interconnections

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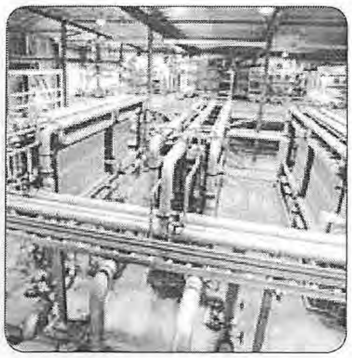
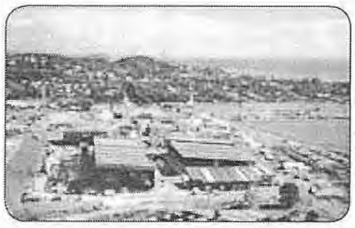
Major projects

Western Corridor Recycled Water Scheme



The Western Corridor Recycled Water Scheme is one of the largest purified recycled water schemes in the world. It has the capacity to supply up to 84 680 megalitres per year of high-quality water to power stations and industry, and to replenish Wivenhoe Dam. Water is also available for supply to irrigators in the Lockyer Valley and below Wivenhoe Dam when not required for urban purposes.

The Western Corridor Recycled Water Scheme comprises three advanced water treatment plants at Luggage Point, Gibson Island and Bundamba that treat wastewater from six wastewater treatment plants. The project was completed in 2008.



South East Queensland (Gold Coast) Desalination Facility

Construction of the SEQ (Gold Coast) Desalination Facility at Tugun was completed in early 2009. The plant has the capacity to supply 46 000 megalitres per year of water into the SEQ Water Grid.

Logan River system

The Cedar Grove Weir and Bromelton Off-stream Storage were completed in December 2007 and July 2008 respectively. The storages are currently releasing water for treatment at South Maclean Weir and supply to areas between Cedar Grove and Logan City.

The Wyaralong Dam is scheduled for completion before the end of 2011. This dam will be operated in conjunction with the Bromelton Off-stream Storage and the Cedar Grove Weir. The three storages are all located in the Logan River catchment. When operated together, the projects will be able to supply more than 30 000 megalitres per year to SEQ.

Interconnections

The SEQ Water Grid is made up of a group of water supply sources connected by a series of large water pipelines.

The key interconnecting pipelines are the:

- the Northern Pipeline Inter-connector between the Sunshine Coast and Brisbane
- the Southern Regional Water Pipeline between the desalination plant at Tugun and Mt Crosby
- the Eastern Pipeline Inter-connector between the Heinemann Road reservoir in Redlands and the Kimberley Park Reservoir in Logan.

The Northern Pipeline Inter-connector Stage 1, Southern Regional Water Pipeline and Eastern Pipeline Inter-connector are all complete and operational. The Northern Pipeline Inter-connector Stage 2 is due for completion in 2011.

The Toowoomba pipeline, between Wivenhoe and Cressbrook Creek dams, became operational in January 2010.

5.3 System yield

The maximum amount of water permitted to be extracted from existing surface and groundwater supplies in SEQ has been established through water resource plans. These plans are implemented through resource operations plans, which have been completed for all SEQ catchments except the Mary River. The resource operations plans specify the operating rules for all dams and weirs. These processes are explained in Chapter 2.

The water resource plans allocate about 530 000 megalitres per year of water from existing major sources of supply for urban use in SEQ. Some 525 000 megalitres per year has been allocated for communities physically attached to the SEQ Water Grid, with the remaining approximately 5000 megalitres per year supplying communities with stand-alone sources of supply. These allocations have differing levels of reliability, and were commonly determined using the Historical No Failure Yield approach without a contingency for drought worse than anything on record.

The Strategy seeks to improve the security of supply in SEQ. One of the means of achieving this has been to apply the LOS approach to assessment of system yield, as described in Chapter 3. By applying the LOS objectives selected for SEQ, less water will be used for urban purposes than is permitted under water resource planning.

The QWC will continue its storage yield investigations, researching the effects of infrastructure operations on evaporative losses, as well as evaluating physical evaporative options.

Operating the SEQ Water Grid

The SEQ Water Grid Manager directs the operation of the SEQ Water Grid, in accordance with the rules described in the SEQ System Operating Plan.

The SEQ System Operating Plan is designed to help achieve the LOS objectives for the region. It guides the SEQ Water Grid Manager in the operation of the SEQ Water Grid. The SEQ System Operating Plan balances the need to maximise water supply security with the need for least-cost operation. It will allow for the take of water from specific sources to vary over time depending on a range of factors, including inflows to dams, operating costs and risk management. The SEQ System Operating Plan is available on the QWC website.

5.3.1 Yield of existing sources and projects currently underway

The LOS system yield will increase from about 485 000 megalitres per year in 2009 to about 525 000 megalitres per year of high priority (Category A) water in 2011, following completion of committed projects. This yield will further increase over time to 545 000 megalitres per year as the Western Corridor Recycled Water Scheme reaches full capacity. Industrial use of purified recycled water will also increase over time.

An additional 32 000 megalitres per year of recycled water is available from the Western Corridor Recycled Water Scheme for rural irrigation (Category B). These Category B supplies will be diverted to Wivenhoe Dam in the event that SEQ Water Grid storage levels decline to 40 per cent of storage capacity. Category B supplies depend on commercial negotiation and could increase over time to about 37 000 megalitres per year, depending on urban demands and increases in wastewater supply to feed the Western Corridor Recycled Water Scheme.

Purified recycled water supplied from the Western Corridor Recycled Water Scheme to the power stations and other industrial users is considered as high priority (Category A) use and is included in the LOS system yield of 545 000 megalitres per year, as these uses would otherwise need to be supplied from other high reliability supplies.

The total combined system yield at 2011 is 553 000 megalitres per year (Categories A and B), increasing to 584 000 megalitres per year over time as the Western Corridor Recycled Water Scheme reaches full capacity.

Depending on the drawdown of sources in the interconnected SEQ Water Grid, there are many alternative scenarios that can achieve the LOS system yield of 545 000 megalitres per year of Category A supplies. Table 5.1 presents an average supply scenario using the existing and committed water sources. It includes the benefit of operating the SEQ Water Grid as a system. The actual amount extracted from any specific source will vary from year to year depending on climate patterns and other influences.

Table 5.1 Supply from existing and committed sources to obtain SEQ LOS system yield

System	Urban allocation (Megalitres per year)[1]	Average contribution to LOS yield (Megalitres per year)	Storage volume (Megalitres)	Minimum operating volumes (Megalitres)
Dams and weirs				
Mary Basin Water Resource Plan area				
Baroon Pocket Dam	36 495	21 900	61 000	4 500
South Maroochy system (Cooloolabin, Wappa, Poona dams)	16 500	7 800	19 470	570
Ewen Maddock Dam	4 315[2]	2 300	16 700	450
Lake Macdonald	3 500	3 300	8 000	800
Borumba Dam	10 144	5 300	46 000	510
Moreton Water Resource Plan area				
Brisbane River system (Wivenhoe, Somerset and Gold Creek dams, Lake Manchester, and Mt Crosby Weir)	285 545	256 300	1 574 650	13 840
Enoggera Dam	1 700	900	4 500	10
North Pine Dam	59 000	33 700	215 000	2 100
Lake Kurwongbah	7 000	3 200	14 370	~ 500
Caboolture Weir	3 600	3 600	1 300	130
Moogerah Dam	890	800	83 700	1200
Toowoomba Pipeline		10 000		
Logan Basin Water Resource Plan area				
Leslie Harrison Dam	7 640[3]	4 300	24 800	2340
Logan River system (Maroon Dam, Cedar Grove Weir, Wyaralong Dam, Bromelton off-stream storage)	19 856 (+ ~ 25 000[4])	36 900	157 140	19 500
Gold Coast Water Resource Plan area				
Hinze Dam	76 300 (+ ~ 7 700[5])	56 300	161 070	2180
Little Nerang Dam			8 400	200
Total dams and weirs	**532 485 (+ ~ 32 700)**	**446 600**	**2 396 100**	**~ 48 830**
Groundwater[6]				
Bribie Island		8 400		
Brisbane aquifers (Algester, Chandler, Forest Lake, Sunnybank, Runcorn)		-[7]		
North Stradbroke Island		9 000		
Total groundwater		**17 400**		
Manufactured water				
SEQ (Gold Coast) Desalination Facility	46 000	46 000[8]		
Western Corridor Recycled Water Scheme	84 680	35 000[9]		
Total manufactured water	**130 680**	**81 000**		
LOS system yield		545 000		

1 Sourced from existing resource operations plans, interim resource operations licences and preparatory information associated with current operating plan development.

2 When the Mary Basin Resource Operations Plan, is released, it is expected to include a licence for taking water from Addlington Creek for 2900 megalitres per year and a licence to take water from the Mooloolah River for 1415 megalitres per year.

3 Expected volume to be included in the final Logan Basin Resource Operations Plan, based on calculations by SunWater.

4 Bracketed values indicate anticipated allocations to be associated with Wyaralong Dam.

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5 Bracketed values indicate anticipated allocations to be associated with the Hinze Dam upgrade.

6 Groundwater entitlements are estimated average water take.

7 The sustainable take of these aquifers is currently being determined. A conservative approach has been taken and the yield has been excluded from the calculation of LOS system yield.

8 The desalination facility also increases the LOS system yield by providing the security to take more water from dams. These increases have been included in the take from dams.

9 Supply for high priority (Category A) uses only, including supply to power stations and industry. In normal operating mode, the Western Corridor Recycled Water Scheme also increases the LOS system yield by providing the security to take more water from dams. These increases have been included in the take from dams.

Table 5.1 also highlights some of the differences between SEQ's dams. Without being connected to the SEQ Water Grid, dynamic smaller coastal storages, such as Baroon Pocket Dam, would be vulnerable to severe drought—particularly as the demand approaches the LOS system yield. These dams have high yield-to-storage volume ratios, meaning that the time available to respond to a water crisis would be short.

Figure 5.3 illustrates LOS system yield over time as the projects currently underway are completed and commissioned. It also illustrates the Category B and combined yield.

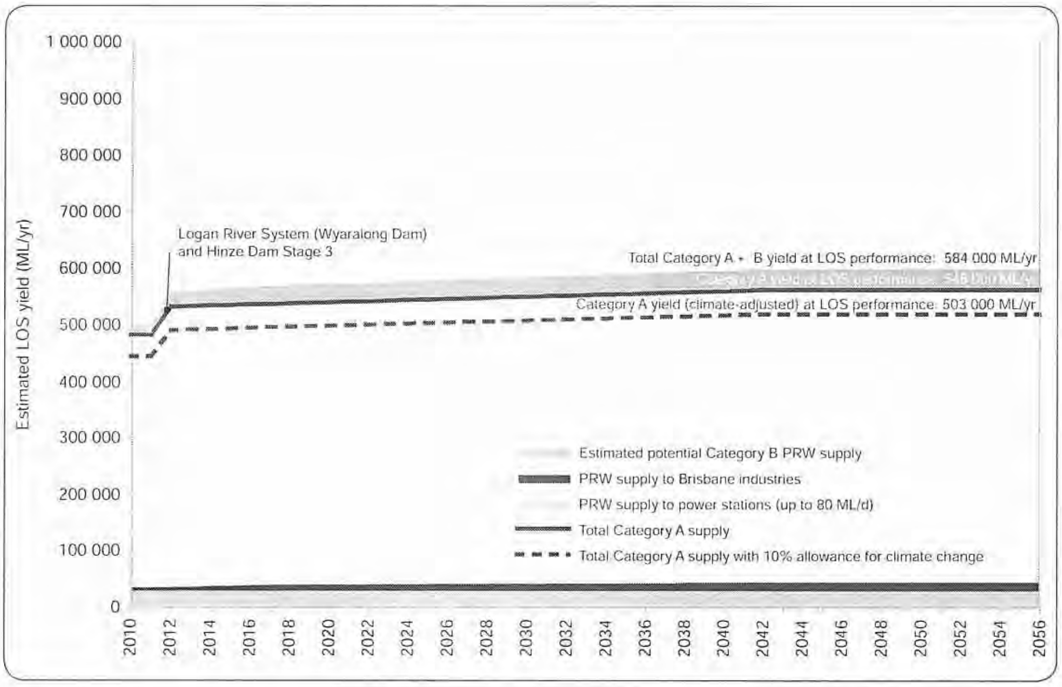

Figure 5.3 System yield of existing and committed infrastructure

Figure 5.4 shows the composition of supplies from the SEQ Water Grid following completion of the committed projects when fully utilised. By comparison, prior to the construction of the SEQ Water Grid, 95 per cent of the region's water supplies were sourced from dams and weirs. The Western Corridor Recycled Water Scheme is included at capacity.

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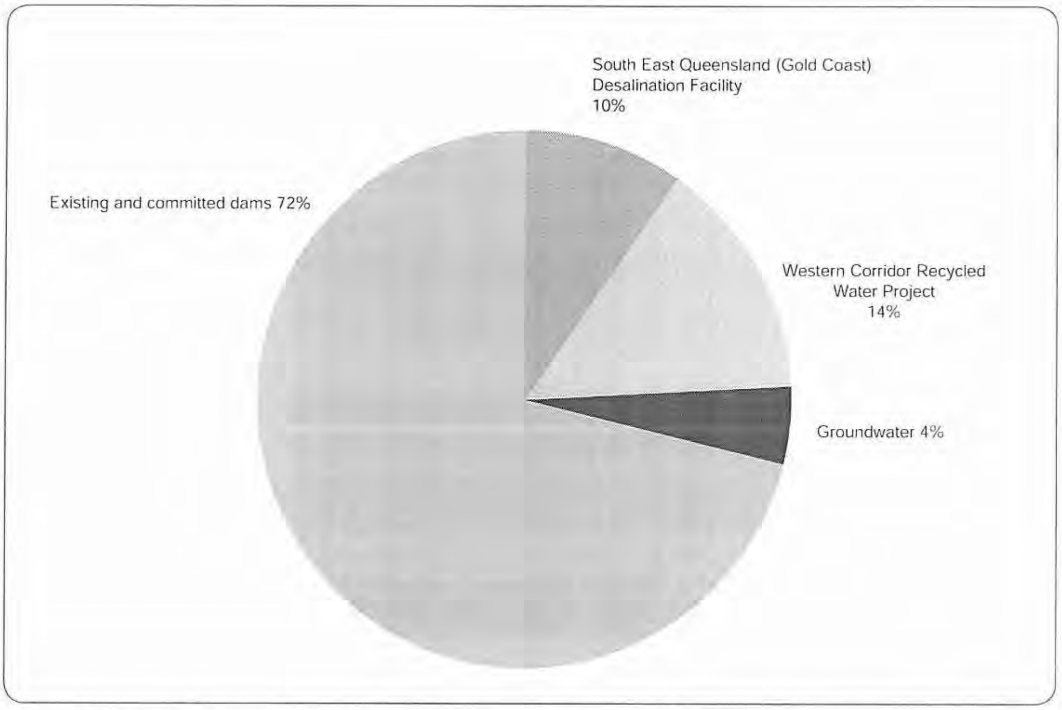

Figure 5.4 Supply distribution from existing and committed infrastructure in 2012

Figure 5.5 illustrates the impact of the LOS system yield on the level of key Water Grid storages using recorded inflows. The analysis is for existing infrastructure and committed projects,where demand equals the LOS system yield and the SEQ Water Grid is operated at capacity. In this scenario, over the past 100 years, restrictions would only have been triggered twice and preparations for constructing new drought-response infrastructure commenced once, as a response to the Millennium Drought. As described in Section 6.1, demand is forecast to equal supply between 2021 and 2033.

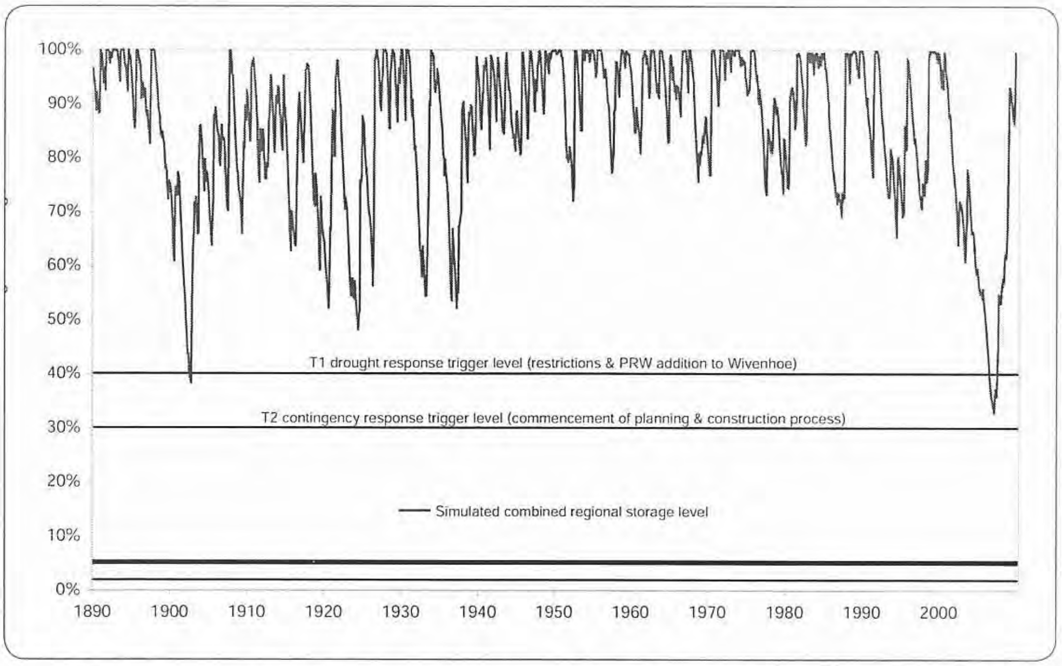

Figure 5.5 Simulated SEQ Water Grid levels based on historic inflows and operation at LOS system yield

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Interconnection and diversification benefits of the SEQ Water Grid

An interconnected and diversified SEQ Water Grid increases the LOS system yield above the combined LOS yields of the discrete water supply systems.

Benefits of interconnection

The benefits of interconnection come about because local demands do not need to be met exclusively by local supplies. Likewise, any excess water in a local system can be diverted to supply other areas, rather than be lost as overflow or spill from a dam.

Further benefits can be realised through the cooperative operation of infrastructure that harvests and stores water, and thereby maximises system yield.

Modelling of the regional water balance in two different modes—connected and disconnected—has determined that if the sources of supply existing in 2006 were operated as a connected SEQ Water Grid, there would have been an estimated increase in the system yield of about 14 per cent.

Benefits of diversification

A dam operated in conjunction with a desalination facility or purified recycled water scheme has the potential to yield a greater supply than the same dam operated in isolation.

Desalination facilities and purified recycled water schemes can deliver these benefits as standby facilities—increasing the amount that can be taken from dams when storage levels are high. This mode of operation reduces operating costs and energy consumption.

Purified recycled water will be available to augment Wivenhoe Dam in severe drought, extending the period before drought response infrastructure is needed. The Western Corridor Recycled Water Scheme does not need to be used to augment Wivenhoe Dam at all times, which means that the water can be made available to irrigators on an interruptible basis without affecting the security of supply for urban users.

Without the benefit of the Western Corridor Recycled Water Scheme (WCRWS) introducing purified recycled water into Wivenhoe Dam when the combined key storages fall to 40 per cent of total capacity, the system yield would reduce from 545 000 megalitres per year to about 445 000 megalitres per year (refer to Figure 5.6a).

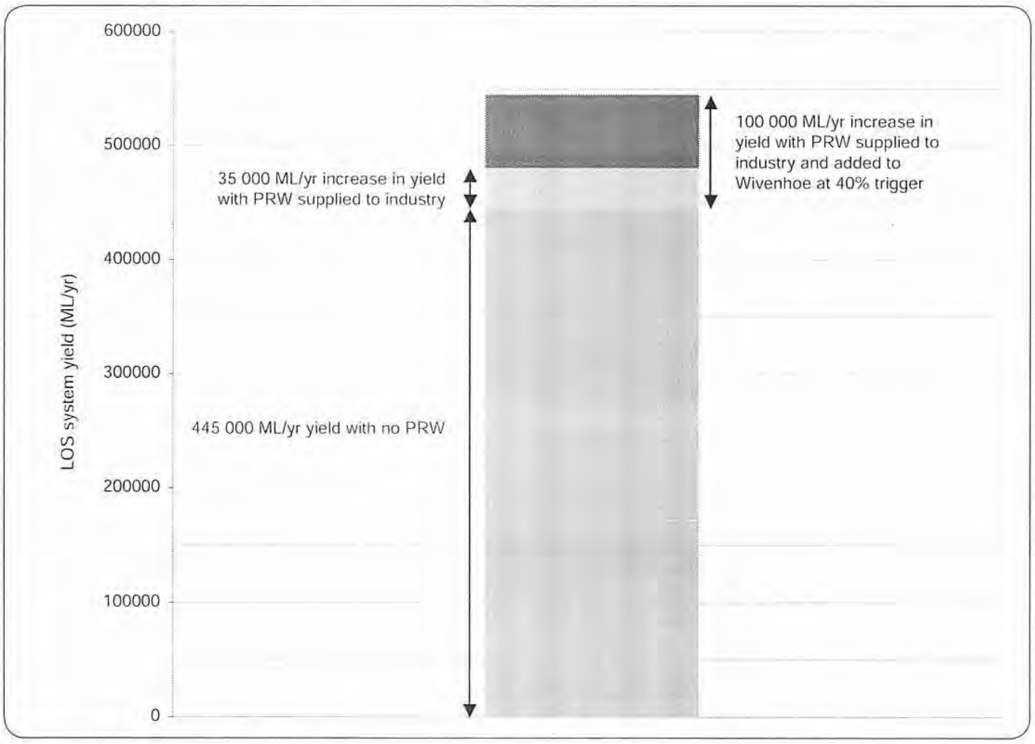

Figure 5.6a Standby value of PRW into Wivenhoe Dam

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Using purified recycled water to augment Wivenhoe Dam only when key Water Grid storages fall to 40 per cent of capacity reflects an optimal operating strategy at this time. Using purified recycled water to augment the dam more frequently would have a relatively small impact on the system yield, while significantly increasing our operating costs. It would defer the need for the next major source of supply by up to about 18 months. Figure 5.6 illustrates the impact of varying the trigger level on LOS system yield.

However, when dam levels drop below the 40 per cent trigger point, it is vital that purified recycled water is introduced to Wivenhoe Dam to ensure that LOS is maintained. Figure 5.6b shows that reducing the trigger point would have a relatively significant impact on the LOS system yield.

The impact of varying the trigger depends on the volume of purified recycled water that is supplied directly to power stations, industry and new residential developments, as illustrated in Figure 5.6. The Strategy is based on purified recycled water directly supplying about 35 000 megalitres per year for urban uses including power stations. Higher levels of substitution would increase the LOS system yield and defer augmentation of bulk water supplies.

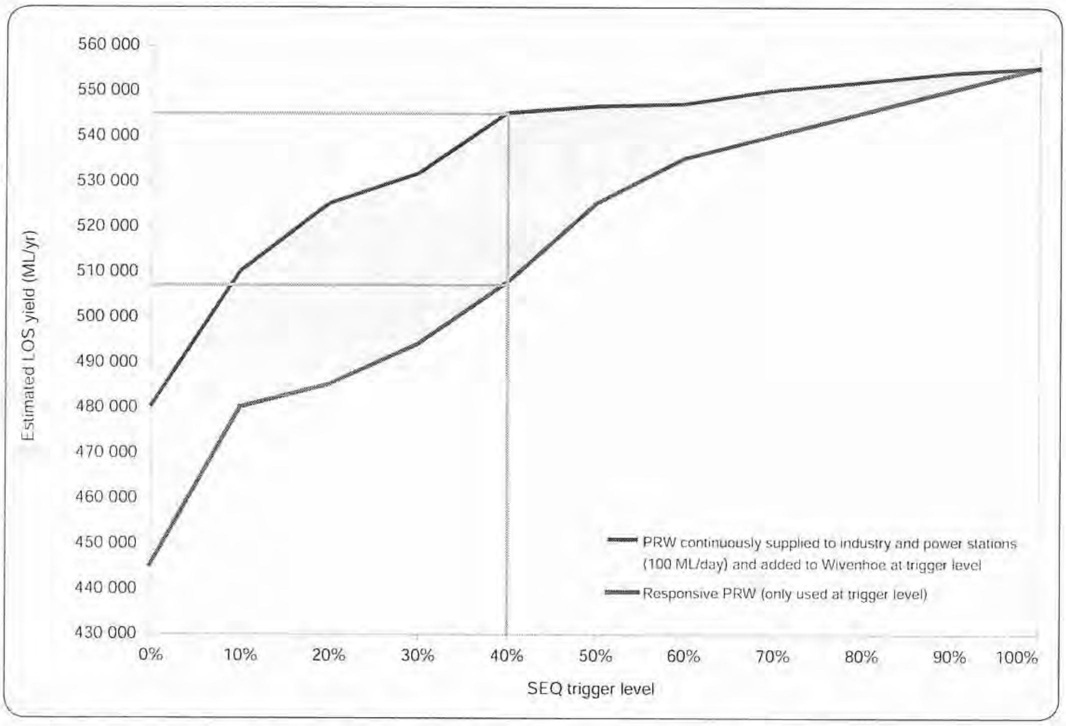

Figure 5.6b Impact of varying the trigger for augmenting Wivenhoe Dam

5.3.2 Potential impacts of climate change

A scenario analysis has been undertaken assuming a 10 per cent reduction in the LOS system yield of surface storages across SEQ due to climate change.

When this climate change scenario is applied, the LOS system yield, including committed infrastructure and the benefits of establishing and operating the SEQ Water Grid, is estimated to reduce from 545 000 megalitres per year to 503 000 megalitres per year. This is shown in Figure 5.3. The system yield in times of drought is discussed in Section 5.3.3.

Case studies have been undertaken for the catchment areas in the western parts of SEQ, as explained in Section 5.3.3. These case studies indicated that changes to annual rainfall could result in annual stream flow for the Brisbane River downstream of Mt Crosby Weir reducing by up to 28 per cent in a dry scenario or increasing by up to 14 per cent in a wet scenario. A preliminary analysis indicates that the upper limit of predicted reduced annual inflows of 28 per cent would result in approximately a 17 per cent reduction in the yield of the system, operating in isolation.

Ongoing work is being undertaken to refine climate impact assessments across the whole of SEQ (refer to Section 3.2). As climate change is unlikely to have a significant impact on supplies in the near future, until this work is completed portfolios for new infrastructure will not include climate change impacts (refer to Section 6.4). However, construction of new infrastructure will be brought forward if evidence of a reduction in yield emerges or if a severe drought triggers the need to construct additional climate resilient or climate independent supplies as part of a drought response plan.

5.3.3 Climate independent and climate resilient supplies

Climate independent and climate resilient water supplies include:

- desalinated water
- recycled water
- the component of inflows to dams that can be relied on under extended and severe drought conditions
- extractions from groundwater aquifers that can be relied on under extended and severe drought conditions.

Producing drinking water from a desalination plant does not depend on the weather. By comparison, producing purified recycled water could be affected by the weather if water restrictions were introduced and access to wastewater was limited. However, at the targeted reduction in demand of 15 per cent in future droughts, Medium Level Restrictions would be highly unlikely to significantly reduce the yield of the Western Corridor Recycled Water Scheme.

Calculating the climate resilient supplies available from dams and aquifers depends on the selection of an appropriate inflow sequence to represent an extended or severe drought. This is discussed in detail in Section 3.1.6. The climate resilient water supplies in the region have been calculated based on the adopted drought inflow sequence. The yields are presented in Table 5.2.

Table 5.2 Climate independent and climate resilient supplies from existing and committed sources

Water supply source	Climate independent and climate resilient yield (Megalitres per year) in severe drought	Indicative contribution to LOS yield (Megalitres per year) in normal times
SEQ surface and groundwater		
• Northern SEQ		89 500
• Central SEQ		268 000
• Southern SEQ		106 500
Subtotal	*220 000*	*464 000*
SEQ (Gold Coast) Desalination Facility	46 000	46 000[1]
Western Corridor Recycled Water Scheme	84 680[2]	35 000[1]
Total	**350 680**	**545 000**

1 Supply to high priority (Category A) uses. The desalination facility and Western Corridor Recycled Water Scheme also increase the LOS system yield by providing the security to take more water from dams. This benefit has been included in the yield from surface water.

2 Assumes that sufficient treated effluent will be available to operate at capacity. Treated effluent flows will increase over time due to population growth. Alternatively, flows could be increased by transferring treated effluent from Loganholme to Gibson Island.

Following the completion of the committed projects, climate resilient and climate independent supplies are forecast to increase to about 331 700 megalitres per year in 2012. These supplies will comprise about 63 per cent of LOS system yield at that time. Climate resilient supplies will increase to 350 700 when the Western Corridor Recycled Water Scheme reaches capacity. The volume of available climate resilient yields in the region is critical to the calculation of the drought storage reserve and the T1 and T2 triggers (as described in Section 3.1.6).

The QWC is investigating options to enable the Western Corridor Recycled Water Scheme to operate at capacity should a drought occur in the short to medium term. Options under investigation include:

- diverting additional wastewater into the catchment of the Gibson Island wastewater treatment plant
- transferring treated effluent from the Loganholme wastewater treatment plant to the Gibson Island advanced water treatment plant.

These options would reduce treated effluent discharges to the Logan River, contributing to improved waterway health.

5.4 Potential future water sources

It is important that the best supply options and pipeline routes are preserved now to prevent inappropriate development on or near the sites and to enable a timely and well-informed response to demand growth and future droughts.

The following categories of potential water supply sources have been considered in developing the Strategy:

- desalination
- dams and weirs
- stormwater harvesting to dams
- purified recycled water
- groundwater
- water trading
- supplies outside SEQ.

Rainwater, stormwater and other types of recycling are addressed in Section 4.6, as opportunities to reduce demand for SEQ Water Grid water.

5.4.1 Desalination

Water supply by desalination became part of the SEQ Water Grid in early 2009, when the SEQ (Gold Coast) Desalination Facility commenced operation.

New desalination plants present an option for additional climate independent supplies. Preserving sites where future supply sources might be required is good planning to ensure that we are ready to respond to future droughts that might occur.

How does desalination work?

There are two widely applied and commercially proven desalination technologies—thermal (evaporative) and membrane-based (reverse osmosis). Thermal desalination involves boiling water and condensing the vapour, leaving the impurities behind. Membrane-based desalination involves forcing water at very high pressure through a semi-permeable membrane. Impurities are too large to fit through the pores of the membrane.

Historically, thermal methods have dominated the desalination market. Thermal desalination requires more energy than membrane-based methods, but tends to be more robust. Thermal methods can accept variable feed quality, while reverse osmosis usually requires extensive pre-treatment.

Desalination by reverse osmosis is now the most common process, following recent advances in membrane technology. Reverse osmosis is being used in all major desalination plants in Australia, including at Tugun.

The Queensland Government has announced priority sites for potential future desalination sites in SEQ at Lytton and Marcoola. Table 5.3 lists the site details.

Reserve sites have been identified at Bribie Island and at Tugun. At Tugun, duplication of the facility could be over land currently occupied by a wastewater pumping facility and landfill waste site. Triplication into the sporting fields to the north of the site has been excluded from further investigation. Table 5.3 lists the site details.

Table 5.3 Priority and reserve desalination sites

Category	Site	Property description	Owner
Priority	Lytton	Lot 49 SP193294	State of Queensland
	Marcoola	Lot 753 CG3375	Sunshine Coast Regional Council
Reserve	Tugun (duplication of existing facility)	Lot 30 SP197355	Gold Coast City Council / State of Queensland
	Bribie Island	Lot 67 SP214143	State of Queensland

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Alternative sites were investigated at Brisbane Airport and Fisherman Islands. These sites were found to be viable, but are currently not available for development and are therefore not considered to warrant preservation. The current preferred site at the mouth of the Brisbane River would be reviewed, if either of the Brisbane Airport or Fisherman Islands sites becomes available for development prior to significant investment in early works and early construction on the Lytton site.

Technological advances could improve the viability of some sites in the future. Reviews will also take into account population growth and augmentations of the SEQ Water Grid, which might affect where future supplies are required.

Due to environmental considerations the Kawana and North and South Stradbroke Island sites, which were identified in the draft Strategy, have been excluded from any further consideration.

Phase 1 and Phase 2 detailed investigations

Detailed site investigations were undertaken in two phases between 2006 and 2009.

The first phase involved several rounds of investigations by consultants, and identified six potential sites. The QWC considered potential sites along the coastal strip from the New South Wales border to Noosa, including the islands of Moreton Bay and the tidal parts of major rivers, particularly the Brisbane River. Information from previous Gold Coast and Sunshine Coast desalination siting studies was incorporated into the review. The investigations highlighted that opportunities for locating additional desalination facilities in SEQ are limited. The key constraints were the shallow protected areas of Moreton Bay and the extent of urban development and conservation areas along the Sunshine Coast and Gold Coast.

Through consultation on the draft Strategy, additional sites were identified by landholders at:

- Brisbane Airport, on Commonwealth land leased by the Brisbane Airport Corporation
- Fisherman Islands, on Port of Brisbane Corporation land.

The option of expanding the SEQ (Gold Coast) Desalination Facility at Tugun was also considered.

The second phase of investigations was conducted during 2008 and 2009 for the nine potential sites identified in initial investigations and during subsequent consultation. The second phase involved:

- identification of potential environmental and social issues
- engineering pre-feasibility studies to determine the full extent of works required
- preliminary economic assessment of capital and operating costs
- further brine dispersion modelling and mapping of ecologically significant areas in Moreton Bay
- a pre-feasibility study for the expansion of the SEQ (Gold Coast) Desalination Facility
- investigation into potential airport operation issues at the Sunshine Coast Airport.

The priority and reserve sites were selected based on regional water balance considerations and detailed site investigations. In relation to the regional water balance, the sites were selected to:

- potentially accommodate desalination facilities with a combined capacity in excess of 1000 megalitres per day, being the potential supply gap at 2056
- maintain diversity in the location of sites within SEQ.

Phase 1 and 2 reports are available on the QWC website.

Desalination site assessments

The priority and reserve sites are the best available desalination sites in SEQ. A number of issues need to be addressed in further detailed planning for each site.

Northern sub-region

Marcoola is the priority site in northern SEQ. Bribie Island is a reserve site.

The Marcoola site was selected as the priority site in northern SEQ due to lesser environmental impacts, lower costs and fewer construction and operational issues.

Marcoola

The Marcoola site is former cane land, devoid of significant vegetation or permanent structures.

The site is adjacent to the proposed second runway for the Sunshine Coast Airport. Advice indicates that operational issues due to the proximity of the two sites are manageable.

Connecting infrastructure must traverse a strip of Mt Coolum National Park to the east of the site. The impact of construction is likely to be minimised by less invasive construction techniques and thorough site rehabilitation once construction is complete. This matter will be addressed as part of Phase 3 detailed planning.

Bribie Island

Bribie Island is a reserve site. While it is one of the best sites in SEQ, a range of issues would need to be addressed as part of detailed planning.

Bribie Island National Park surrounds most of the land parcel containing the proposed site. To access the sea, pipelines would need to traverse a section of the national park that is also part of the Moreton Bay Marine Park, which is a listed Ramsar Wetland.

The pipelines to transport product water from the desalination facility to the SEQ Water Grid would traverse Pumicestone Passage. The passage is recognised on the directory of important wetlands and is zoned Conservation Park under the Moreton Bay Marine Park. Tunnelling could be required in order to avoid unacceptable impacts, increasing the cost of the project.

Power supply to the Bribie Island site would be more expensive than for Marcoola and traffic would need to be managed during construction, particularly around the bridge.

Central sub-region

In the central sub-region, Lytton is a priority site. This designation might be reviewed if and when the alternatives become available for development. If not already developed, the Lytton site could be immediately released for industrial development. Brine dispersion is a key consideration for all sites at the mouth of the Brisbane River.

Lytton

The Lytton site is currently industrial land. No significant constraints exist on the site that would inhibit the construction of a desalination plant.

Brisbane Airport

The site nominated at the Brisbane Airport could be considered as an alternative to the Lytton site. The site is relatively free from environmental constraints. Subject to airport master planning, it could become available after completion of the parallel runway, which is currently scheduled for 2018.

Fisherman Islands

The Fisherman Islands site lies within an operational rail loop at the port. The site is not currently available. In order to develop the site, a planned expansion of the rail loop would need to be completed. Significant ground preparation works would also be required. The Brisbane Airport site is a superior option.

Southern sub-region

No priority sites have been designated in southern SEQ. The reserve site in this sub-region is for a duplication of the existing desalination facility at Tugun.

Duplication of the Tugun desalination facility would involve use of adjoining land occupied by a wastewater pump station, a decommissioned wastewater treatment plant, sporting fields and an active landfill.

Tugun is not a priority site, due to the security of supply in this sub-region with the existing desalination facility and upgrade to Hinze Dam. However, over the long term, demands on the Gold Coast are forecast to exceed existing supplies. Additional capacity at the Tugun site could be used to meet increased local demand, minimising bulk transport costs compared to alternative supplies in other regions.

Future investigations

Detailed investigations of priority sites for desalination have commenced so that they can be delivered whenever required, including as a drought response.

This preparatory phase will culminate in a business case that will recommend the preferred location, size, cost and project delivery mechanism for the facility. The business case is expected to be completed by the end of 2011, for consideration by the Queensland Government.

The business case will recommend a detailed work program for delivering the project when required. Having completed this phase, it could be possible to put the project on hold until about four years prior to when the next facility is required, as guided by the supply and demand balance. Alternative bulk water supplies will also be investigated and, if feasible, might defer the need for additional desalination facilities.

The subsequent phases and key activities are summarised in Table 5.4. This approach will minimise the time and uncertainty involved in construction while providing scope for design innovation at the time that the plant is delivered. In particular, it provides an opportunity for the most recent technologies to be used as part of the detailed design.

Table 5.4 Planning and delivery of the next desalination facility

Phase	Activities	Outcome
Preparatory	• Community consultation • Preservation of sites, land use planning • Identification and preservation of connecting corridors • Detailed engineering options analysis, including for water quality and electricity supply • Detailed review of environmental and cultural factors • Confirmation of environmental approvals processes, including through a referral to the Australian Government Department of the Environment, Water, Heritage and the Arts • Identification of potential project delivery mechanism • Refined cost estimates • Business case for delivering the next desalination facility • Detailed work program, including the approvals process	Recommendation regarding preferred location, size, cost and project delivery mechanism for the next desalination facility
Holding	• Ongoing stakeholder consultation and community information • Baseline environmental monitoring • Feedwater characterisation • Ongoing technology scan • Ongoing review of key assumptions	Detailed and up-to-date basis for project procurement and delivery
Procurement	• Community consultation • Securing of funding • Confirmation of project delivery mechanism • Preparation of project scope and specifications • Acquisition of remaining corridors, if required • Tender, assessment and letting	Engagement of a company to deliver the facility
Design and approvals	• Community consultation • Preliminary design • Piloting of plants • Gaining of environmental and other project approvals • Early works	Approval to construct the facility
Construction	• Community information • Detailed design • Construction • Commissioning • Practical completion and project handover • Monitoring of environmental compliance	An operational desalination facility

The preparatory phase will include consideration of whether it is more cost-effective to construct a larger plant at one site, rather than two smaller plants at different locations. In addition, while the structure and connecting pipelines will all be built as one activity, there could be scope for the treatment trains to be installed in stages.

This phase will also include a review of environmental factors for each site, incorporating terrestrial and marine environmental studies. Input from the key stakeholders will be incorporated and cultural heritage issues addressed, as part of this review. Informed by the review, the approvals process required under the *Environmental Protection and Biodiversity Conservation Act 1999* will be confirmed. The approvals process will inform design and approval stages and the terms of reference for an environmental impact assessment.

A project is already underway to investigate the marine communities that exist in the receiving waters, through the SEQ Healthy Waterways Partnership. This project will determine the range of fauna and flora that live on and in the seabed in the vicinity of a brine discharge point. It will also investigate the resilience of these ecosystems to potential elevations in salinity. Detailed field investigations will be carried out.

The SEQ Healthy Waterways Partnership has also started a project with the CSIRO to develop an enhanced receiving water quality model. The enhanced model will be used to assess the impacts of brine discharges in more detail. A range of other issues identified by the Partnership will also be considered as part of detailed planning.

A full assessment of the cultural heritage value of sites will be carried out for both the plant sites and other land that could be required for pipeline construction. Consultation with relevant Indigenous groups will be carried out where required.

Preparatory works will be undertaken for the Marcoola and Lytton sites only. For the Tugun site, the master plan for the local area is being updated to ensure that the potential use of the site for an expanded desalination facility is taken into account. This planning will be undertaken in partnership with the Gold Coast City Council. No further investigations of the Bribie Island site will be undertaken until the need for the site is defined.

Protecting the health of Moreton Bay

Desalination involves removing salt and other impurities from sea water. The salt is then concentrated into a separate stream of high-salinity water, commonly called brine. The most common way of managing the brine is to mix it back into the ocean where it came from. Sometimes this can present environmental risks for the receiving waters, such as Moreton Bay, which has poor flushing characteristics.

The QWC engaged the SEQ Healthy Waterways Partnership to model brine dispersion for different capacity plants and different discharge locations in Moreton Bay, and to provide advice on how species and communities could be affected by the elevated salt concentrations.

Modelling conducted by the SEQ Healthy Waterways Partnership showed that brine dispersion from a 100-megalitre-per-day capacity desalination plant located at the mouth of the Brisbane River would have 'negligible to low risks' on Moreton Bay marine life, with the impacts being further reduced by placing the discharge further out into the bay.

The SEQ Healthy Waterways Partnership recommended that a discharge site located outside the river mouth towards Mud Island could disperse brine from a plant of 73 000 megalitres per year capacity with 'negligible to low risks'.

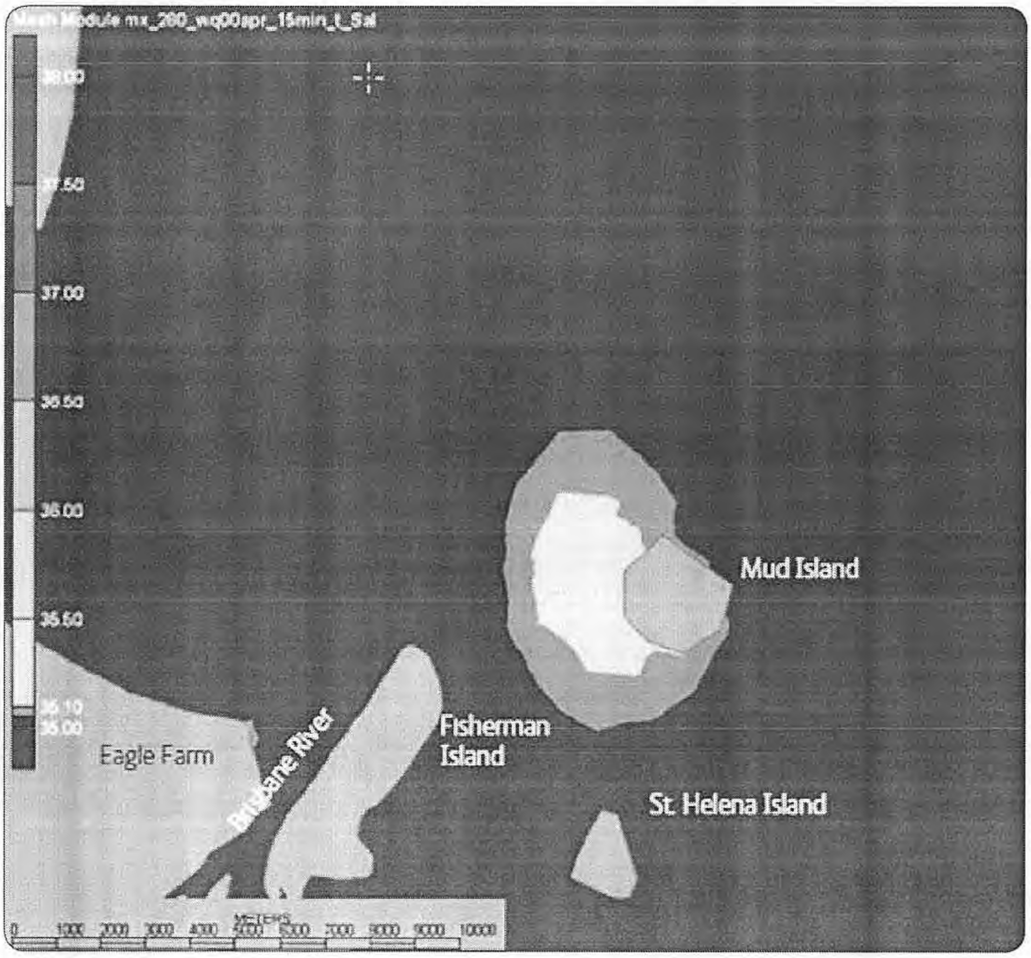

Figure 5.7 Example output from hydrodynamic modelling—median salinity contours

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5.4.2 Dams and weirs

Additional surface water supplies could be developed through:

- constructing new dams and weirs
- augmenting existing dams and weirs

  or
- water harvesting during high flow events into off-stream storages.

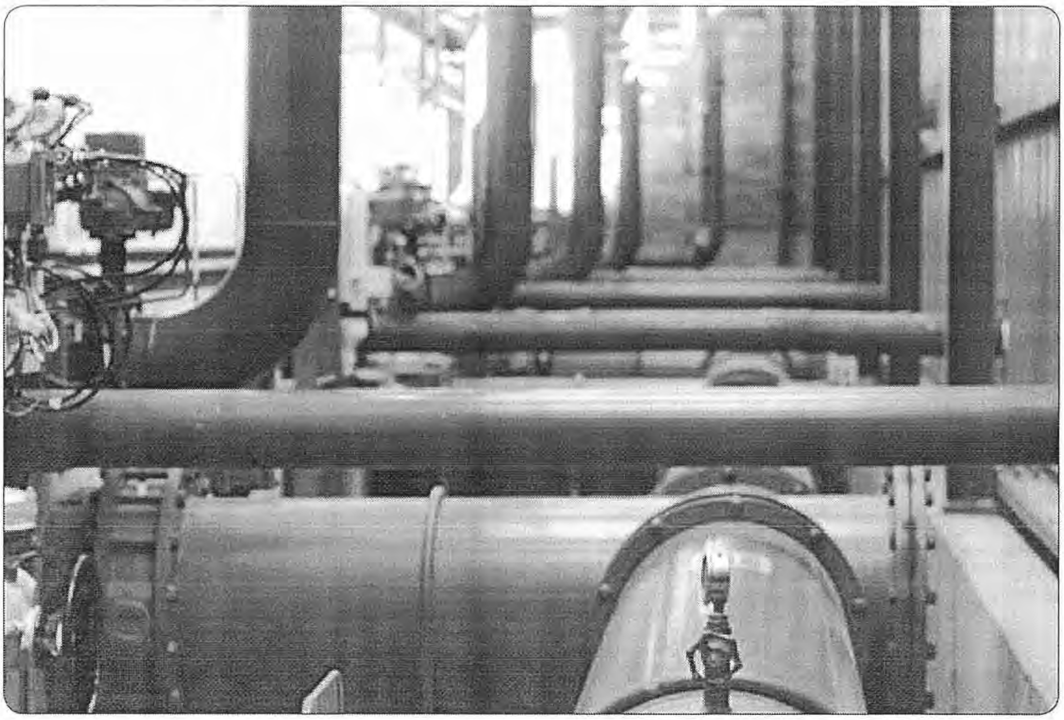
A comprehensive review has highlighted that there are no sound opportunities for developing major new dams in SEQ, beyond committed projects. This is due to the limited availability of additional water for urban use under the water resource plans and the shortage of suitable sites.

Water resource plans specify environmental flow and water allocation security objectives, as described in Section 2.1.3. Through environmental flow objectives, water resource plans for SEQ have already protected a significant portion of surface water flows for the environment.

Water resource plans contain environmental flow objectives at various locations. Table 5.5 specifies the end-of-system flow that must not be jeopardised by future water resource planning decisions in SEQ. This flow is expressed as a percentage of mean annual flow for the area in an undeveloped state. These objectives are a minimum, with actual environmental flows being higher where strategic reserves are not fully allocated for urban or rural use.

Table 5.5 Mean annual flow objectives at river mouth

Water resource plan	Gold Coast	Logan Basin	Mary Basin	Moreton
Location	Mouth of the Nerang River	Mouth of the Logan River	Mouth of the Mary River	Mouth of the Brisbane River
Mean annual flow objective as a proportion of pre-development flows	66 per cent	76 per cent	85 per cent	66 per cent



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Mary Basin area

The *Water Resource (Mary Basin) Plan 2006* nominates a strategic reserve of 150 000 megalitres per year as available in the Mary Basin.

The decision of the Commonwealth Minister for the Environment, Heritage and the Arts not to allow the Traveston Crossing Dam project to proceed indicates that it might be challenging to achieve environmental approvals for other water storage projects drawing on this reserve. However, given the limited surface water supply options available to the region, a number of smaller development options will be investigated.

Investigations will be undertaken in partnership with the Department of Environment and Resource Management and in collaboration with Seqwater and the Sunshine Coast and Gympie regional councils. Stakeholder input will be sought in accordance with the proposed project selection process that is outlined in Section 3.5. Options to increase the security and volume of supply to downstream urban and rural users will be considered, including for Gympie.

The options to be investigated include:

- an upgrade to Borumba Dam (Stage 3)
- a weir or pumping pool on the Mary River in the vicinity of Coles Crossing
- one or more off-stream storages
- water harvesting from the Mary River.

Combinations of options will also be considered.

Borumba Dam was raised in 1997 (Stage 2), increasing its storage capacity to 46 000 megalitres. Without water harvesting to the dam, a further (Stage 3) raising to around 350 000 megalitres capacity is considered the upper limit of practical development, taking into account the environmental flow requirements and the probability of filling the dam.

In conjunction with a new weir on the Mary River at Coles Crossing, this raising could provide an additional 20 000 to 30 000 megalitres of water per year. The weir would make available significantly more water than the dam alone, while also providing a pumping pool for extracting water from the Mary River to supply local areas and the SEQ Water Grid.

An off-stream storage could enhance the efficiency of pumping to the dam. Water harvested from the Mary River to the storage could be pumped to the dam over a longer period, reducing the capacity and cost of connecting pumps and pipes. The construction of one or more off-stream storages without pumping to the dam will also be investigated as an option to reduce cost and energy requirements. The off-stream storages could be excavated to below river level and be gravity-fed from the river, or be constructed at a higher level with pumping from the river to the storage.

In addition, the QWC will also investigate options to operate the SEQ Water Grid to provide local benefits. For example, when supply for SEQ exceeds demand, Noosa could be supplied from the Northern Pipeline Inter-connector Stage 2 rather than from Borumba Dam. This would enable the SEQ Water Grid Manager to make additional water available from Borumba Dam for local purchase and use, subject to appropriate conditions. This could defer the need for additional supplies in the Mary Basin.

Similarly, should one of the smaller options be viable, the QWC will investigate options to integrate water treatment for the SEQ Water Grid with water treatment for Gympie and other local areas.

The QWC will not investigate further options to raise Borumba Dam to make available 70 000 megalitres per year at a similar level of reliability to Traveston Crossing Dam. A 2007 consultancy report, undertaken as part of the Strategy investigations, estimated that the capital cost of such a scheme was in the order of $3 billion. The scheme would also have high ongoing pumping costs.

Other potential dam options have also been excluded from further consideration, including the construction of dams on:

- Amamoor Creek
- Obi Obi Creek at Kidaman
- Mary River near Cambroon.

The options of future storages on the Mary River (Cambroon) and Obi Obi Creek (Kidaman) were excluded by the Queensland Government from further consideration in a 1994 study due to the high cost and significant environmental and social impacts. The dam on Amamoor Creek would also have significant environmental impacts.

Logan Basin area

In the Logan Basin area, there is still potential for up to around 14 000 megalitres per year of high priority water allocation beyond the allocations for committed projects.

A number of options to make additional water available will be investigated, including:

- raising Cedar Grove Weir
- constructing a raw water pipeline to transfer water from the Bromelton Off-stream Storage to Wyaralong Dam
- constructing a weir on the Albert River, immediately downstream of the proposed Wolffdene Dam site
- constructing an off-stream storage adjacent to the Albert river in the vicinity of the existing Luscombe Weir
- constructing a small on-stream or off-stream storage, in the vicinity of the proposed Glendower Dam site on the Albert River.

Moreton area

In the Moreton Water Resource Plan area, an estimated 25 000 megalitres per year of strategic reserve is available.

The introduction of drought storage reserves has reduced the working volume of dams. This, in turn, has reduced the yield from the storage. In these cases, the reduction can be partially offset by increasing the working storage of the dam. The increase in working storage can be achieved by several methods, including raising the dam wall or modifying the operating rules that balance water storage capacity and flood mitigation capacity. Downstream flood impacts will be a key consideration in investigations into any of these options.

A detailed investigation will be conducted to determine the maximum level to which the working storage of Wivenhoe Dam could be raised without raising the dam wall. The investigation will be carried out in conjunction with Seqwater and the Brisbane and Ipswich City Councils. It will include detailed consideration of:

- the impact on frequency, severity and duration of flooding both upstream and downstream of the dam
- any effect on the structural integrity of the dam and its components or any required spillway upgrades
- environmental and social impacts, including adverse affects on any roads and crossings caused by flooding.

Hydrological investigations will be carried out to determine the increased security of supply or the additional volume of water that could be made available to the SEQ Water Grid while still remaining within the requirements of the water resource plan.

Some of the reserve could be accessed by raising the Mt Crosby Weir. Another possibility is as an additional extraction from Wivenhoe Dam. Some of the reserve might also be accessed in other smaller river systems.

Gold Coast area

In the Gold Coast Water Resource Plan area, an estimated 30 000 megalitres per year of additional high priority water allocation may be made available through the construction of additional infrastructure.

Around 7700 megalitres per year of this will become available through the raising of the wall of Hinze Dam. There is some potential to water harvest from Gold Coast creeks and the Coomera River into Hinze Dam.

5.4.3 Stormwater harvesting to dams

The QWC will investigate opportunities to use stormwater to augment inflows to dams, to improve system yield and benefit the local environment.

Sunshine Coast Water has undertaken preliminary investigations into a scheme for collecting stormwater from the Caloundra South development area to augment Ewen Maddock Dam. The scheme could double the catchment area of the dam, increasing the volume and reliability of supply. It would also reduce stormwater discharges from the development area.

The proposed scheme is likely to be the most feasible in SEQ, because:

- the dam is located only 7 kilometres from the potential development area, meaning that the transfer pipeline would be relatively short

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- the dam is at a relatively low height above the potential development area, meaning that the energy required to pump stormwater up to the dam is relatively small
- the dam supplies an advanced water treatment plant with surplus capacity, meaning that upgrades are unlikely to be required
- it is a new development area, meaning that it can be designed around the proposed stormwater harvesting scheme.

A range of issues will need to be investigated before the scheme proceeds, including water quality risks, environmental flow benefits, impacts on the ecology of the dam, and economic viability. The benefits of water-sensitive urban design in removing contaminants of concern will also be considered. The QWC will further investigate the proposal, as part of the proposed sub-regional total water cycle management plan for the area. Investigations will be undertaken in partnership with Seqwater, Unitywater and the Sunshine Coast Regional Council.

Local rainwater and stormwater harvesting are addressed in Section 4.6, as opportunities to reduce demand for SEQ Water Grid water. This includes proposed research projects at Coolum and Fitzgibbon to harvest roofwater for treatment and introduction to water distribution systems.

5.4.4 Purified recycled water

Purified recycled water is wastewater that has been treated to drinking water quality using the best available technology. This high-quality water can be delivered directly to end-users, such as power stations or industries, or used to augment a dam or aquifer. If purified recycled water is added to a dam, natural processes provide an additional environmental and time buffer before treatment of the blended water at the existing water treatment plant and distribution to consumers. More information about the treatment process, including an explanatory video, is available on the QWC website.

The water is subject to water quality monitoring and testing at all stages of this process. In Queensland, purified recycled water must meet health and safety requirements contained in the *Water Supply (Safety and Reliability) Act 2008* and the Public Health Regulation 2005.

Purified recycled water has many benefits:

- Purified recycled water is highly climate resilient. Weather is unlikely to significantly affect the availability of purified recycled water. At the targeted reduction in demand of 15 per cent in future droughts, Medium Level Restrictions would be highly unlikely to significantly reduce the volume of wastewater produced and therefore would not significantly reduce the yield of purified recycled water schemes.
- The treatment process removes about 50 per cent of phosphorus that otherwise would have been released into waterways, rivers and Moreton Bay. Phosphorus from existing wastewater treatment plants is one of the key causes of algal blooms in the Brisbane River and Moreton Bay.
- Energy requirements for purified recycled water are less than for seawater desalination. The pressure required to operate reverse osmosis units is approximately proportional to the salinity of the water being treated. Seawater commonly has a salinity of over 30 times that of treated wastewater, resulting in substantially higher energy requirements. Energy consumption is further discussed in Section 6.8.

Interim Water Quality Report

In February 2009, an *Interim Water Quality Report* on purified recycled water from the Bundamba advanced water treatment plant was published. The report contains the results of more than 8000 tests undertaken during the validation testing program for the plant.

The QWC also published a review from the Expert Advisory Panel, which states that the commissioning of the Western Corridor Recycled Water Scheme is proceeding well, demonstrating that it is capable of consistently producing purified recycled water that is safe to be used to augment Wivenhoe Dam.

Western Corridor Recycled Water Scheme

The Western Corridor Recycled Water Scheme is one of the largest purified recycled water schemes in the world. It has the capacity to supply up to 84 680 megalitres per year of recycled water to industry and power stations and for replenishing Wivenhoe Dam.

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Up to 32 000 megalitres per year of recycled water will be available for rural production in the Lockyer Valley and along the middle reaches of the Brisbane River when not required to supplement Wivenhoe Dam. Subject to urban demands, the amount available for supply to irrigators mgiht increase to 37 000 megalitres per year over time as feed water flows to the project increase.

The Western Corridor Recycled Water Scheme will maintain a high level of water quality in preparedness for augmenting water supply as necessary.

An expert advisory panel of world leaders in toxicology, environmental science, microbiology and advanced water treatment provide independent advice on the regulatory framework for purified recycled water and the Western Corridor Recycled Water Scheme. There are nine members on the Panel, which is chaired by Professor Paul Greenfield, AO (Vice-Chancellor, The University of Queensland). More information about the panel is available on the QWC website.

Industrial use of purified recycled water

A number of industrial customers have expressed interest in receiving purified recycled water. The process to receive this water involves negotiations between the industrial customer and the retailer, who negotiates with the SEQ Water Grid Manager for supply and delivery of the purified recycled water to the customer.

The uptake of purified recycled water by current industrial customers is limited by a number of factors:

- Many large industrial users are already using recycled water, including the BP and Caltex refineries.
- The supply of purified recycled water requires dedicated infrastructure, including pipelines to individual customers, pumps, valves and meters, which adds to its cost.
- Many high-volume industrial water users are not situated within a reasonable vicinity of the pipeline that delivers purified recycled water from the Western Corridor Recycled Water Scheme.
- As businesses have established water efficiency management plans (WEMPs), they have already reduced their water consumption.

Over time, there is potential for the supply of purified recycled water via dual reticulation to a number of proposed industrial parks located within reasonable proximity of the Western Corridor Recycled Water Scheme. Planning for supply to industrial areas will focus on locations where one or more large foundation customers can be established to provide an anchor for new recycled water schemes.

Other potential schemes

Increased community confidence in purified recycled water schemes could permit the development of additional schemes and the greater utilisation of the Western Corridor Recycled Water Scheme. The QWC considers that it is prudent to proceed with investigations of these potential schemes, with a view to preserving land for treatment facilities and pipeline corridors if viable.

Two potential purified recycled water schemes have been identified as possible future sources of supply, or as part of the response to a severe drought:

- augmentation of supply to North Pine Dam using purified recycled water produced from the Sandgate wastewater treatment plant and wastewater treatment plants in the Moreton Bay Regional Council area
- augmentation of supply to Hinze Dam using purified recycled water produced from one or more of the Coombabah, Elanora and Merrimac wastewater treatment plants at the Gold Coast.

These additional schemes have the potential to increase the available supply, in total, by about 60 000 megalitres per year by 2056.

The assessment of potential schemes took into account wastewater availability, future water demands, capital and operating costs, options for concentrate disposal, and the potential level of dilution and detention in dams.

Local governments and distributor-retailers should consider alternative uses for any treated wastewater effluent, except that required to feed the Western Corridor Recycled Water Scheme, especially where improvements to the health of receiving waterways can be achieved.

5.4.5 Groundwater

Groundwater resources in SEQ are almost fully developed. The annual volume of groundwater used for urban purposes over the next 50 years is expected to remain largely static. The use of groundwater for rural production is also considered fully developed and, in some cases, over-developed.

Groundwater sources have been developed at Bribie Island and at several aquifers in greater Brisbane. These projects were initiated in 2006 as part of the drought response and are now supplying water to the SEQ Water Grid. The sustainable yield of the Brisbane aquifers is currently being determined.

At this stage, development of any additional groundwater supplies will not be pursued. The identified opportunities within and adjacent to SEQ are generally small and not considered to be economically viable as a regional resource. These opportunities include:

- the offshore sand dune islands, including North and South Stradbroke, Moreton, Bribie and Fraser islands
- localised, onshore sand dune deposits near to the coastline and extending intermittently from Rainbow Beach in the north to the Gold Coast in the south
- an extensive system of mostly fractured volcanic rocks associated with what is known geologically as the Gympie Province, extending from just north of Nambour to Gympie
- sedimentary deposits, mostly sandstones associated with the southern part of the Maryborough Basin and known locally as the Myrtle Creek Sandstone
- limited outcrops of relatively young tertiary basalts in the Maleny, Buderim, Sunnybank, Redland Bay and Tamborine Mountain areas
- reasonably extensive tertiary sedimentary deposits outcropping in the Brisbane metropolitan area to the north and south of the city.

Several of these aquifers were investigated as part of the Millennium Drought. Drilling in the extensive sedimentary deposits associated with the Nambour Basin—extending from north of Maroochydore inland to Maleny and southwards to Caboolture—revealed that the available groundwater supplies are small and do not warrant development as an urban supply.

Of the remaining opportunities, the most significant are the Moreton Island and the Cooloola–Teewah sand masses. These aquifers have not been considered as normal supply options because of their location within national parks and the relatively small quantities that could be extracted without unacceptable environmental impacts.

Increased extraction from the aquifer on North Stradbroke Island was considered as part of the response to the Millennium Drought. The project was not progressed due to the risk of long-term impacts on the sensitive environment of the island. A detailed investigation was undertaken, with potential impacts on Blue Lake and other groundwater dependent ecosystems considered.

Separately, the *Water Resource (Moreton Basin) Plan 2007* has established groundwater management areas in Cressbrook Creek, the Lockyer Valley and the Warrill–Bremer Valley. These management areas are expected to reduce the rate of groundwater extractions to more sustainable levels with the aim of protecting water quality and ecosystem health.

The use of aquifers as storage for recycled water is under consideration as part of the Urban Water Security Research Alliance project, building on earlier work by the CSIRO. Preliminary indications are that a limited number of sites around Brisbane could be developed for stormwater harvesting and aquifer storage. A specific application of aquifer storage and recovery is under investigation on the Gold Coast to store recycled water for irrigation purposes.

5.4.6 Water trading between rural and urban allocations

Water resource plans provide a framework for water trading between water users, as explained in Section 2.1.3. In some cases, this framework can provide for the conversion of medium priority to high priority water allocations, and potentially vice-versa.

For SEQ, converting medium priority water for rural production to high priority water for urban supply is not considered to be a viable alternative for augmenting urban water supplies. In general, rural water allocations are small compared to existing urban demand. With conversion from medium priority to high priority, the volumes would be significantly smaller. Measures to increase the availability of water for rural production are explained in Chapter 6. In the right environment, there could be some small trading opportunities with willing sellers and purchasers of water allocations.

M415

5.4.7 Supplies from outside SEQ

There are opportunities to import water into SEQ from outside the region.

Investigations were completed in October 2007 into a direct pipeline connection between the Burdekin Basin and SEQ. The capital cost estimates for the project were found to be prohibitive at that time. Operating such a scheme would also exceed the total energy cost of a desalination plant. The completed report is available on the Department of Environment and Resource Management website.

Consideration has also been given to supplies from north-eastern NSW, such as the Tweed, Brunswick, Clarence, Richmond and Wilson river catchments. Bulk water supply opportunities were investigated, but were found to be costly compared to committed SEQ projects and to have numerous social and environmental issues.

5.4.8 Supplies from coal seam gas developments

Water extracted as a by-product of coal seam gas developments in the Surat Basin could be a future water supply source for SEQ. Before coal seam gas water is considered for SEQ the highest and best local uses should first be investigated. The supply of coal seam gas water to SEQ for potable use must meet strict water quality regulations. In addition, the supply would be at no cost to the SEQ Water Grid, at least until further water supplies are required.

Chapter 6

The Strategy

M417

This chapter outlines a comprehensive strategy to ensure that SEQ never runs out of water. It describes the water supply and demand management initiatives required to meet the needs of regional growth and provide security of supply during drought.

Key messages

- The Strategy aims to deliver sufficient water to support a comfortable, sustainable and prosperous lifestyle while meeting the needs of urban, industrial and rural growth and the environment.
- Water supply for SEQ is now secure. There is a less than 1 per cent probability of key SEQ Water Grid storages falling to 40 per cent of combined capacity over the next five years, triggering the reintroduction of Medium Level Restrictions.
- The Strategy is sufficiently robust to accommodate uncertainty regarding population growth, lifestyle expectations and climate.
- Demand for water will be managed by continuing to improve structural and operational water efficiency and continuing to encourage efficient water use.
- The Strategy challenges residents to maintain average consumption at or below 200 litres per person per day (Target 200).
- If this target is achieved, new supplies will not be required until around 2027. New supplies could be required from 2021, should the target not be achieved.
- Over time, climate change could reduce the yield of our dams, potentially bringing forward the time at which new supplies are required. The QWC will continue to research the impacts of climate change, in partnership with the CSIRO and local universities.
- Demand management is forecast to almost halve energy consumption for the SEQ Water Grid at 2050, compared to pre-drought trends.
- Local supplies are forecast to reduce demand on the SEQ Water Grid by about 35 000 megalitres per year in 2026 and about 60 000 megalitres per year in 2056.
- The QWC will review the Strategy before providing advice about the next major water supply. Potential supplies will be assessed through a robust and transparent process.
- Additional desalination facilities will underpin future water security. Detailed planning for facilities at Marcoola and Lytton has commenced.
- A range of other options is being investigated that could reduce and defer the need for additional desalination facilities.
- Drought response plans will be prepared for rural towns and for the SEQ Water Grid as a whole.
- 32 000 megalitres per year of recycled water has been made available for rural production.

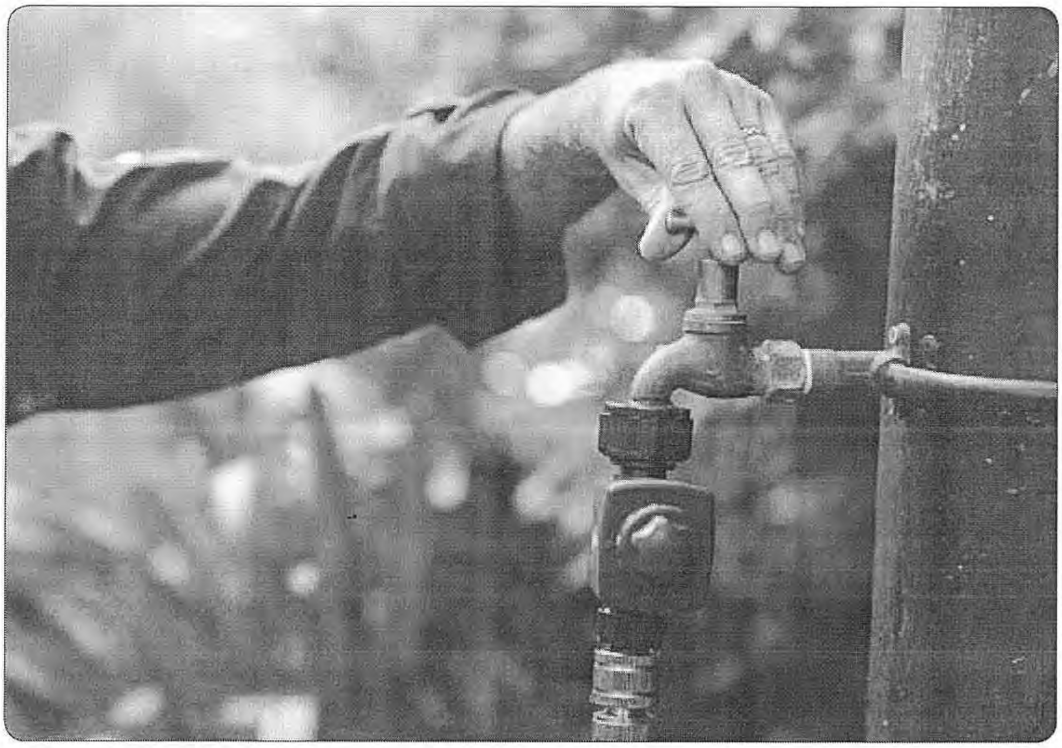
The main purpose of the Strategy is to achieve the LOS objectives. Critical to achieving this outcome is to ensure that water is used efficiently and available supplies always exceed demand.

Many elements of the Strategy are already being implemented. Critical planning elements must be finalised in order to ensure that we are ready to respond to the effects of population growth, consumption trends and climate change.

This chapter applies the planning methodology outlined in Chapter 3 to:

- quantify the potential future supply gap in normal operating mode (refer to Section 6.1)
- identify additional demand management measures (refer to Section 6.3)
- identify a preferred infrastructure program, pending the outcomes of detailed investigations of potential sources of supply (refer to Section 6.4)
- establish drought response plan requirements (refer to Section 6.9).

In addition, the chapter specifically addresses water supplies for rural communities and rural production, water quality, research and development, and energy and greenhouse gas emission implications of the Strategy.



6.1 Water balance

Water supply for SEQ is secure for the short to medium term, due to the SEQ Water Grid being constructed and key Water Grid storages being full or nearly full.

The next major supply will be triggered by demand increasing to the point that it exceeds the LOS system yield or by drought causing dam levels to fall to 30 per cent of capacity.

The next supply is likely to be triggered by demand growth, due to key Water Grid storages being full or almost full. A major new supply might be required in 2021, beyond the completion of projects currently underway. This forecast is based on:

- average total consumption of 375 litres per person per day
- high series population growth.

However, it is more likely that a major new supply will not be required until mid-2020s. For example, a new supply would not be required until around 2026 with:

- average total consumption of 375 litres per person per day
- medium series population growth.

Figure 6.1 presents a scenario for the water balance for Category A supplies to 2056, based on existing infrastructure and projects currently underway, and with demand forecasts based on medium and high series population forecasts.

M419

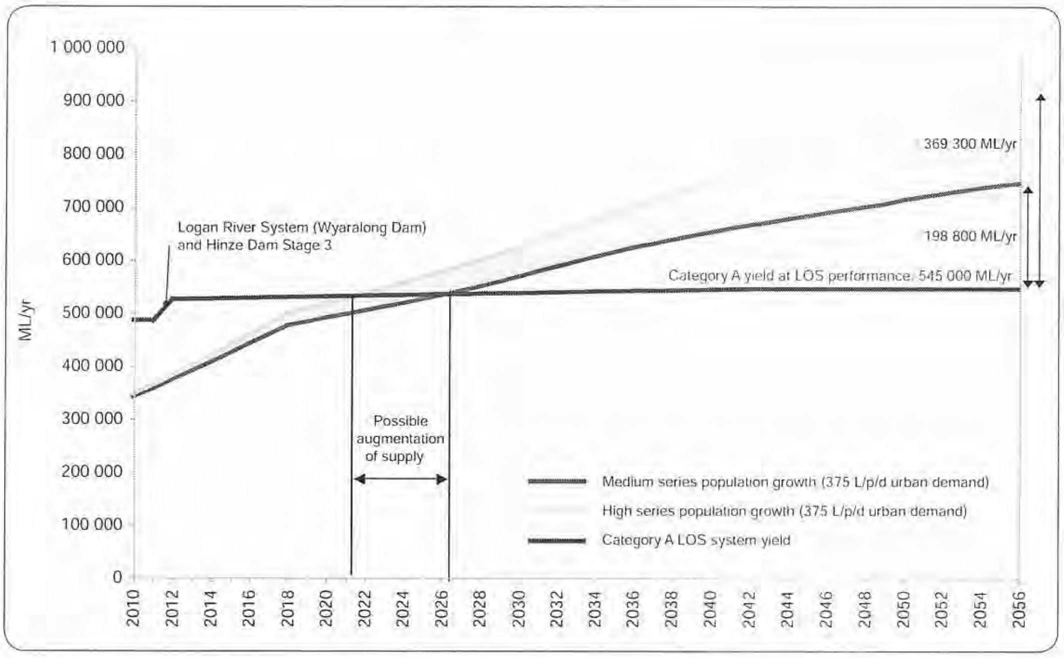


Figure 6.1 Category A water balance in normal operating mode

Figure 6.1 illustrates approximately when supply gaps could occur in the future. A supply gap occurs when demand is greater than the LOS system yield. The potential supply gap depends on the assumptions made regarding the demand for water and the effects of climate change.

As explained in Section 3.2, detailed analysis of the potential impacts of climate change on SEQ water supplies is being undertaken by the Queensland Government Climate Change Centre of Excellence and the CSIRO, through the SEQ Urban Water Security Research Alliance. Until this work is completed, a mid-range climate change scenario of 10 per cent reduction in surface water availability by 2030 has been adopted. In contrast to Perth, these changes are expected to occur over the medium to long term. However, should there be an immediate 10 per cent reduction, the earliest date for supply augmentation would move forward from about 2022 to about 2017. While this scenario is considered unlikely, it is prudent that we continue to plan to be prepared to respond as required.

Having a supply gap does not mean that water supplies will be completely depleted. A supply gap results in an increased likelihood that LOS objectives cannot be met and a greater chance of water restrictions being imposed.

Where supply equals demand, indicated where the demand and system yield lines intersect, the likelihood of entering restrictions is one in 25 years on average. When the system is in surplus, there is a reduced likelihood of entering restrictions, depending on how the SEQ Water Grid is operated.

In accordance with the LOS objectives, the Strategy plans to make sufficient Water Grid water available to meet an average regional urban demand of 375 litres per person per day. As explained in Chapter 4, this is a conservative assumption, and a prudent approach for water supply planning. It takes into account the timeframes for delivering bulk water supply infrastructure, and the level of uncertainty regarding the extent of permanent behavioural changes by the community, population growth, climate variability and the potential impacts of climate change.

6.2 Target 200

The Strategy seeks to build a long-term water savings culture in the SEQ community. It sets a voluntary regional residential consumption target of 200 litres per person per day (Target 200). This challenge is separate from restrictions and will be actively encouraged but not enforced.

The QWC considers that this target can be achieved without significantly changing the lifestyle we enjoy, including the ability to sustain healthy, water-wise gardens. By doing so, the need for additional supplies and the amount of water that is treated and distributed through the SEQ Water Grid can be reduced and deferred, saving money and electricity.

Figure 6.2 shows that reducing average regional consumption by 30 litres per person per day to 345 litres per person per day would defer the need for additional supply beyond projects currently underway from 2026 to around 2033 with medium series population growth and no allowance for climate change.

It would also reduce the supply gap at 2056 by at least 65 700 megalitres per year—equivalent to the Grid water used by about 300 000 houses.

Usage of 345 litres per person per day is equal to the saving that will be achieved if residents of SEQ maintain average regional residential consumption at or below 200 litres per person per day (Target 200). However, changes in the demand profiles can occur for many other reasons.

The sensitivity assessment assumes no adjustments to the LOS objectives relating to the frequency, severity and duration of restrictions and to the frequency of triggering a drought response plan. If the planning assumption for average regional consumption were to be reduced, it would be necessary to consider the impact on effectiveness of future restrictions.

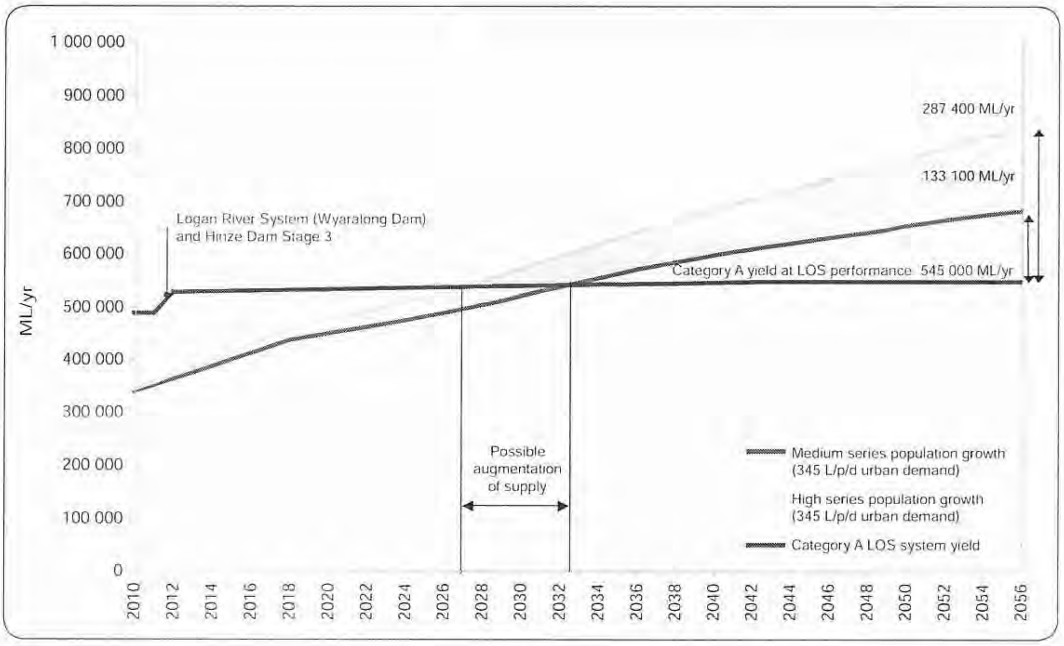


Figure 6.2 Impact of reducing average total consumption by 30 litres per person per day

At the same time, for the reasons outlined in Section 4.3, the QWC recognises that there could be a rebound in water use that might make the consumption target challenging to achieve.

In setting the target, the QWC recognises that actual residential consumption will vary considerably between households and across SEQ due to the type and age of homes, number of occupants, location in terms of climate, soil type conditions and the size and type of gardens. Small households in dry locations might use more, but households in new houses should aim to use less. Actual residential consumption will also vary between seasons and years.

The consumption target will be a key element of an ongoing low level education and communications program. This program will provide timely, well-targeted information and will seek to reinforce some of the basic behavioural changes that enabled residents of SEQ to reduce average demand to below 140 litres per person per day during the Millennium Drought, and to support structural and operational water efficiency measures. The program will include ongoing reporting on achievement of Target 200, with a focus on the long-term benefits of maintaining average regional consumption below 200 litres per person per day.

The collective benefits of these types of behavioural changes can be dramatic, as demonstrated by the success of the Target 140 residential campaign. Once the Target 140 campaign commenced, average residential consumption in central SEQ dropped to below 140 litres per person per day within six weeks and remained below 140 litres per person per day for the year from July 2007 to July 2008. This was a significant drop from the 300 litres per person per day used in 2004–05.

M421

Support for Target 200

Across SEQ, average residential consumption was 165 litres per person per day over six months from 1 December 2009, when Permanent Water Conservation Measures commenced. In central SEQ, average consumption has remained at 148 litres per person per day. Consumption has also:

- remained low on the Gold Coast, where residents were exempted from restrictions from 8 January 2009 until the commencement of Permanent Water Conservation Measures, with average residential consumption of 206 litres per person per day
- reduced on the Sunshine Coast, which has not previously been subject to QWC water restrictions, with average residential consumption of 224 litres per person per day.

These trends reflect the results of a 1000 respondent online survey undertaken from 3 to 8 March 2010, during which combined dam levels rose from 82.3 to 95.8 per cent of capacity. In particular:

- 74 per cent of respondents were either very comfortable or comfortable with 200 litres per person per day as a permanent usage target
- 42 per cent of respondents indicated that we should preserve water and hold people to usage levels similar to those we have now (200 litres per person per day). Nearly a third (29 per cent) of respondents indicated that the target should not go far above 200 litres per person per day.

6.3 Demand management program

The Strategy aims to build on the successful demand management programs that commenced during the Millennium Drought. Existing measures that will be continued are described in Section 4.4 and summarised below. New structural, operational and behavioural elements of this program are described below. Consistent with Section 4.4, demand management measures have been categorised as:

- structural—making sure our homes and businesses have water-efficient devices, appliances and equipment installed
- operational—making sure that water-efficient equipment is used correctly to achieve efficient outcomes
- behavioural—encouraging good water use behaviours and ensuring that the community understands the benefits of conserving water.

The continuing and proposed water savings measures are generally cost-effective compared to new sources of supply and can be achieved without significant changes to lifestyle. Chapter 4 explains the basis for the savings and the impacts for residents.

Continuing water use efficiency measures

A range of water use efficiency measures that were implemented during the drought will continue long term. These measures include:

- public education and communication programs
- requirements for alternative local water sources, such as internally connected rainwater tanks, to be installed in most new buildings
- requirements for water-efficient fittings and fixtures to be installed in new and renovated commercial, industrial and residential buildings
- requirements for businesses using more than 10 megalitres per year to prepare a water efficiency management plan that demonstrates how they will move towards best practice water use efficiency
- requirements for all businesses to ensure that their urinals and cooling towers are efficient
- requirements for businesses using 1 megalitre per year or more to ensure that all internal water fittings on the premises are water-efficient
- requirements for sub-meters to be installed in new residential and commercial multi-unit developments
- provision of water use information to residential tenants, in accordance with guidelines issued by the QWC
- ability for landlords to pass on water consumption charges to tenants of individually metered and water-efficient premises.

6.3.1 Water restrictions

Water restrictions will continue to be part of the demand management program.

Permanent Water Conservation Measures were introduced across SEQ on 1 December 2009. Under these measures, time restrictions have generally been relaxed, but efficiency measures remain in place.

The QWC will continue to review the role of water restrictions as part of the overall demand management program. In doing so, the QWC will seek to ensure that it achieves an appropriate balance between water restrictions and other demand management measures, with the objective of encouraging water efficiency at the lowest possible economic, social and environmental costs.

The QWC will also develop future Medium Level Restrictions as part of the drought response plan. These restrictions will be designed to achieve the LOS objective of reducing average regional consumption of 375 litres per person per day by 15 per cent.

Permanent Water Conservation Measures

Permanent Water Conservation Measures are low-level water restrictions that were introduced across SEQ on 1 December 2009—the first time that common restrictions had applied across the region. These measures reflect feedback on the Strategy that the community supports the ongoing use of low-level restrictions, provided that the focus is on water efficiency rather than water use volume.

Permanent Water Conservation Measures have been designed specifically to capture long-term demand savings, such as through integration with other demand management and water efficiency programs.

Time restrictions on outdoor water use are generally removed, except for a requirement to water gardens and lawns outside the heat of the day. There is also a requirement to use water-efficient devices, such as trigger nozzles on hoses, high-pressure cleaners and efficient irrigation.

Heavy residential water users will continue to be identified and, where high water use cannot be justified, the user will enter a program to assist their household to reduce water use. Section 4.3 highlights the importance of this program.

Permanent Water Conservation Measures also give effect to a small number of structural and operational measures that are not currently implemented through other means, such as the Queensland Development Code.

Outdoor water use requirements for non-residential water users are generally the same as for residents, except where a business wishes to irrigate an area greater than 500 square metres. Where this is the case, the business is required to develop an irrigation water efficiency management plan.

The QWC will review the Permanent Water Conservation Measures during 2010 and 2011. Working with key stakeholders, the QWC will review and refine each measure individually to ensure that it is necessary, effective and efficient. The QWC will specifically investigate whether some requirements should be integrated into end-user contracts, moved to other regulations, or discontinued. The review will focus on non-residential restrictions. Key residential restrictions, such as the restriction on the use of water for irrigation in the middle of the day, are not expected to change.

Target 200 is not part of Permanent Water Conservation Measures. It is a voluntary measure that will be actively encouraged but not enforced.

6.3.2 Demand management measures for investigation

A range of new structural, operational and behavioural water efficiency measures are currently being investigated, as are improvements to existing programs. In combination with the existing measures, these new measures will assist the SEQ community to meet our water savings targets. These new measures are listed below.

M423

Demand management measures under investigation Structural water use efficiency measures
Promote water use efficiency star ratings for non-residential property Water consumption in office buildings will be monitored and rated on a scale of one to five stars (best practice is five stars).
Ban the sale of inefficient water devices With the exception of toilets, plumbing and white goods, producers currently do not have to meet minimum water use performance standards. This measure involves working with the Australian Government and industry to develop and implement minimum standards. Consideration could also be given to expanding the range of products covered by the existing WELS scheme.
School water use efficiency This measure involves a trial to assess the benefits of installing web-based smart monitoring and alarm systems on water meters in a number of schools. The web-based monitoring system is designed to trigger an alarm if water consumption rises above a pre-set level. Sydney Water has successfully trialled this type of monitoring. An audit of 13 Sydney schools showed that 44 per cent of water used within the grounds was lost through leaks.
Operational water use efficiency measures
Targeted education programs for selected industries This measure involves developing a training program for professions and trades involved in the sale and installation of water-using appliances and fixtures, and garden and landscaping products.
Behavioural water efficiency measures
Regionally consistent billing approach This measure involves phasing in a standardised approach to billing information. Distributor-retailers are required to produce water bills in accordance with guidelines that specify a minimum content and format, with regular billing cycles. This will allow consumers to become more informed about their water consumption.

M424

6.3.3 Updating the demand management program

A comprehensive review of the demand management program will be undertaken regularly and as part of future reviews of the Strategy. Additional demand management measures will be identified as part of continuous improvement. These measures will be informed by changes in population growth, climatic conditions, consumption trends and community expectations, as well as technological developments and the timeframe for constructing additional sources of supply.

The LOS objective for the volume of water to be supplied in normal times (375 litres per person per day for all uses) might be amended at the next review of the Strategy if average water use across the region remains significantly below the planning assumption.

In assessing any changes to the LOS objectives for supply in normal operating mode, consideration will be given to the impact on the scope for future restrictions if the T1 trigger is hit. Once residents, business and industry achieve best practice water use efficiency, consumption cannot be further reduced without significant economic or lifestyle impacts. These matters could affect the LOS objectives relating to the severity of restrictions.

Consistent with the approach adopted in the Strategy, additional demand management measures should be undertaken where they are cost-effective compared to the cost of building new supplies.

6.4 Meeting the supply gap

This section summarises potential supply options and infrastructure programs. Some of the minor dam and weirs projects could also be developed to improve availability of water for rural users, subject to their capacity to pay.

As explained above, major new supplies are unlikely to be required for at least 10 years. The Strategy seeks to further defer when these supplies are required through:

- the efficient operation of existing infrastructure (refer to Sections 3.1 and 7.2.2)
- ongoing water efficiency (refer to Sections 4.4, 6.2 and 6.3)
- the integration of local supplies into new development (refer to Section 4.6).

Section 5.4 outlines a range of investigations into potential supplies that will inform future revisions of the Strategy. The investigations will also establish a benchmark against which water efficiency and local supply options can be assessed. For example, as noted in Section 4.6, some local supplies might be able to exceed the minimum requirements in the Queensland Development Code. Options that improve water savings locally should be implemented if they meet all regulatory requirements and if the incremental cost above the minimum requirements is equal to or less than the cost of major new supplies, compared on a triple bottom line basis. The QWC is investigating methods for objectively undertaking such assessments.

6.4.1 Potential supply options

Future supply options were identified in Chapter 5 and are listed in Table 6.1.

Table 6.1 Potential sources of supply for detailed investigation

Type of source	Potential source
Desalination sites	• Marcoola (priority site) • Lytton, near the Brisbane River mouth (priority site) • Expansion of the facility at Tugun on the Gold Coast (reserve site) • Bribie Island (reserve site)
Dams and weirs	• Borumba Dam Stage 3, water harvesting from the Mary River or a combination of both • Raised operating levels in Wivenhoe Dam • Raising of the Mt Crosby Weir • Additional minor supplies in the Logan and Albert catchment, including potentially a pipeline between the Bromelton Off-stream Storage and Wyaralong Dam
Purified recycled water schemes	• Augmentation of Hinze Dam • Augmentation of North Pine Dam
Decentralised systems	• Investigations into proposed sites, including North Brisbane and the Sunshine Coast for stormwater, rainwater systems and local recycling

Based on existing technology and identified alternative water source options, desalination is currently the only practical supply to fill a regionally significant supply gap. Desalination facilities at the priority and reserve sites will underpin water security for SEQ. Current information indicates that these sites could accommodate desalination facilities with a combined capacity of over 300 000 megalitres per year. With improvements in technology, the same sites could accommodate facilities with more capacity.

There are limited bulk supply options beyond these sites. As explained in Section 5.4.2, dam and weir options could supply an additional 50 000 to 100 000 megalitres per year in normal operating mode. In addition, two purified recycled water schemes that could supply up to 100 000 megalitres per year have been identified for detailed investigation. However, the development of these schemes depends on improved community confidence in purified recycled water.

The supply gap could be reduced if local supplies achieve savings larger than required for new houses under the water savings targets. Detached houses must target savings of 70 000 litres per year, while terrace houses and townhouses must aim to achieve savings of 42 000 litres per year. These savings could be met by internally plumbed rainwater tanks, stormwater harvesting, dual-reticulation recycled water schemes, or the treatment and reuse of greywater. For new houses, the water savings target is forecast to reduce demand by about 60 000 megalitres per year by 2056. However, higher savings might be cost-effective in particular locations and sites—for example by adopting a water-sensitive urban design approach that seeks to integrate stormwater harvesting with stormwater management.

Due to the limited opportunities available, there are currently no plans for substantial increases in the volume of water extracted from groundwater.

6.4.2 Potential supply portfolios

This section presents the preferred portfolio of projects to fill the supply gap, based on current forecasts and pending detailed investigations of potential supplies, as described in Section 3.5

The final selection of each future water supply project will be made based on detailed feasibility studies coupled with the latest information on regional growth patterns and climate change impacts. Section 3.5 describes the process by which the QWC will assess options and make a recommendation to the Minister.

In the meantime, a number of potential infrastructure programs have been developed based on information currently available.

The projects in these programs have been timed to ensure that LOS system yield exceeds forecast demand at all times. This approach does not put water security at risk, but defers both capital expenditure and minimum operating costs. In turn, this defers the impact of price increases. Deferring the next supply also provides time for technology to improve, with a range of potential benefits in terms of cost and efficiency.

M426

The portfolios were based on sub-regional demand and supply analysis. The distribution costs and the capacity of interconnections in the SEQ Water Grid were key considerations for the sequence, timing and location of supply projects. For example, it is expected that the desalination facility at Tugun will only be duplicated from around 2030, following the emergence of significant further population growth on the Gold Coast.

The analysis assumed average total regional consumption across SEQ of 375 litres per person per day, with some differences between locations. Lower consumption could significantly defer the need for augmentation and the sequencing of new supplies across SEQ, including as a result of achieving Target 200.

The portfolios will be reviewed and updated in the future reviews of the Strategy. In particular, detailed investigations could find that some potential projects are not viable or could highlight advantages and disadvantages that were not taken into account at an earlier time. The framework developed for these assessments can also be adapted and applied to any portfolio being considered, including local water supplies or demand management initiatives that exceed the minimum standards.

Medium series population growth

Figure 6.3 illustrates one potential infrastructure program, based on average total consumption of 375 litres per person per day, medium series population growth and no allowance for climate change. This scenario identifies:

- the development of a desalination facility at either Marcoola or Lytton as the next major augmentation of the SEQ Water Grid, with connecting pipelines constructed to enable a duplication of the facility when required
- the expansion of this desalination facility, around 2030
- the third major augmentation being the development of the other priority desalination site
- the final augmentation being the expansion of the existing desalination facility at Tugun, which is identified as occurring beyond 2030 in order to supply new development on the Gold Coast.

In total, this scenario involves development on three of the four desalination sites. While the desalination facilities only provide an additional 155 500 megalitres per year of capacity to the system, the LOS system yield increases by approximately 185 000 megalitres per year due to an improvement in the performance of the dams. Pending detailed investigations other options, such as dams and weirs, could reduce the need for desalination.

In addition, this program includes raising the operating level of Wivenhoe Dam and raising Borumba Dam (with allowances for the impact of climate change). Both of these options require detailed investigations, with a range of technical and environmental issues to be addressed. However, they would be less energy-intensive than desalination and, at least in the case of Wivenhoe Dam, cheaper.

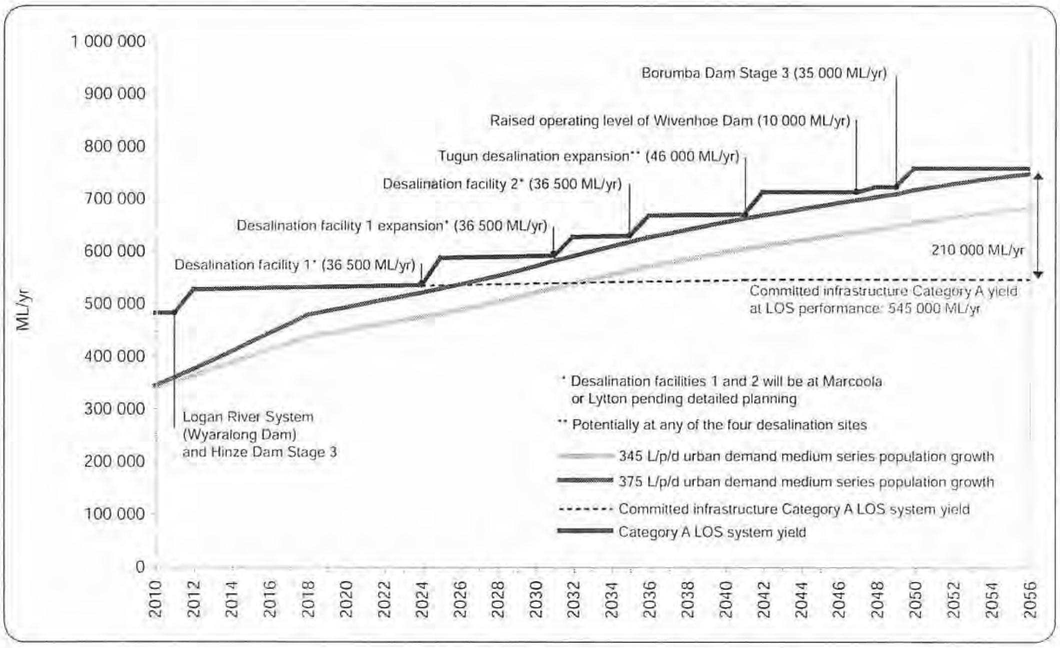


Figure 6.3 Potential portfolio with medium series population growth (subject to detailed planning and assessment)

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High series population growth

A sensitivity assessment has been undertaken, indicating the impact of high series population growth and no allowance for climate change. In this scenario, up to 369 300 megalitres per year of additional supply capacity would need to be constructed by 2056.

A possible portfolio of supply options to meet this increased demand is presented in Figure 6.4.

The first augmentations are the same as for the medium series population forecast scenario.

Beyond the upgrades of Wivenhoe and Borumba dams, additional desalination facilities and the expansion of some of these facilities would be required. These facilities could be located at Marcoola, Bribie Island or Lytton. Pipeline costs and environmental considerations would determine the preferred location and sequence of these facilities.

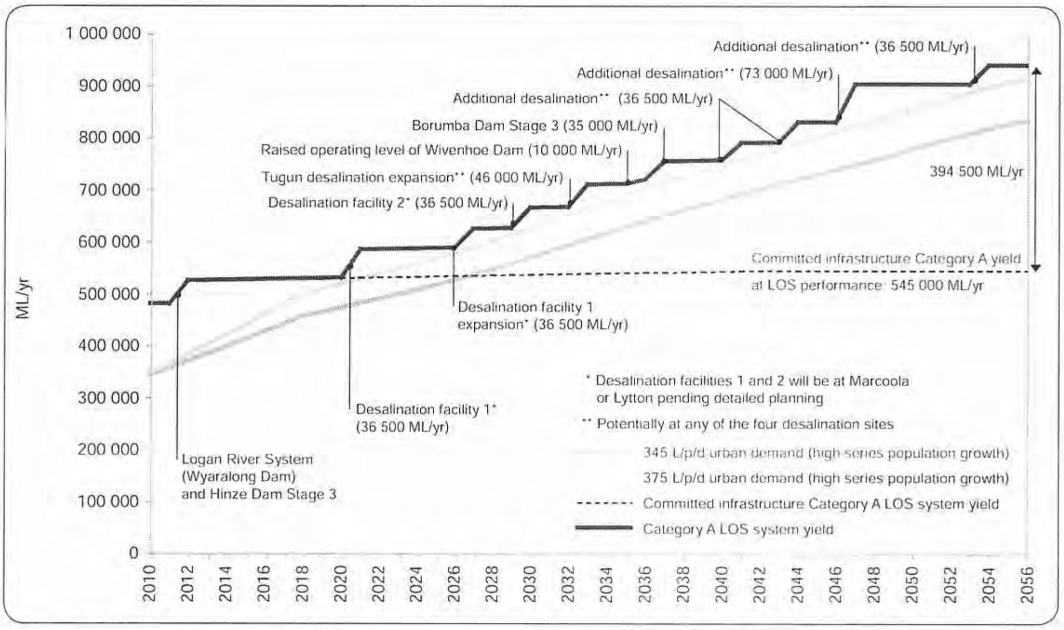


Figure 6.4 Potential portfolio with high series population growth and no allowance for climate change (subject to detailed planning and assessment)

Impact of reduced consumption

Reducing average consumption will defer and reduce the need for additional desalination facilities. Figure 6.3 shows that with medium series population growth and average total regional consumption of 345 litres per person per day, it is possible that only two additional desalination facilities would be required before 2050. The need for the first of these facilities would be deferred to 2033, as explained in Section 6.2.

M428

The portfolio with high series population growth and average total consumption of 345 litres per person per day would be similar to that identified in Figure 6.4. This reduction in consumption, which could be achieved by average residential consumption remaining at or below 200 litres per person per day, could result in fewer desalination facilities being required to meet demand.

Potential impacts of climate change

The extent and timing of any climate change impacts is another key variable for determining when the next bulk water supply might be required. As explained in Section 3.2, the CSIRO is currently undertaking downscaling modelling (reducing the size of modelling grids used for global scale models to smaller scales that are more useful for localised assessments) for SEQ through the Urban Water Security Research Alliance. The preliminary results indicate that, while climate change might reduce yield by about 10 per cent, the impact is likely to occur over decades, rather than immediately. A scenario has been prepared to assess such a possible climate change impact and is shown in Figure 6.5. Such a scenario may bring forward the next possible augmentation date to as early as 2017. However, as discussed above, this climate change impact is unlikely to occur in the immediate future.

The supply gap will reduce if population growth or the average regional consumption is below the planning assumptions outlined above. Conversely, it will increase if climate change impacts are greater than the assumed scenario or if average regional urban water consumption increases to greater than a regional average of 375 litres per person per day, or growth exceeds high series projections.

The volume required will also vary. Without additional water supplies, by 2056 the gap between supply and demand could be between 133 100 and 410 700 megalitres per year, depending on population growth, the demand for water and the impacts of climate change.

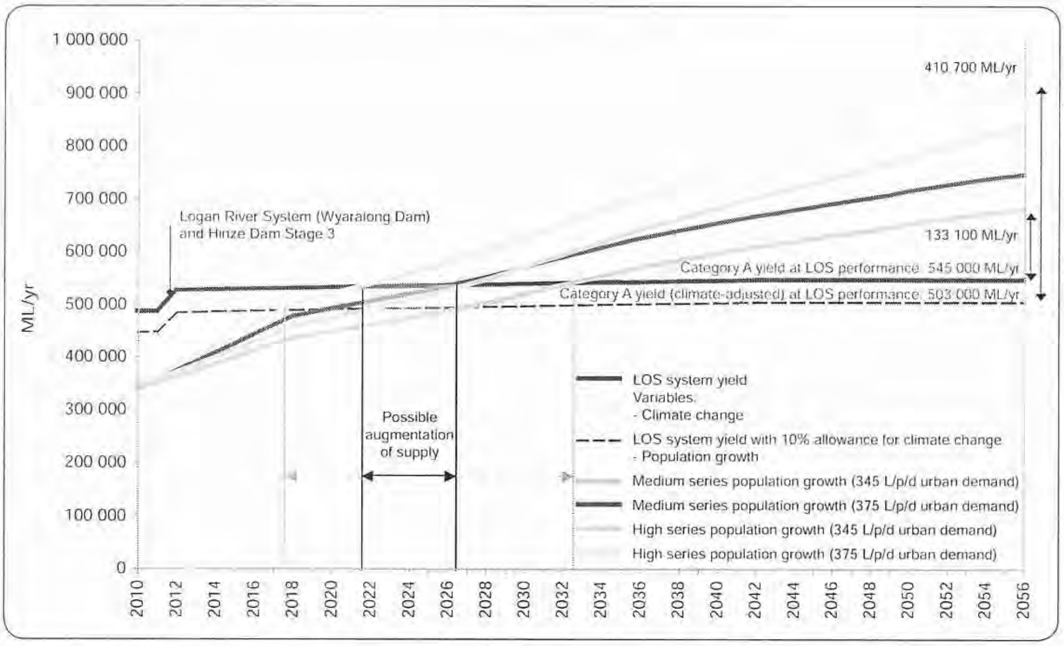


Figure 6.5 Category A water balance in normal operating mode and an allowance for climate change

The purpose of the Strategy is to bring on supplies at appropriate times to prevent this gap from developing. The QWC will monitor demand and supply forecasts on an ongoing basis. Changes to these forecasts will have a direct impact on the potential supply gap, which will be reflected in future revisions of the Strategy and the planning program for potential water supplies.

The construction of major new supplies could also be triggered as part of a drought response. However, with key SEQ Water Grid storages full or almost full, it is likely to be at least 10 years before storages fall to 30 per cent of capacity (refer to Section 6.9.1). The probability of this occurring prior to 2020 is estimated at about 1 per cent.

M429

6.5 Rural towns and villages

The Strategy plans to provide increased security of supply to more than 200 000 residents of SEQ who live in towns that are not connected to the SEQ Water Grid. These residents rely on local surface water or groundwater supplies or on water from rainwater tanks.

6.5.1 Communities with reticulated drinking water

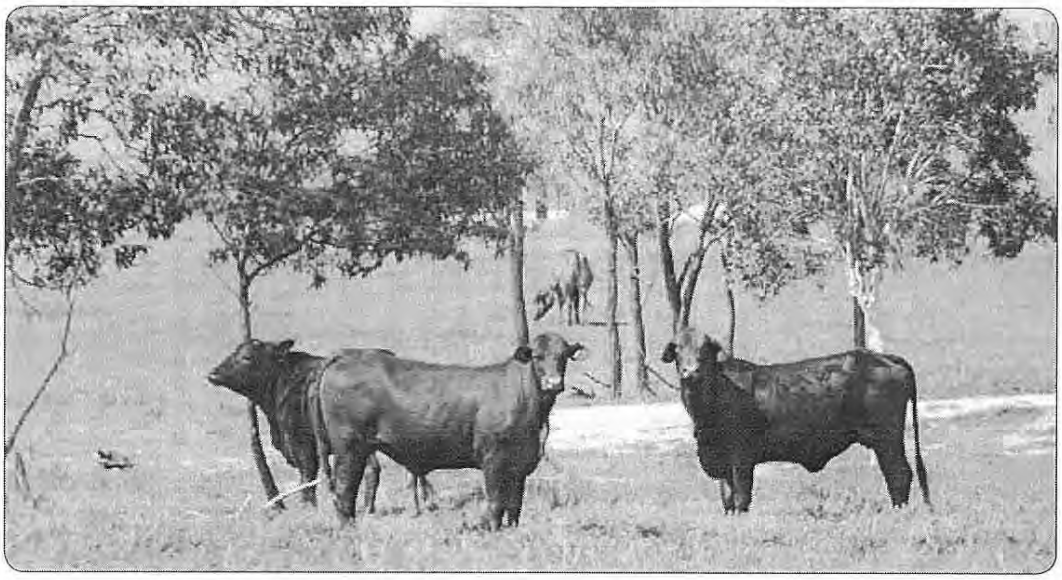
About 20 000 residents of SEQ live in communities that have reticulated drinking water supplies not directly connected to the SEQ Water Grid. These communities have a diverse range of water supply sources and varying levels of security. They also differ in terms of size and forecast population growth.

The Strategy seeks to achieve the same security of supply for these communities in the future as for those connected to the SEQ Water Grid.

A number of these communities are already benefitting from improved security of supply, following the completion of SEQ Water Grid projects.

In the Logan River system, the construction of the Bromelton Off-stream Storage and Cedar Grove Weir has allowed the SEQ Water Grid Manager to reduce the demand on Maroon Dam, increasing supply reliability to the communities of Beaudesert, Kooralbyn and, to a lesser extent, Rathdowney. These communities rely on high priority water allocations from the Logan River Water Supply Scheme and have previously experienced restrictions once every 10 years, on average. With the new supplies, hydrologic modelling indicates that it should be possible to reduce the frequency of restrictions to less than once every 15 years, on average. In the short to medium term, it could even be possible to achieve the LOS objectives.

In the Warrill Valley system, more than 8000 megalitres per year of high priority water allocation has been made available. Previously, 7000 megalitres of this allocation was held by the Swanbank Power Station, which is now supplied from the Western Corridor Recycled Water Scheme. Through the SEQ System Operating Plan, the QWC has reserved this allocation to enhance the short-term security for urban users in Aratula, Boonah, Kalbar and Mount Alford.



The QWC is reviewing the future needs of all rural towns and villages with reticulated supplies. The review will inform decisions regarding supply augmentations and drought response planning. Options to improve security of supply include:

- directly connecting to the SEQ Water Grid through the construction of new pipelines
- augmenting existing sources of supply with additional surface and groundwater supplies
- carting water.

The Sunshine Coast Regional Council began constructing a water supply pipeline to Maleny from the Landers Shute water treatment plant in mid-January 2010. The pipeline is expected to be completed about mid-2010.

A range of options are being investigated for other communities. Table 6.2 lists the key priorities. The QWC will provide advice to the Queensland Government about the preferred means of securing supply to Beaudesert and Canungra in late 2010.

Table 6.2 Options to improve security of supply to rural towns

Town	Current investigations
Beaudesert	Options under investigation are a pipeline to the planned Wyaralong water treatment plant or an upgrade to the existing water treatment plant.
Canungra	Options under investigation include a pipeline to Beaudesert or the construction of an off-stream storage and an upgrade to the existing water treatment plant.
Dayboro	A pipeline from Petrie is being investigated. Moreton Bay Regional Council has completed a planning study concluding that the construction of a pipeline would be the most cost-effective option.
Boonah	A pipeline to either Ipswich or the planned Wyaralong water treatment plant is being investigated as a possible drought response measure.

For some communities, the LOS objectives will be targeted but might not be deliverable in the short term. The priority of connection will be determined based on the likelihood of restrictions and size of the community, including business and industry.

The Lockyer Valley Regional Council communities of Preston, Upper Flagstone and Upper Lockyer (bordering on Highfields) currently have water services supplied by Toowoomba Regional Council. This operating arrangement will continue.

Amity Point, Dunwich and Point Lookout on North Stradbroke Island already have very secure supplies and are unlikely to require augmentation.

For communities that are not physically connected to the SEQ Water Grid, security of supply will generally be maintained by water carting in severe drought.

6.5.2 Communities without reticulated drinking water

About 180 000 residents dispersed across SEQ in small villages and rural residential developments rely on drinking water from rainwater tanks and private bores.

These residents will be able to supplement local supplies from the SEQ Water Grid as necessary, through existing carting services. Water carters will continue to have regulated access to stand pipes, and residents will continue to be responsible for organising and paying for carting. Such arrangements will also continue to apply to communities such as Mt Tamborine. Demand forecasts for the SEQ Water Grid include water to supplement rainwater tanks during periods of low rainfall.

Local government planning schemes specify the minimum size of rainwater tanks required for new houses in areas where reticulated drinking water is not available. These requirements currently vary across SEQ. The QWC will review the minimum requirements for the size of rainwater tanks and connected roof area across SEQ, taking into account the costs of new rainwater tanks and carting. Local governments could choose to mandate larger tanks than the minimum size.

Over time, reticulated drinking water could be supplied to some rural villages that are currently supplied from rainwater tanks and private bores. Factors that will be taken into account when considering supplying these villages with reticulated water include:

- demand from residents and industry
- population growth
- cost and cost recovery
- community views.

Local governments and the new distributor-retailers will decide whether a reticulated drinking water system will be provided to rural villages and determine pricing to provide service delivery to customers.

The QWC will develop a new policy framework to guide decisions regarding the supply of reticulated drinking water to communities that currently rely on drinking water from rainwater tanks and private bores.

M431

6.6 Rural production

Water resource plans have assured access to water for rural production. However access to additional water for rural production and the cost of that water has proven to be a major challenge in parts of SEQ.

While some of the projects that have been constructed as part of the drought response are already delivering benefits for rural users in parts of SEQ, there is potential to do more.

The QWC and the Department of Environment and Resource Management will lead the investigation of a range of options to improve the availability of water for rural production. These options could increase the total amount of water available, or improve the reliability of its supply. They would build on existing entitlements, under which about 150 000 megalitres was used for rural production in SEQ in 2005, excluding recycled water and rural water consumption in the Mary Basin.

Any water supply initiatives in SEQ must directly address the needs of existing and potential producers. In most catchments the volume of unallocated water available under water resource planning is limited, meaning that there are no opportunities for major new rural supply dams. Recycled water could provide further opportunities, but can be expensive to transport over long distances.

Rural water advisory group

A rural water advisory group has been established to assist planning for rural water supply initiatives in SEQ. The group was established by the Queensland Farmers Federation, in partnership with the QWC and the Department of Environment and Resource Management. It will comprise representatives of rural water users, who will provide input to the investigations outlined in this section, ensuring that options address local needs.

6.6.1 Introduce tradeable allocations

Water allocated for rural uses in SEQ includes a range of high priority and medium priority entitlements from supplemented schemes and some unsupplemented water entitlements. A supplemented water supply is one that is made more reliable by releases of stored water from dams.

While available, some of these existing allocations are not being used or only partly used (i.e. 'dozers' and 'sleepers').

There are a range of reasons why allocations are not being used—for example, some farms that were previously irrigated are now used for less water-intensive activities. The reasons for these types of changes range from water not being available during the drought, to the land having been purchased as a hobby farm.

The QWC has received feedback from some irrigators that these entitlements do not match their business needs. For example, some irrigators have explained that major purchasers are increasingly requiring certainty of supply over a number of years. The irrigators have expressed concern that they cannot match these demands under their existing allocations. Some other irrigators have expressed concern that they often do not receive most of their announced allocations until after the planting season.

As water resource plans are progressively implemented in SEQ, water trading is likely to provide opportunities for expanding production through the movement of under-utilised existing water entitlements. The QWC, with the Department of Environment and Resource Management, will investigate options to facilitate trading in key areas as identified through the rural water advisory group.

6.6.2 Investigate options to increase reliability

The SEQ Water Grid provides a range of opportunities to conjunctively manage rural and urban supplies, potentially increasing both the volume and reliability of supply for rural use. Options that could directly benefit rural users include:

- providing access to surplus urban allocations on a temporary basis, in addition to existing rural allocations
- temporarily increasing the reliability of existing rural allocations or the announced allocations earlier in the water year, through under-utilised urban allocations.

Rural users can indirectly benefit if less than the full allocation is used for urban purposes. This occurs when water is held back in the dam, so as to be available during a severe drought, or is simply not needed at that time. Where the water is held back in the dam, announced allocations for rural users will be higher than would otherwise be the case.

Some of these indirect benefits are already being realised. In the Warrill Valley, as a temporary measure, the QWC has reserved 8250 megalitres of interim water allocation to enhance supply reliability for Boonah and connected towns, as explained in Section 6.5.1. As a result, Moogerah Dam will be maintained at a higher level than would otherwise be the case. In turn, announced allocations for rural users will generally be higher.

In the Logan River, the reliability of supplemented supplies to communities and rural irrigators has improved due to the construction of Cedar Grove Weir and the Bromelton Off-stream Storage and applying LOS objectives to the delivery of urban water supplies (refer to Section 6.5.1). Hydrological modelling indicates that application of LOS principles to the operation of the urban supplies will increase supplemented irrigator monthly supply reliability required under the water resource plan by up to 10 per cent. Options to further improve availability or reliability, for the period until Wyaralong Dam and the water treatment plant are constructed and while LOS system yield continues to significantly exceed demand, are being assessed.

Any such supply must occur within a transparent framework, which ensures that the costs are appropriately shared. The QWC will develop this framework in 2010 and 2011. The framework will address a range of issues, including the conditions of supply and the price to rural users. For example, the framework will specify when supply to rural users will be interrupted.

As background to the framework, the QWC will seek input from existing rural producers in partnership with the rural water advisory group and the local governments to establish whether existing entitlements meet local needs. Where they do not, the QWC, in collaboration with the Department of Environment and Resource Management, will assess possible options that address these needs within the water resource planning framework.

Options for conjunctive management of urban and rural water supply apply in specific catchments, generally where an urban water supply source is located upstream of rural irrigation areas. These circumstances apply to:

- Borumba Dam on the Mary River
- Wivenhoe Dam on the Brisbane River
- Maroon Dam and the Bromelton Off-Stream Storage on the Logan River
- Moogerah Dam in the Warrill Valley.

The QWC will also investigate these options in 2010 and 2011.

6.6.3 Increase the use of recycled water

About 245 000 megalitres of treated wastewater was discharged from wastewater treatment plants in SEQ in 2006. About 17 000 megalitres of this was recycled, including about 400 megalitres for rural production. By 2056, it is forecast that the amount of treated wastewater available for recycling will exceed 400 000 megalitres per year.

The QWC is investigating a range of opportunities to increase the use of recycled water for irrigation, as a means of increasing rural production and improving the health of waterways and Moreton Bay. Some of these investigations are discussed below.

Western Corridor Recycled Water Scheme

The Lockyer Valley is generally regarded as one of Australia's most productive horticultural regions. It contains over 40 000 hectares of the most productive horticultural soil in Queensland. However, water availability and reliability has become increasingly critical to growing operations. Declining volume and quality of both surface water and groundwater in the valley has led to a reduction of up to 75 per cent in the productivity of this key horticultural production area. Recent surveys indicate that current production operates at only 20 to 30 per cent of total potential due to the poor reliability of the water supply.

The supply of recycled water from the Western Corridor Recycled Water Scheme has the potential to significantly improve water availability, and especially water reliability. This reliability is fundamental to restoring profitability and productivity to the irrigators, and vibrancy to the area. For example, it could restore farm practices of planting three crops per season and thereby allow local irrigators to secure a stable and sustainable share of the Brisbane and Sydney markets.

It could also help to transform farm practice and crop selection to higher value products. At present, Lockyer Valley irrigators mainly grow cereal, fodder and forage crops that do not have the same value as fruit, flora and vegetable crops. Water reliability would enable more of these farms to grow higher value crops, ensuring their long-term economic sustainability and a more sustainable supply located close to the Brisbane market.

The Queensland Government first announced that 32 000 megalitres per year would be available from the Western Corridor Recycled Water Scheme for supply to irrigators in mid-2006. Supply is contingent on a number of conditions, which were made clear in the business case and have been reflected in draft term sheets and negotiations. These conditions include that:

- supply ceases when key SEQ Water Grid storage levels fall to 40 per cent of combined capacity
- pricing is at short-run marginal cost
- a sustainable management regime is implemented over the Lockyer Valley aquifers.

As outlined in Section 5.4.4, the optimal operating strategy for purified recycled water is currently to use it to augment Wivenhoe Dam only when key Water Grid storage levels fall to 40 per cent of capacity. This mode of operation means that recycled water will be available for supply to Lockyer Valley irrigators at all other times.

In addition, the amount of recycled water available for rural production from the Western Corridor Recycled Water Scheme in normal operating mode could increase over time from 32 000 to 37 000 megalitres per year. The time at which the additional Category B recycled water became available would depend on the rate of increase in feed water flows to the Western Corridor Recycled Water Scheme and demands for urban use.

The Lockyer Water Users Forum has proposed a number of recycled water schemes prior to and following this announcement. Each of these schemes has involved distribution from the Western Corridor Recycled Water Scheme direct to irrigators, and each has relied on further funding commitments by the Queensland and Australian governments to be economically viable.

The SEQ Water Grid Manager and the QWC are now investigating a number of options to enable the supply of recycled water to the Lockyer Valley at less overall cost. These options include using the existing Western Corridor Recycled Water Scheme pipeline and existing irrigation dams as balancing storages. If these investigations prove to be unsuccessful, supply of a smaller volume of recycled water to irrigators near the existing pipeline will be considered. The SEQ Water Grid Manager and the QWC will continue to consult with irrigators.

Other investigations

The QWC is investigating options for regionally significant recycled water schemes across SEQ, as part of sub-regional total water cycle planning (refer to Section 2.4.5).

The first sub-regional total water cycle management plan has involved detailed assessment of the potential for reusing treated wastewater from the Beaudesert and Flagstone areas for irrigation purposes along the Logan River. The advantages of this option include an increase in water for rural irrigation and a significant reduction in the discharge of nutrients into the Logan River.

The QWC will also investigate other local reuse opportunities, in areas such as Redland Bay and Somerset. Some of these opportunities are being investigated as an alternative to, or to supplement, a planned upgrade to a wastewater treatment plant in the area. Studies are required to determine the viability of using the treated wastewater, potential uptake, and costs of any new or upgraded infrastructure.

At the local scale, schemes could be identified as part of local government planning processes or by a distributor-retailer. Any recycled water scheme would be subject to physical supply constraints, pricing that reflects at least the short-run marginal cost of supply and compliance with relevant water resource plan and water quality requirements.

6.6.4 Investigate potential surface storages

Under water resource planning, there are few remaining opportunities in SEQ for surface storages for urban or rural purposes.

The QWC will undertake detailed investigations of remaining options in the Logan and Mary basins, as explained in Section 5.4.2. These investigations could identify small storages that might be used for rural purposes, subject to cost and within the requirements of water resource plans.

Rural water availability in the Warrill Valley area could be further increased if and when a pipeline is constructed to Boonah from the SEQ Water Grid.

6.6.5 Increase efficiency

Improved rural water use efficiency will continue to be driven by:

- programs to improve farm efficiency, such as the SEQ Irrigation Futures program
- water markets and trading
- appropriate pricing to better reflect National Water Initiative pricing principles
- more efficient rural water supply schemes.

Queensland Government initiatives for rural water supply

Rural Futures Strategy

The Rural Futures Strategy has been released as part of the Regional Plan. The Rural Futures Strategy supports the sustainable economic and social development of rural areas in SEQ. It builds on existing strategies, policies and programs, providing a whole-of-government approach to address planning and economic issues in rural SEQ.

SEQ Irrigation Futures

SEQ Irrigation Futures is a partnership program between the Queensland Government, five major irrigation industry groups and SEQ Catchments to help irrigators use water more efficiently. An efficiency gain of 12 per cent was achieved across all irrigation sectors in the region by the end of 2009, equivalent to approximately 21 000 megalitres per year. The program addresses irrigation management and impacts from irrigation. It includes system efficiency assessments, field trials and workshops and, where appropriate, financial incentives to assist irrigators to cut consumption.

Rural Water Use Efficiency Initiative

The Rural Water Use Efficiency Initiative is a partnership between the Queensland Government and seven industry groups. It helps irrigators to improve on-farm management of natural resources and reduce off-farm impacts, particularly through efficient irrigation and management of nutrients. The initiative includes extension activities, on-farm trials, demonstrations and system assessments, and financial incentives to upgrade irrigation and effluent management systems. The Queensland Government has committed $6.5 million over four years.

Knowledge Management System for Irrigation

An internet-based system that assists irrigators to manage a range of water issues on their properties was launched in August 2008. Known as the Knowledge Management System for Irrigation, it is an initiative of SEQ Irrigation Futures and it gives irrigators and industry personnel access to decision making tools, water use calculators and natural resource information. This enables irrigators to improve aspects of their water management, such as irrigation scheduling and pump efficiency.

Water metering project

In 2005, the Queensland Government initiated a statewide policy to establish a consistent approach for metering unsupplemented water taken for irrigation and other commercial purposes. Metering is a cornerstone of the National Water Initiative. It ensures the fair use of resources, enhances entitlement security and reliability, and improves water planning and management outcomes.

6.7 Supplies to outside SEQ

In the same way that SEQ's water supplies could be affected by the ability to source water from outside SEQ, consideration has also been given to supplying water from SEQ to neighbouring communities.

With the completion of key SEQ Water Grid assets, a level of water security has been reached that enables consideration of further opportunities to supply water outside SEQ.

A substantial amount of work is required to prepare a policy framework that would govern supplies from the SEQ Water Grid to urban areas outside the SEQ region, including economic and operational principles, standard contractual provisions and even possible inter-governmental agreements.

Any new supply should be on a full commercial basis. The price will vary depending on whether the supply is interruptible and whether it brings forward the timing of the next major supply.

Any supply of water to irrigators and to urban areas outside of SEQ will not be permitted to impact on the achievement of the LOS objectives for urban customers within SEQ.

6.7.1 Toowoomba

The Queensland Government has made a commitment to supply up to 10 000 megalitres per year from Wivenhoe Dam to the Toowoomba Regional Council area. This supply has been factored into demand forecasts and the water balance.

Supply could increase to 18 000 megalitres per year over time, depending on demand from the Toowoomba Regional Council area.

6.7.2 Cooloola region

The QWC will investigate options to operate the SEQ Water Grid to improve the volume and reliability of supply to towns in the Mary Basin (refer to Section 5.4.2).

In the short to medium term, when supply for SEQ exceeds demand, Noosa could be supplied from the Northern Pipeline Inter-connector Stage 2 rather than from Borumba Dam. This would enable the SEQ Water Grid Manager to make additional water available from Borumba Dam for local purchase and use, potentially deferring the need for additional supplies in the Mary Basin.

In the longer term, new supplies could be developed in the Mary Basin for local use and to supply the SEQ Water Grid.

6.7.3 Tweed

With the current high level of security of supply from the SEQ Water Grid, the Queensland Government will consider supply to the Tweed Shire Council area and other adjoining areas, where supply has no impact on the achievement of the LOS objectives for SEQ and on a full commercial basis, without subsidy or a price path.

6.8 Energy

The SEQ Water Grid will become increasingly energy-intensive over time, due to the operation of manufactured water sources and interconnecting pipelines. This section outlines the energy savings that will be achieved through demand management and the efficient operation of the SEQ Water Grid.

6.8.1 Total water cycle energy use

Energy use for water supply and wastewater collection and treatment represented about 0.1 per cent of energy use in the total urban system in SEQ in 2006–07.

Actual energy consumption for water supply varies across the region. About 2430 megajoules of energy was consumed for every megalitre of water supplied in Brisbane in 2006–07. By comparison, the energy intensity of supplying water to the Gold Coast from Hinze Dam is relatively low (about 750 megajoules per megalitre of water supplied), due to the lower treatment requirements and the height of the dam.

Tertiary treatment of wastewater before discharge to Moreton Bay is a significant user of energy in the SEQ water cycle. In Brisbane, wastewater treatment plants use another 2070 gigajoules for every megalitre of water supplied. On the Gold Coast, wastewater treatment plants use 3600 gigajoules per megalitre of water supplied.

The end uses of water are responsible for substantially more energy consumption and greenhouse gas emissions than its supply. Most of this energy is used to heat water. Across Australia, water heating is responsible for about 25 per cent of residential energy demand and 27 per cent of greenhouse gas emissions in households, excluding transport.

In Brisbane, residential hot water systems are estimated to use about 0.5 per cent of energy use in the total urban system in 2006–07. On the Gold Coast, it is 1.3 per cent—more than nine times the energy used for water supply and wastewater collection and treatment.

This section focuses on the energy used in the operation of the SEQ Water Grid. However, it is acknowledged that water efficiency can also contribute to major reductions in energy consumption for residential and non-residential end uses and for collecting, treating and discharging wastewater.

6.8.2 Avoided energy use due to demand management

A demand management program across all customer groups is an integral part of the Strategy, as outlined in Section 6.2.

Maintaining average regional urban consumption at or below 375 litres per person per day will result in a total energy saving of around 315 000 megawatt hours per year in 2020 compared to pre-drought trends, increasing to around 720 000 megawatt hours per year by 2048 (refer to Table 6.3). Additional savings will be achieved if actual consumption is less than the planning assumption of 375 litres per person per day. These estimates highlight the importance of the demand management program in reducing the need for additional energy-intensive water supplies. The estimates are based on the updated portfolio, including the greater use of desalination and increased energy intensity.

These estimates are also based on most of the additional demand being supplied from desalination and using the energy intensities described in Figure 6.6. It represents a saving of about 40 per cent in energy consumption for the supply of bulk water and is equivalent to the total energy consumption of about 86 000 homes.

These estimated energy savings reflect current technology and do not take into account the effects of state and federal government policies such as the Mandatory Renewable Energy Target, Renewable Energy Target and any future emissions trading scheme.

The savings listed in Table 6.3 relate to SEQ Water Grid assets. Energy consumption for distributing treated water and collecting and distributing wastewater is also likely to be reduced. The analysis also does not include energy savings to residents and businesses inside the home or business associated with the demand management program. Conversely, the estimate does not include additional energy requirements associated with local supply solutions such as rainwater tanks and greywater systems.

Table 6.3 Forecast energy savings from demand management (medium series population growth, no allowance for climate change and including rural communities within the SEQ Water Grid)

	2020		2048	
	Forecast demand for Grid water (Megalitres per year)	Forecast Grid energy consumption (Megawatt hours per year)[1]	Forecast demand for Grid water (Megalitres per year)	Forecast Grid energy consumption (Megawatt hours per year)[1]
Pre-drought trends	608 000	769 000	867 000	1 896 000
With the demand management program	491 000	454 000	701 000	1 176 000
Savings due to water efficiency	**117 000 (19 per cent)**	**315 000 (41 per cent)**	**166 000 (19 per cent)**	**720 000 (38 per cent)**

Note: Data has been rounded, including the savings estimates.

1 Assumes that the SEQ Water Grid is operated to maximise energy efficiency.

6.8.3 Energy to deliver water

Until recently, SEQ's water has been supplied through dams and other low energy intensity infrastructure. Diversifying the sources of supply to achieve the LOS objectives comes with an increased energy cost. Managing this increase is a key consideration for water supply planning.

As illustrated in Figure 6.6, water from desalination is expected to be significantly more energy-intensive to produce than treated dam water. The energy requirements are based on the infrastructure operating at capacity. While the energy requirement for transporting water is similar for all new sources, the increased movement of water around the SEQ Water Grid will increase the overall energy intensity of the region's water supply.

M437

Water supplied from rainwater tanks can vary enormously in its energy intensity. Water that is delivered by gravity, with no additional treatment, does not require any other energy inputs. However, water that is treated to drinking water quality and delivered by pump can exceed the energy intensity of water produced from local dams or even the Western Corridor Recycled Water Scheme.

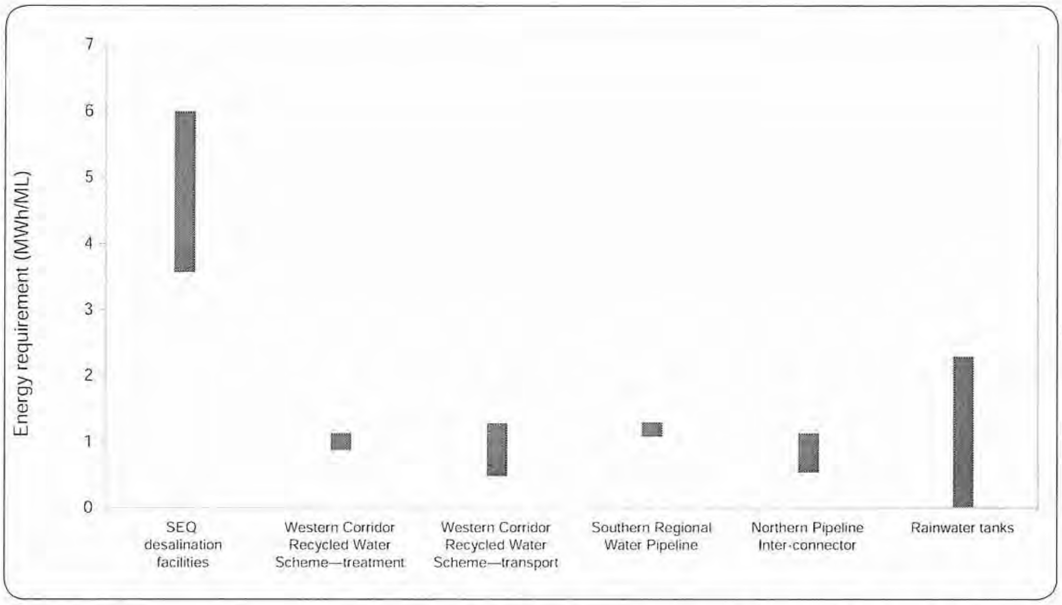


Figure 6.6 Estimated energy intensity of selected components of the SEQ Water Grid

Figure 6.7 shows the forecast energy required to produce water if the SEQ Water Grid were operating at capacity in 2020.

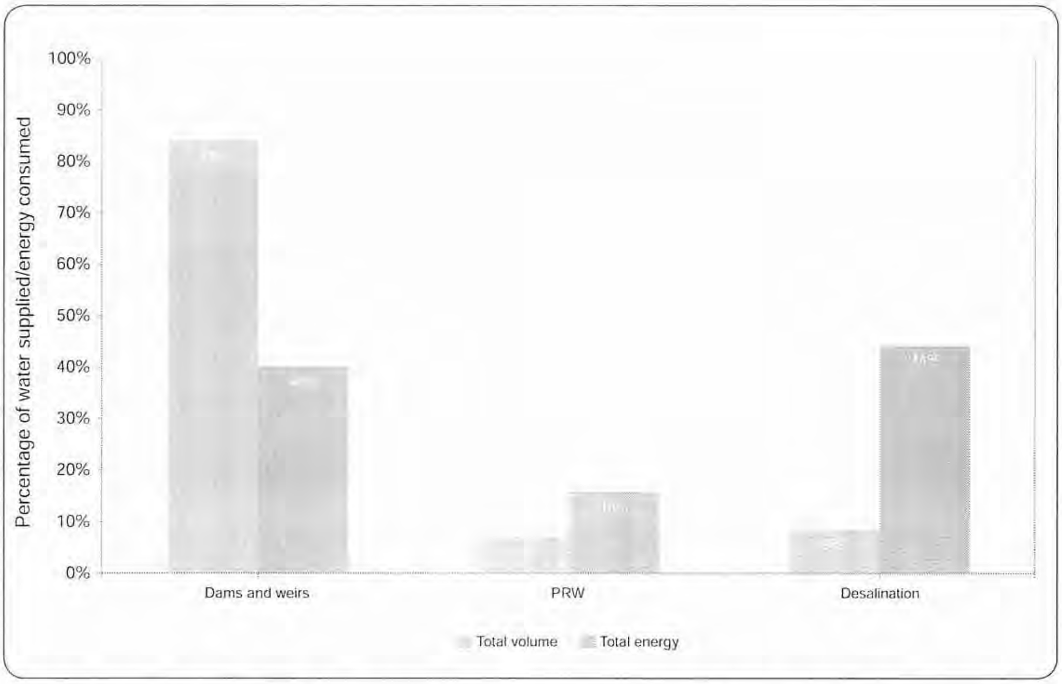


Figure 6.7 Projected water production capacity and associated energy consumed in 2020

In practice, desalination and purified recycled water schemes will not be required to operate at maximum capacity at all times. Figure 6.8a illustrates the estimated energy required to operate the SEQ Water Grid if population grows in line with the medium series projections. Figure 6.8b shows the energy usage if population growth tracks on the high series projections. At any time, actual energy used will be within the ranges presented. Without the demand management program, significantly more water would be required, and the overall energy requirement would increase accordingly.

M438

The average energy intensity of water supplied from the SEQ Water Grid is estimated to be about 0.5 megawatt hours per megalitre per year in 2010. As the proportion of desalination supplies increases over time, the average energy intensity of water will increase to about 0.9 megawatt hours per megalitre per year in 2020 and 1.6 megawatt hours per megalitre per year in 2050.

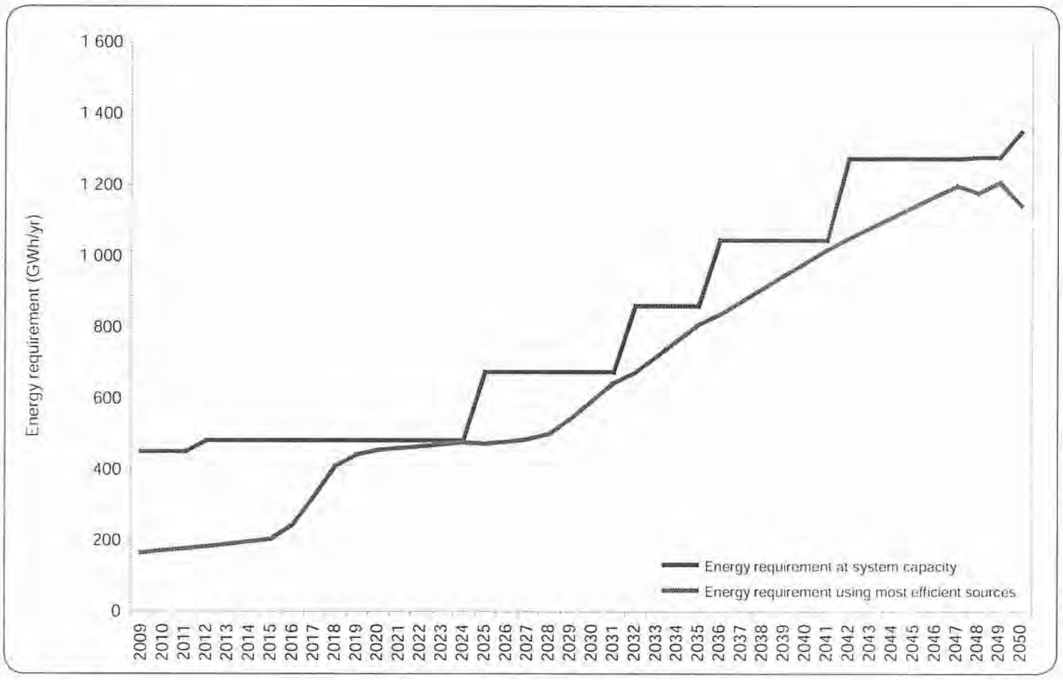


Figure 6.8a Estimated energy consumption for bulk water supply (proposed portfolio, medium series population growth, no allowance for climate change)

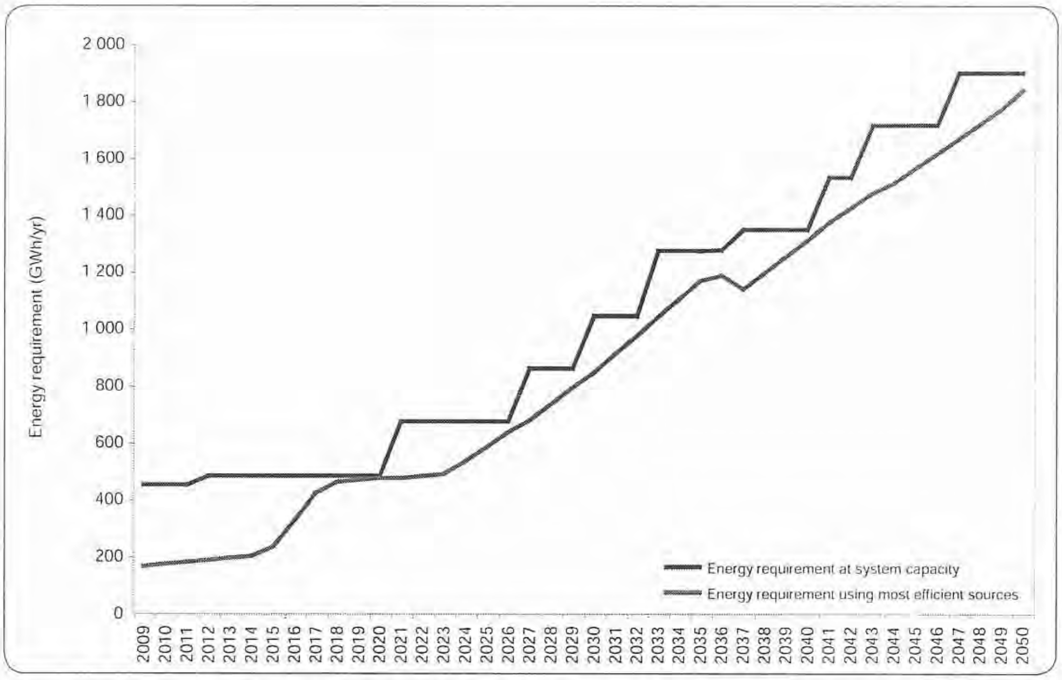


Figure 6.8b Estimated energy consumption for bulk water supply (proposed portfolio, high series population growth, no allowance for climate change)

If average total consumption is maintained at 345 litres per person per day, the projected average energy intensity and greenhouse gas emissions from the grid would reduce.

The QWC will assess all aspects of energy consumption associated with projected new water sources and factor these into water supply planning.

M439

6.8.4 Greenhouse gas emissions of water supplies

Greenhouse gas emissions are calculated from energy use by applying greenhouse gas emissions factors, calculated by considering all the emissions associated with energy production and transmission. Emissions are standardised to carbon dioxide equivalents published by the Australian Government Department of Climate Change and Energy Efficiency. The emissions generated for each kilowatt hour of electricity supplied in Queensland are equivalent to approximately 0.89 kilograms of carbon dioxide.

WaterSecure is purchasing renewable energy certificates to offset the operational energy requirements of the SEQ (Gold Coast) Desalination Facility.

Conversely, fugitive emission such as nitrous oxide and methane from wastewater treatment processes or methane emissions from water storages could be significant in some systems.

6.8.5 Water and energy reporting

Industries across the country are increasingly required to become more energy- and water-efficient. The co-dependence of energy and water in many industries presents opportunities to improve water and energy efficiency simultaneously, with users receiving a net benefit of lower electricity and water bills.

Industries are currently targeted under mandatory federal and state initiatives to identify and report on energy efficiency opportunities. At the same time, large water using industries in SEQ are required to implement water efficiency management plans.

The overlap between mandatory reporting for energy and water could result in potential for synergies, conflicts and duplication between an individual business's water and energy management plans. The QWC proposes to work in collaboration with water service providers and the Queensland and Australian governments to improve the efficiency of reporting for industry and move towards streamlined water and energy reporting.

6.9 Drought response planning

The purpose of drought response planning is to ensure continuity of supply consistent with the LOS objectives and regardless of climatic conditions, as explained in Section 3.1.2. The proposed process for developing and implementing the regional drought response plan is described in Chapter 7.

Under the LOS objectives, a regional drought response plan is expected to be triggered no more than once every 25 years, on average. Three out of four of these droughts will ease within the preparatory phase, before the construction of new supply sources commences.

Drought response plans will also be maintained for communities that have reticulated drinking water supplies not directly connected to the SEQ Water Grid.

6.9.1 Probability of triggering implementation of a drought response plan

SEQ now has a much more secure water supply than it did prior to the Millennium Drought, due to the efficient use of water and the completion of climate resilient supplies and interconnections. Due to this improved level of security, it is likely that the next augmentation will be triggered by population growth, rather than another severe drought.

The QWC models short-term security based on the combined levels of the twelve key SEQ Water Grid storages, including dams in the Sunshine and Gold Coasts. The combined level of these storages provides the trigger to initiate water strategy measures, such as implementing water restrictions.

Figure 6.9 shows probable dam levels of the next five years, based on different drawdown curves that have defined probabilities that the dams will be drawn down at a greater rate. For example, the 99 per cent curve shows dam levels that have a 99 per cent probability of exceedence at any point along the curve (that is, there is only a 1 per cent chance that these low levels will occur). The drawdown curves use data for inflows, rainfall and weather patterns extending back for 117 years as inputs to stochastic modelling.

The model illustrates that there is a less than 1 per cent probability of dams falling to 40 per cent of combined capacity over the next five years, which would trigger the implementation of the regional drought response plan.

The model also illustrates that there is an even lower probability of key SEQ Water Grid storages falling to 30 per cent of capacity before the end of 2014, triggering the construction of new climate resilient supplies.

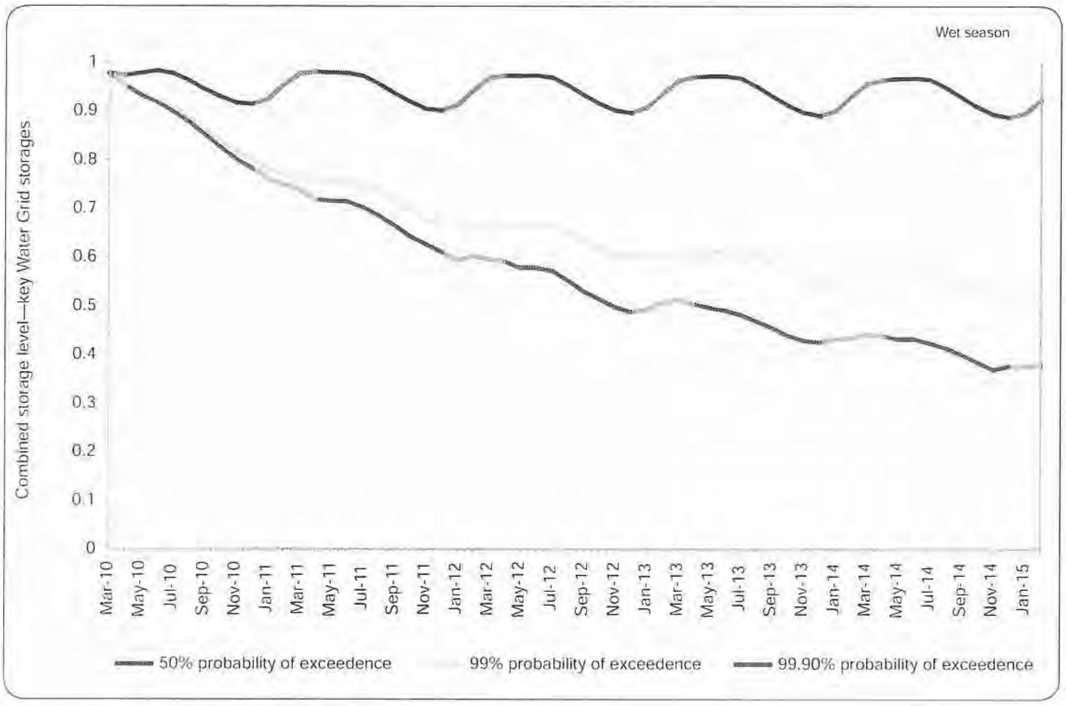


Figure 6.9 Forecast SEQ Water Grid storage levels

The modelling is based on average regional urban consumption across SEQ of 375 litres per person per day, and includes an allowance for medium series population growth. Lower levels of consumption will result in higher dam levels than are reflected in the model. The model is based on operation of the SEQ Water Grid in accordance with the existing SEQ System Operating Plan (for instance, one of the requirements of the existing SEQ System Operating Plan is to reduce production from the SEQ (Gold Coast) Desalination Facility to one-third of capacity when dam levels are high). It also takes into account supply from Wivenhoe Dam to Toowoomba and new sources, including Wyaralong Dam from 2012.

6.9.2 Drought supply requirement

The drought response plan will include a combination of applying Medium Level Restrictions, introducing purified recycled water to Wivenhoe Dam and constructing climate resilient supplies. The drought response plan should consider the ability to construct sufficient new climate resilient infrastructure within a nominal 30 months. This timing would be reviewed based on the preparatory planning outlined above.

The drought supply requirement is the gap between restricted demand and the climate resilient supply capability of existing supplies at any time over the planning horizon. This is the amount that would need to be supplied by the drought infrastructure, which must be able to be commissioned within the 30-month period to achieve the LOS objectives. This timeframe will be refined based on the amount of preparatory work undertaken and the level of preparedness.

As explained in Section 5.3.3, climate resilient and independent supplies are forecast to increase to about 331 700 megalitres per year following the completion of the committed projects. At this time, climate resilient supplies will comprise about 63 per cent of the LOS system yield, compared with 40 per cent in 2006.

As a result, much less infrastructure would need to be constructed in response to another severe drought than was required in response to the Millennium Drought. The drought response plan of the time would need to address these requirements

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There might be a practical limit to the amount of infrastructure that can be constructed as part of a drought response. For example, if the drought supply requirement were to become greater than 180 000 megalitres per year at any point in time, it might not be possible, if a drought occurred, to procure and commission sufficient drought infrastructure in time to avoid extreme level restrictions—meaning that the LOS objectives would be at risk of not being achieved. These risks can be reduced through construction of additional climate resilient supplies as part of infrastructure development to maintain supplies during normal conditions. These factors should be considered in future long-term planning decisions as the Strategy is reviewed.

The drought response plan will also set specific triggers to start building infrastructure, based on detailed technical investigations. These triggers are likely to include preparatory work in advance of the 40 per cent trigger to commence drought response activities to enable completion of the projects within the assumed timeframe.

6.9.3 Local drought response planning

Drought response plans will be maintained for communities that are not physically connected to the SEQ Water Grid, including Kenilworth, Kilcoy, Linville, Jimna, Coominya and Canungra. These plans usually involve a combination of water efficiency measures and carting of water, as were implemented in Maleny and Canungra in late 2009.

The costs of implementing local drought response plans will be shared across all customers of the SEQ Water Grid.

Over time, the Strategy seeks to achieve the same security of supply for these communities as for those connected to the SEQ Water Grid, as explained in Section 6.5.

6.10 Strategy outcomes

An outcome of the Strategy is a list of actions that, if implemented, would deliver the Water Supply Guarantee. Table 6.4 provides an overview of the key elements of the Strategy and the likely outcomes.

Table 6.4 Key elements of the Strategy

Strategy	Outcomes
Implement LOS objectives	• Infrastructure is planned and operated to meet a regional urban water demand of 375 litres per person per day so that: – Medium Level Restrictions are expected to be required no more than once every 25 years, on average – Medium Level Restrictions are not expected to exceed six months' duration more than once every 50 years, on average – Medium Level Restrictions will require a reduction in demand of 15 per cent. • The system yield is increased by about 14 per cent, due to optimised use of all water sources and taking advantage of variable conditions across the region.
Efficient water use	• Water is used at least 24 per cent more efficiently compared to pre-drought trends, while the active, outdoor lifestyle that residents of SEQ enjoy is maintained. • Planning is based on a conservative assumption of average urban water consumption of 375 litres per person per day. • The community is encouraged to maintain average residential consumption at or below 200 litres per person per day (Target 200). • Business and industry is regulated to move towards best practice water use efficiency. • Urban water system losses are reduced from 14 per cent in 2005 to a target of 8 per cent. • Permanent Water Conservation Measures are introduced. • Power stations in the SEQ region use purified recycled water when taking water from the SEQ Water Grid. • The demand management program encourages efficient water use through an appropriate balance of structural, operational and behavioural measures.

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Local supplies	• All new homes in SEQ meet mandatory water savings targets. Rainwater tanks and stormwater harvesting are options to meet the target. • Most new industrial and commercial buildings install alternative water supplies, potentially including a rainwater tank. • Higher savings are pursued where cost-effective, provided that community health and safety are maintained. • Water to top up pools is primarily sourced from a rainwater tank or downpipe rainwater diverter. • Increased recycling and increased capture of rainwater and stormwater contribute to the improved water quality of waterways and Moreton Bay.
Water balance	• Additional supplies could be required in 2021, depending on average consumption, population growth and the impact of climate change on the supply from dams and weirs. • Maintaining average residential consumption at 200 litres per person per day could defer the need for additional supplies by at least five years, to between 2027 and 2033. • The QWC will now undertake detailed planning to ensure that additional supplies can be delivered efficiently and when required. The planning investigations will inform a final decision regarding the preferred location, capacity and timing of future water supplies. • Further investigations will also be undertaken for a range of other potential sources of supply. • Priority desalination sites have been confirmed at Lytton and Marcoola. Reserve sites are at Tugun and Bribie Island. • Investigations to enable a decision on the preferred desalination sites, including a project plan for delivery as a drought response if required are continuing. It is anticipated that the preferred site will be identified in the 2011–12 financial year.
Drought response planning	• A drought response plan is prepared for future droughts. • Drought response plans are prepared for communities with stand-alone sources of supply.
Operating the SEQ Water Grid	• The SEQ System Operating Plan will direct water security, considering cost and a range of other factors including energy use. • Measures will be introduced to ensure that the SEQ Water Grid is managed in accordance with the *Australian Drinking Water Guidelines* and the *Australian Guidelines for Water Recycling*.
Groundwater	• Water from groundwater aquifers will continue to make a small contribution in the delivery of urban supplies. The sustainable take from these aquifers is expected to remain relatively static. • Over time, the overall take from regulated groundwater aquifers in the Warrill Creek and Lockyer Creek catchments is planned to be reduced to sustainable levels.
Rural communities	• Consistent LOS objectives are targeted across communities with reticulated drinking water. • Drought response plans will be prepared for communities that are not directly connected to the SEQ Water Grid. • About 180 000 residents of SEQ rely solely on water from rainwater tanks and groundwater aquifers. These residents will be able to access water from the SEQ Water Grid when required. • A policy position will be developed for providing reticulated drinking water to communities that rely on water from individual rainwater tanks and groundwater aquifers.
Rural production	• Additional supplies could potentially be made available from the SEQ Water Grid for rural production when not required to meet urban needs. • Up to 32 000 megalitres per year of purified recycled water has been made available to irrigators when not needed for urban supplies, subject to conditions. • Options to make supply of recycled water to the Lockyer Valley economically viable will continue to be investigated in detail. • Other recycled water schemes will be investigated, to increase production and reduce wastewater discharges to waterways and Moreton Bay. • Rural water use efficiency will continue to improve, driven by water markets and trading and other factors. • A rural water advisory group has been established to investigate actions for improving the security of water supply for rural production through SEQ Water Grid operation.

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Integration with the Regional Plan	• Sub-regional total water cycle plans will be prepared for key development areas and where regionally significant water supply infrastructure is located. The purpose of these plans is to integrate land use planning with planning for waterway health and for water supply for urban and rural purposes. • A water-sensitive urban design approach will be adopted, whereby planning for water supply and sewerage is integrated with planning for stormwater management.
Environmental outcomes	• Environmental flows are maintained under water resource plans. • Using water efficiently will reduce the amount of energy used by the SEQ Water Grid. The savings are equivalent to the total energy consumption of around 67 000 homes in 2048, compared to pre-drought consumption trends. • Further energy will be saved in the distribution and wastewater system, and within buildings.
Flood mitigation	• New or raised dams will provide additional flood mitigation benefits.
Research and development	• Research and development programs will influence and support future water decision making by exploring new technologies and opportunities.
Implementation and review	• The QWC will monitor and report on the implementation of the Regional Water Security Program. • The Strategy will be reviewed at least every five years, in parallel with the Regional Plan, or as changes to key assumptions require. • The QWC will provide an annual report on key issues, progress on actions and a review of assumptions.

Chapter 7

Implementation and review

This chapter summarises the actions that will be undertaken in the short to medium term to implement the Strategy. It also explains the proposed timeframe for future reviews.

Key messages

- The Regional Water Security Program sets out the future planning actions to ensure ongoing water security for SEQ.
- The Strategy will form the basis of advice to the Minister for Natural Resources, Mines and Energy and Minister for Trade about the Regional Water Security Program.
- The QWC is responsible for monitoring, reviewing and reporting on the implementation of the Regional Water Security Program.
- A number of different agencies are responsible for implementing elements of the SEQ water planning framework.
- The Strategy will be reviewed at least once every five years, aligned with the SEQ Regional Plan.
- The QWC will report on implementation annually. The annual report will include an assessment on whether an earlier review may be appropriate.

7.1 Water planning framework

The Strategy is part of a suite of regional water policies that contribute to achieving the outcomes of the SEQ Regional Plan, as described in Figure 2.1. The Strategy will be implemented in conjunction with those policies and strategies.

To deliver the Water Supply Guarantee, a range of detailed plans must also be prepared, as described in Table 7.1. The scope of these plans varies from regional policies to detailed operational plans.

Before building future water infrastructure, detailed feasibility assessments are required to prove project viability and sustainability. All state and Commonwealth government statutory approvals must also be obtained.

The QWC will continue to refine the hydrologic modelling on which the Strategy is based, in partnership with the Department of Environment and Resource Management (DERM) and the Urban Water Security Research Alliance. In particular, the QWC will review and update the modelling as climate change science improves.

Table 7.1 SEQ water planning framework

	Elements	Responsibility
Regional scale	• Strategy	• QWC
	• Regional Water Security Program	• Minister to make program • QWC to provide advice and coordinate implementation
	• SEQ System Operating Plan	• QWC
	• Drought response plan	• QWC
	• SEQ Water Grid Quality Management Plan	• SEQ Water Grid Manager
	• Healthy Waterways Strategy	• Healthy Waterways Partnership
Sub-regional scale	• Water resource planning	• DERM
	• Sub-regional total water cycle planning	• QWC in partnership with key stakeholders
	• Detailed investigation of potential upgrades to the SEQ Water Grid, including potential sources of supply	• QWC in partnership with key stakeholders
	• Waterways and catchment planning	• DERM, Healthy Waterways Partnership, Seqwater and local governments
	• Distribution and wastewater planning	• Local governments and distributor-retailers

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	Elements	Responsibility
Local government scale	• Planning schemes, including master plans	• Local government
	• Local total water cycle planning	• Local government
	• Distribution network planning	• Local governments and distributor-retailers
	• Wastewater network planning	• Local governments and distributor-retailers
	• Drinking water quality management plans and recycled water management plans	• SEQ Water Grid Manager and water service providers
On-site development scale	• Development assessment	• Local governments , with the involvement of other stakeholders, as appropriate
	• Water efficiency management plans	• Businesses

7.1.1 Regional Water Security Program

On 5 March 2010, a revised Regional Water Security Program was made. The Program was informed by the revised draft Strategy. It specifies LOS objectives and key projects to achieve water security for the region.

The QWC is responsible for ensuring that the key actions and responsibilities of Queensland Government departments and water service providers are carried out or complied with in delivering the Program.

Based on the final Strategy, the Minister may request that the QWC provide updated advice about revised regional water security options. Within four months of receiving the QWC advice, the Minister will make and publish a revised Program.

The QWC will monitor progress against the Program to ensure that water security continues to be achieved for the region.

7.1.2 Review and updating of the Strategy

In general, it is expected that the Strategy will be reviewed on a five-year cycle, aligned with the review of the Regional Plan. The next review of the Strategy may be undertaken earlier, depending on the rate and extent of rebound in demand following the introduction of Permanent Water Conservation Measures across SEQ.

Implementation and monitoring of the Strategy will be reported and published yearly through a report to the Minister, which is required under the SEQ Water Market Rules. Performance will be measured and reported against the activities, works and initiatives (listed in Table 7.3) that must be undertaken to achieve the goals of the Strategy and the underlying assumptions for determining the required LOS yield.

To ensure successful implementation of the Strategy, the monitoring program will include:

- implementing infrastructure against milestones and performance criteria
- continually analysing and assessing the water balance assumptions against population growth, economic development, climate impacts and regional water efficiency
- regularly reviewing and evaluating the SEQ Water Grid performance, seeking improved efficiencies and service delivery
- integrating outcomes from detailed investigations of demand management measures and potential sources of supply
- incorporating findings from the research and development program
- reviewing outcomes delivered through Strategy implementation.

Based on this assessment, the annual report may recommend that the next review of the Strategy be brought forward. This approach will guide further Strategy development and assist in ensuring that the Water Supply Guarantee can be achieved.

7.1.3 Stakeholder and community engagement

The QWC is committed to open, accountable and inclusive community engagement processes. The QWC will provide stakeholder organisations, individuals and interest groups with opportunities to influence water planning and management. Stakeholders and community groups will be consulted as part of detailed investigations of potential demand management measures and potential sources of supply.

A separate stakeholder group will be formed to provide input and advice on the implementation of the Strategy and its review.

Figure 7.1 identifies the principle stakeholder organisations and interest groups.

Figure 7.1 Strategy consultative framework

7.2 Efficient operation of the SEQ Water Grid

Water security is the first and foremost purpose of the SEQ Water Grid. A new framework has been established to ensure that this security is delivered as efficiently as possible, taking into account quality and reliability of service. Key features of the framework are:

- the SEQ System Operating Plan
- a detailed operating strategy
- an integrated water quality management framework.

7.2.1 SEQ System Operating Plan

The SEQ System Operating Plan outlines the rules for operating the SEQ Water Grid to help achieve the LOS objectives for the region, as specified in the Regional Water Security Program.

The SEQ System Operating Plan:

- facilitates water sharing across the region by specifying the share of available water that SEQ Water Grid customers may access
- establishes risk criteria for the short- and medium-term management of available water
- provides rules to promote the efficient and cost-effective operation of the SEQ Water Grid
- details minimum requirements, including for the production and supply of manufactured water
- ensures that operating costs are reduced, where possible, without compromising regional water security.

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The risk criteria are a key feature of the SEQ System Operating Plan (refer to Table 7.2). The LOS objectives specify the basis for operating the SEQ Water Grid over the long term. The criteria provide the basis for balancing water security and operating costs over the short to medium term.

The risk criteria establish the acceptable levels of risk of triggering restrictions and construction of drought response infrastructure. Through these criteria, the SEQ System Operating Plan effectively mandates that the SEQ Water Grid be operated at capacity as key SEQ Water Grid storages approach 40 per cent of capacity. Under the current rules, it is it is estimated that full operation will be required below about 60 per cent of combined capacity, depending on the time of year and level of demand.

The risk criteria do not guarantee that the defined trigger levels will not be reached. However, they do ensure that potential operational changes to avoid them are taken as and when required.

Table 7.2 SEQ System Operating Plan risk criteria at March 2010

Volume of water stored by all key Water Grid storages	Probability of reaching stored volume		
	within 1 year	within 3 years	within 5 years
40 per cent	Less than 0.2 per cent	Not specified	Less than 5 per cent
30 per cent	Not specified	Less than 0.5 per cent	Less than 1 per cent

When the probability of reaching the trigger levels is less than the risk criteria, the SEQ Water Grid should be operated so as to minimise costs. Options include:

- reducing production from climate resilient supplies, such as desalination
- placing high-cost water treatment plants in standby mode
- reducing transfers through major interconnections
- selling water to irrigators on an interruptible basis (refer to Section 6.6).

The current risk criteria are conservative. They may be revised as new information becomes available on the efficient operation of the SEQ Water Grid and factors such as climate change.

7.2.2 Operating strategy

The SEQ System Operating Plan requires the SEQ Water Grid Manager to prepare an operating strategy outlining how the SEQ Water Grid will be operated.

The operating strategy must demonstrate how the LOS objectives and risk criteria are planned to be achieved as efficiently and effectively as possible. For example, it must address the amount of water that is expected to be taken from key supplies and the amount that is expected to be transferred through major interconnecting pipelines.

The SEQ Water Grid Manager will issue monthly Grid instructions based on the approved operating strategy. The operating strategy will focus on operation over a 12-month period. It will be submitted to the QWC for approval at 6-month intervals.

The operating strategy is based on overarching principles for various water supply assets. These principles include:

- ensuring compliance with resource operations plans and system operating rules
- maximising the use of more efficient supply options
- minimising the use of small, inefficient treatment plants, where an alternative exists
- maintaining minimum production levels at the desalination facility, ensuring that it is available when required
- maintaining minimum water flows through major inter-connectors, minimising the cost of operation and ensuring that they are available at short notice
- maintaining water quality from the Western Corridor Recycled Water Scheme in preparedness to augment Wivenhoe Dam as required.

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The operation of the SEQ Water Grid is based on a robust risk management framework. This framework protects water security, quality and reliability by integrating operations across water supply entities. The SEQ Water Grid Manager has given specific consideration to:

- emergency management, ensuring business and service delivery continuity in the event of natural disasters or system failures
- security management, due to water supply being an essential community service
- risk management practices consistent across the seven entities in the supply chain.

7.2.3 Drinking water quality management

The SEQ Water Grid creates the opportunity to improve water quality management across the region by managing multiple treatment plants and potentially the blending of treated water. This is a significant change from the traditional approach where there is a dependency on individual water treatment plants.

Consistent with this approach, the quality of water delivered from the SEQ Water Grid will be assured through an integrated set of management plans for individual assets and across the Grid as a whole.

The SEQ Water Grid Manager manages the overarching water quality strategy through the Water Grid quality management plan. The aim of the quality management plan is to mitigate water quality risks and achieve water quality standards across the SEQ Water Grid as a whole.

Within this framework, each water service provider is required to prepare a drinking water quality management plan in accordance with the requirements in the *Water Supply (Safety and Reliability) Act 2008*. The regulations are being introduced in two stages. Providers are required to:

- carry out an initial mandatory monitoring and reporting program from 2 January 2009, until they have an approved drinking water quality management plan in place
- develop and implement the approved drinking water quality management plan.

In a drinking water quality management plan, the provider is required to:

- assess the risks in the system
- document the process for managing these risks
- outline operational requirements for managing the system, including how mandatory criteria will be monitored, how operational and verification monitoring will be conducted, and what reporting arrangements are in place to ensure safe water.

A recycled water management plan and drinking water quality management plan must be approved before purified recycled water is released into Wivenhoe Dam.

Rainwater tanks

Queensland Health does not recommend the use of water from rainwater tanks for drinking and food preparation if a potable reticulated water supply is available.

Many people in Queensland rely on water from rainwater tanks for their drinking water. Although the risk of contracting illness from these supplies is low when roof catchments and tanks are well maintained, the quality of water from rainwater tanks is not as consistently high as that provided by well-managed reticulated supplies that obtain their water from a high-quality source. The risks from using rainwater for potable purposes, including drinking and food preparation, can be managed through a risk management framework such as the one described in the 2004 enHealth Council document, *Guidance on use of rainwater tanks*.

Improvement program

Improvement programs will also be coordinated across the SEQ Water Grid. Upgrades may be undertaken as part of the renewal of existing infrastructure, or in response to increasing water quality standards or community expectations.

The QWC will coordinate regionally significant water quality improvements, through the Statement of Needs process described in Sections 3.5.2 and 7.3.

In partnership with the SEQ Water Grid Manager, the QWC will also coordinate periodic reviews of water quality standards and infrastructure. In 2010 and 2011, the QWC will review the costs and benefits of moving to a common residual disinfection standard across SEQ. The review will focus on disinfection by-products, residual maintenance, costs and operability and will inform planning for future water treatment plants and major upgrades to existing treatment plants.

Catchment management

Catchment management is a core element of drinking water quality management. Existing uses need to be managed, and new development planned and assessed, to ensure that risks to water quality are controlled to an acceptable level. These controls need to be applied for all land from which water flows to drinking water supplies.

Local government planning schemes and related policies must identify these catchment areas and include appropriate development controls. Planning studies in these areas must consider how to avoid future types or scales of development that would pose an unacceptable risk to water quality. Where development is permitted, strict controls may be required. Infrastructure should also be located and designed taking into account water quality risks.

Administrative arrangements are being established to refer relevant development applications in dam catchments to Seqwater for consideration. Seqwater has prepared guidelines on how to address development in dam catchments.

In the longer term, Seqwater must have appropriate involvement in land use planning in dam catchment areas. Drinking water quality management plans will involve both planning and development assessment.

The QWC is reviewing current policy for managing the effect of land use and development in water storage catchments on drinking water quality. The purpose of the review is to ensure that arrangements can manage risks to drinking water quality. As an initial step, Seqwater has an assessment role for selected developments surrounding drinking water storages. The review will address the areas and activities that may need improved assessment and management arrangements to protect drinking water quality. Local governments are currently required, under the SEQ Regional Plan, to control the water quality impacts of all development in drinking water catchments.

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7.3 Statement of Needs

The Statement of Needs will be based on the Strategy, and will summarise key activities that must proceed over the next ten years to ensure that the LOS objectives can be achieved (refer to Section 3.5.2). Based on the Strategy, the key elements of the first Statement of Needs will be as follows:

- Remaining committed projects in the Regional Water Security Program should be delivered. Timing and staging options should be considered, where applicable.
- Beyond these projects, additional bulk water supplies may be required as early as 2017. However, if SEQ is able to maintain regional average total water use at or below 345 litres per person per day, then new bulk water supplies may not be required until at least 2022.
- Operational improvements and capital upgrades to comply with water quality requirements under the *Water Supply (Safety and Reliability) Act 2008* should continue.
- A drought response plan should be prepared for the region and for towns with stand-alone sources of supply.
- Capital upgrades should be made over time to achieve the same level of service for stand-alone communities as for the remainder of the SEQ Water Grid.

7.4 Research and development

Applied research and development will improve the sustainable and integrated management of water in SEQ. This research will make significant contributions to reducing costs and environmental impacts, as well as improving planning and investment decisions.

7.4.1 Urban Water Security Research Alliance

The Urban Water Security Research Alliance (UWSRA) is the largest urban water research program in Australia. It was formed in 2007 as a partnership between the Queensland Government, the CSIRO, The University of Queensland and Griffith University. The partners have committed $50 million over five years.

The objective of the program is to collaboratively develop the knowledge and tools to inform and support the implementation of the Strategy. The program will address areas such as climate change, changes in technology and the introduction of purified recycled water. Research is being undertaken on three themes, with each theme involving a number of specific projects.

The themes are described in Table 7.3. Further information is available from the UWSRA website at <www.urbanwateralliance.org.au>.

Table 7.3 Projects comprising the Urban Water Security Research Alliance

Reducing demand	
Stormwater harvesting and reuse	Researching the innovative capture and storage of stormwater for additional water supply in SEQ. The impact of harvesting stormwater on creek and ecosystem health is also being investigated.
Decentralised systems	Researching the performance and reliability of rainwater tanks and decentralised water supply systems in residential and commercial developments, including energy use and water quality standards.
Demand management and communication research	Researching community attitudes and behaviour in relation to demand management.
Residential water end-use	A detailed survey into household water end-uses that will quantify the impact of urban water demand management strategies.

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Water quality	
Hospital wastewater	Researching the contribution of pharmaceutical and other compounds to domestic wastewater from hospitals.
Pathogens and trace contaminants in dams	Researching sources of target pathogens and organic chemicals and the treatment capacities of dams to remove them under different climatic and seasonal conditions in SEQ.
Bio-assays and risk communication	Development of scientific, technical and communication bases for the implementation of bio-analytical tools in water quality monitoring programs.
Health risk assessment of local source waters	Researching the survival, and removal, of pathogens in rainwater tanks and stormwater.
Enhanced treatment	Evaluating alternative treatment processes that may be able to achieve similar water qualities and risk profiles as the micro-filtration and reverse osmosis process used for purified recycled water.
Disinfection by-product formation in alternative source waters	Researching disinfection by-product formation from blending treated drinking water of different qualities from different sources within the SEQ Water Grid.
Electrochemical treatment of reverse osmosis concentrate	Supporting research into the efficiency of electrochemical treatment of reverse osmosis concentrate to remove total organic carbon, chemical oxygen demand and dissolved organic nitrogen.
Managing efficiently	
Climate and water	Through the use of modelling, this project is examining how the climate has changed, what the key drivers are, and the regional implications for water resources.
Total water cycle analysis	Evaluating the impact of rainwater tanks, recycling, stormwater harvesting and sub-regional scale water cycle plans on the water balance at the regional scale.
Water quality monitoring technology and information collection	Developing systems for online, real-time monitoring of water quality in sewage systems. A proof-of-concept system has been developed to monitor inflows to wastewater treatment plants, providing the capacity to detect sudden changes.
Evaporation losses from water storages	Assessing the reduction in evaporation that can be achieved through the use of mono-layers and the potential impacts of these mono-layers on water quality and ecology.
Purified recycled water in the Lockyer Valley	Evaluating the impacts on soil quality of delivering recycled water to the Lockyer Valley for irrigation.

7.4.2 Water Cycle Sciences Project

The multidisciplinary Water Cycle Sciences Project is another key element of water research in SEQ. Managed by DERM, the project has a focus on identifying the barriers and solutions to achieving a sustainable long-term water cycle.

7.4.3 Queensland Climate Change Centre of Excellence

In March 2007, the Queensland Government established the Queensland Climate Change Centre of Excellence as a specialist unit within DERM. The Centre provides policy advice and scientific information on climate change and its impact on the community, economy and environment. The Centre has formed links with national and international researchers to ensure that Queensland benefits from global research on climate change, as well as having strong links with national policy initiatives. At the same time, that knowledge will be applied at a regional level so that the local climate change impacts can be assessed and managed.

7.5 Key actions

Table 7.4 summarises the activities, works and initiatives that the QWC considers should be undertaken over the next 10 years to achieve the goals of the Strategy.

The activities are additional to:

- existing measures, such as the demand management program
- committed projects, such as those listed in the Emergency Regulation
- legislative and regulatory requirements, such as the preparation of drinking water quality management plans
- requirements under the SEQ System Operating Plan and market rules, including the development of a SEQ Water Grid operating strategy.

Table 7.4 Recommended planning activities and initiatives

Number	Section reference	Activity, work or initiative	Timeframe	Responsible agency
Total water cycle planning				
1	2.3	Finalise the Mt Lindesay and Beaudesert sub-regional total water cycle management plan.	Short-term	QWC in partnership with key stakeholders
2	2.3	Prepare sub-regional total water cycle management plans for key development areas, including in the Moreton Bay and Sunshine Coast Regional Council areas.	Medium-term	QWC in partnership with key stakeholders
3	2.3	Prepare and publish a guideline for sub-regional and local total water cycle planning.	Medium-term	QWC in partnership with DERM and local governments
Strategy review and implementation				
4	3.5 and 7.1.1	Provide updated regional water security options to the Minister based on the key elements of the Strategy.	By the end of 2010	QWC
5	3.5 and 7.1.1	Report on the status of the implementation of the Regional Water Security Program.	Annually	QWC
6	3.5 and 7.1.2	Publicly report on the implementation of the Strategy and currency of key assumptions.	Annually	QWC
7	3.5	Develop a triple bottom line assessment framework for potential demand management measures and potential water supplies.	Short-term	QWC
8	7.1.3	Establish an expert stakeholder forum to discuss issues associated with the implementation of the Strategy—as a priority.	Short-term	QWC
9	3.5	Review the Strategy as required, and prior to a decision regarding the next major supply.	At least once every five years, aligned with the Regional Plan	QWC
Drought response planning				
10	6.5.1	Finalise drought response plans for towns with stand-alone sources of supply.	Short-term	QWC
11	6.9	Prepare a drought response plan for the SEQ Water Grid in accordance with legislative requirements.	Medium-term	QWC
Demand and supply modelling				
12	3.2 and 5.3.2	Undertake further hydrologic modelling to better address the potential impact of climate change on inflows of major dams.	Medium-term	UWSRA, QWC and DERM
13	7.1.2	Publish an annual water report, summarising key consumption and demand trends in SEQ.	Annually	QWC
14	7.1.2	Monitor and analyse consumption and demand trends, and review and refine future demand forecasts as appropriate.	Ongoing basis	QWC

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Number	Section reference	Activity, work or initiative	Timeframe	Responsible agency
Demand management program				
15	6.2	Deliver information and education campaigns related to efficient water use and Target 200, including through the development and delivery of targeted education programs for schools and selected industries.	Ongoing	QWC, DERM and Seqwater
16	6.3.1	Review the efficiency and effectiveness of the existing Permanent Water Conservation Measures. Investigate whether individual measures can be integrated into end-user contracts, moved to other regulations, or discontinued.	2010 and 2011	QWC, distributor-retailers and other stakeholders
17	6.3.3	Review the overall demand management program to ensure that it continues to achieve an appropriate balance between water restrictions and other demand management measures, with the objective of encouraging water efficiency at the lowest possible economic, social and environmental costs.	Ongoing	QWC
18	4.4 and 6.3	Develop an online reporting facility and templates for businesses with water efficiency management plans.	Short-term	QWC
19	6.3.2	Work with the Commonwealth and other jurisdictions to develop a national approach to water efficiency for large water users, potentially including a star-rating system.	Long-term	QWC and DERM
20	6.3.2	Work with the Commonwealth Government to promote the Water Efficiency Labelling Scheme and ban the sale of appliances that do not meet these requirements.	Ongoing	QWC and DERM
21	6.3.2	Assess viability and trial the use of web-based water monitoring systems to detect leaks within schools.	Long-term	QWC and Department of Education and Training
22	6.3.2	Implement standardised water billing requirements across SEQ.	Commencing July 2010	Distributor-retailers
23	6.3.3	Undertake a comprehensive review of the potential demand management measures.	As part of future reviews of the Strategy	QWC
24	4.5	Review medium- to long-term non-residential demand forecasts based on updated development and water use trends.	Medium-term	QWC and distributor-retailers
25	4.3	Undertake a detailed review of system leakage targets for bulk and distribution infrastructure using the Infrastructure Leakage Index approach.	Long-term	QWC, LinkWater and distributor-retailers
26	4.3	Review peaking factors recommended in the Planning Guidelines for Water Supply and Sewerage based on the planning assumption for average total consumption, with allowance for local demand and supplies.	Medium-term	QWC and DERM

Number	Section reference	Activity, work or initiative	Timeframe	Responsible agency
Local supplies				
27	4.6	Research options to enhance the efficiency of the water saving target acceptable solutions, including by increasing the average yield, cost-effectiveness or energy efficiency.	Ongoing basis	QWC, Department of Infrastructure and Planning and the UWSRA
28	4.6	Quantify and assess the performance and reliability of rainwater tanks in residential and commercial developments, including the costs and benefits of larger tanks.	Medium-term	QWC and UWSRA
29	4.6	Research the survival and removal of pathogens in rainwater tanks and stormwater.	Long-term	QWC, UWSRA and Queensland Health
30	4.6 and 5.4.3	Investigate opportunities to use stormwater to safely and efficiently provide alternative water supplies. Potential impacts on environmental flows and the benefits of water-sensitive urban design in removing contaminants of concern will also be investigated.	Medium-term	QWC and the UWSRA
31	4.6	Facilitate the development of major stormwater harvesting demonstration projects that achieve the water saving target through supply to toilet cisterns and washing machines.	Medium-term	QWC with local governments and developers
32	4.6	Deliver an education program for local governments and developers regarding options to achieve the water saving target.	Medium-term	QWC
33	4.4	Research into community attitudes and behaviour in relation to demand management.	Medium-term	UWSRA and QWC
Committed projects				
34	5.1	Complete remaining Emergency Regulation projects.	As specified in the Emergency Regulation	Responsible entities
35	5.2	Construct the first stage of the Wyaralong water treatment plant and Cedar Grove Connector.	Medium- to long-term (to be based on QWC's recommendation)	Department of Infrastructure and Planning
36	5.2	Construction the second stage of the Wyaralong water treatment plant and Karawatha Inter-connector.	Medium- to long-term (based on QWC's recommendation)	Department of Infrastructure and Planning
Potential desalination facilities				
37	5.4.1	Preserve priority sites at Marcoola and Lytton and reserve sites at Bribie Island and at Tugun.	Short-term	QWC
38	5.4.1	Establish community reference groups and consultation programs for investigations of priority sites. Conduct community consultation on the Phase 3 investigation work at and surrounding the priority sites.	Short-term	QWC
39	5.4.1	Prepare a land use master plan for land surrounding the existing SEQ (Gold Coast) Desalination Facility as a priority to enable coordination of planning activities for a range of different uses in the area.	Short-term	Gold Coast City Council and the QWC
40	5.4.1	Identify and preserve pipeline corridors required to connect priority sites to the SEQ Water Grid and to augment the Water Grid as required.	Medium-term	LinkWater

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Number	Section reference	Activity, work or initiative	Timeframe	Responsible agency
41	5.4.1	Undertake detailed engineering investigations at priority sites to investigate such issues as ground conditions and flooding risk to provide input into the design and approvals processes.	Medium-term	QWC
42	5.4.1	Undertake detailed investigations into the composition and condition of flora and fauna communities in Moreton Bay in order to establish a baseline condition of potentially affected marine ecosystems.	Medium-term	QWC and SEQ Healthy Waterways Partnership
43	5.4.1	Commence appropriate water quality monitoring for priority sites to establish baseline seawater conditions.	Medium-term	QWC and SEQ Healthy Waterways Partnership
44	5.4.1	Through the SEQ Healthy Waterways Partnership, develop an advanced three-dimensional receiving water quality model to investigate potential effects of brine dispersion.	Medium-term	QWC and SEQ Healthy Waterways Partnership
45	5.4.1	Commence ecological investigations at priority sites and adjoining areas to confirm the presence of any native habitats and any significant environmental values not yet identified.	Medium-term	QWC
46	5.4.1	Compile a review of environmental factors, which could constitute a project referral document for referral of a proposed new desalination plant to the Commonwealth environmental regulator.	Medium-term	QWC, LinkWater and Watersecure
47	5.4.1	Based on the investigations outlined above, develop a business case for the development of additional desalination capacity as a future bulk water supply source.	Medium-term	QWC
Potential dams and weirs				
48	5.4.2	Undertake a detailed investigation of the option to further raise Borumba Dam and the potential of water harvesting from the Upper Mary River to the dam.	Short-term	QWC, DERM and local government
49	5.4.2	Undertake a detailed investigation of options to increase supply from the Logan Basin, including by development of a small storage on the Glendower Dam site or by a pipeline to transfer water from the Bromelton Off-stream Storage to Wyaralong Dam.	Medium-term	QWC
50	5.4.2	Review the operation of the Brisbane River system to optimise the water supply yield and balance flood storage and water supply storage volume requirements.	Medium-term	QWC and Seqwater
51	5.4.2	Review the potential to water harvest from Gold Coast creeks and the Coomera River into Hinze Dam.	Long-term	QWC
Stormwater harvesting to dams				
52	5.4.3	Investigate opportunities to use stormwater to augment dams, including a scheme to augment Ewen Maddock Dam.	Medium-term	QWC, local government, Unitywater and Seqwater

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Number	Section reference	Activity, work or initiative	Timeframe	Responsible agency
Purified recycled water				
53	5.4.4	Enhance community access to information regarding purified recycled water, including in relation to water quality, environmental benefits and the role of the Western Corridor Recycled Water Scheme as a standby facility with the capacity to supplement Wivenhoe Dam at appropriate times.	Ongoing	WaterSecure
54	5.4.4	Publish water quality reports for the Western Corridor Recycled Water Scheme.	At least annually	WaterSecure
55	5.4.4	Develop a strategy to maximise cost-effective supply of purified recycled water to existing and future industrial users.	Short-term	SEQ Water Grid Manager and QWC
56	5.4.4	Investigate options to increase treated effluent flows to the Gibson Island advanced water treatment plant, as a drought response measure or normal operating practice.	Medium-term	QWC with distributor-retailers
57	5.4.4	Investigate projected wastewater volumes available for supply, and potential viable sources of demand, as well as ecosystem consequences of wastewater discharge and recycling options.	Medium-term	QWC with distributor-retailers
58	5.4.4	Investigate potential purified recycled water schemes to augment Hinze Dam and North Pine Dam.	Long-term	QWC
59	5.4.4	Commence baseline hydrodynamic and water quality monitoring on Hinze and North Pine dams, informed by detailed investigations.	Long-term	Seqwater
Rural towns				
60	6.5.1	Recommend options to improve water security for Beaudesert and Canungra.	Short-term	QWC
61	6.5.1	Investigate water security options for other towns with a stand-alone source of supply, including Dayboro and Boonah.	Medium-term	QWC
62	6.5.2	Review minimum requirements regarding rainwater tank capacity and connected roof area where reticulated drinking water supplies are not available.	Medium-term	QWC
63	6.5.2	Investigate the volumes of water required to augment supply from rainwater tanks during drought, where reticulated drinking water supplies are not available.	Medium-term	QWC and distributor-retailers
64	6.5.2	Develop a policy position regarding the provision of reticulated water supplies to communities that currently rely on drinking water from rainwater tanks and groundwater bores.	Long-term	QWC, distributor-retailers and local governments
Rural production				
65	6.6	Establish a rural water advisory group to oversee planning for rural water supply initiatives in SEQ.	Short-term	QWC
66	6.6.2 and 6.6.3	Develop a framework, including pricing policies, to make additional water available for rural production, when not required for urban supply.	Short-term	QWC, DERM, SEQ Water Grid Manager and Seqwater

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Number	Section reference	Activity, work or initiative	Timeframe	Responsible agency
67	6.6.2	Undertake a survey of existing rural producers in partnership with the rural water advisory group and local governments to establish whether existing entitlements meet local needs.	2010	QWC, DERM and local governments
68	6.6.2	In the Warrill Valley, investigate an option to enhance the reliability of supply to rural irrigators through an amendment to the interim resource operations licence.	Short-term	QWC and Seqwater
69	6.6.2	Investigate opportunities to make additional SEQ Water Grid water available for rural production, when not required for urban supply.	Medium-term	QWC and SEQ Water Grid Manager
70	6.6.3	Investigate alternative schemes to make the supply of recycled water from the Western Corridor Recycled Water Scheme to the Lockyer Valley economically viable, including options involving use of existing infrastructure and, if necessary, a reduction in the irrigation area.	Short-term	SEQ Water Grid Manager, QWC and DERM
71	6.6.3	Investigate opportunities to supply recycled water for rural irrigation, including as part of sub-regional total water cycle planning.	Medium-term	QWC, distributor-retailers and local governments
Supply to outside SEQ				
72	6.7	Develop a framework for the supply of water to areas outside SEQ, on a full commercial basis and without impacting on the ability to deliver LOS reliability to SEQ. The framework should include economic and operational principles, standard contractual provisions and possible inter-governmental agreements.	Short-term	QWC
System operation				
73	7.2.1	Review the SEQ System Operating Plan as required.	As required	QWC
74	7.1.2	Report annually to the Minister on the operation of the SEQ Water Grid, as part of the annual market rules review.	No later than 30 November each year or by such other time as the Minister may determine	QWC
75	7.2.3	Review the costs and benefits of moving to a common residual disinfection standard across SEQ.	Short-term	QWC with water service providers
76	7.2.3	Implement appropriate development controls in the catchment area of Cedar Grove Weir, while preserving appropriate development rights.	Medium-term	QWC and Scenic Rim Regional Council
77	7.2.3	Develop a policy approach on catchment management controls for management of water quality risks in dam catchments.	Medium-term	QWC, DERM and Seqwater
78	7.2.3	Participate in future planning scheme reviews and in the development assessment process as a concurrence agency.	Ongoing	Seqwater

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Number	Section reference	Activity, work or initiative	Timeframe	Responsible agency
Other research				
79	7.4	Quantify residential water end-uses and develop options for target interventions to improve water use efficiency.	Medium-term	UWSRA and QWC
80	7.4	Research opportunities to further improve the quality of purified recycled water through source control, wastewater treatment technologies and management within natural water bodies.	Medium-term	UWSRA and WaterSecure
81	7.4	Research sources of target pathogens and organic chemicals and the treatment capacities of dams to remove them under different climatic and seasonal conditions in SEQ.	Medium-term	UWSRA and Seqwater
82	7.4	Evaluate alternative treatment processes that may be able to achieve similar water qualities and risk profiles as the micro-filtration and reverse osmosis process used for purified recycled water.	Medium-term	UWSRA
83	7.4	Research disinfection by-product formation from blending treated drinking water of different qualities from different sources within the SEQ Water Grid.	Medium-term	UWSRA, QWC and Seqwater
84	7.4	Research and evaluate options to reduce evaporation from dams.	Medium-term	UWSRA and DERM

Key terms

Term	Definition
Allocation	A right to take water that is an asset separate from land title and can be traded. Water allocations are generally granted via processes contained within resource operations plans.
Brisbane River system	Wivenhoe and Somerset dams, Lake Manchester, Gold Creek Dam and the Mt Crosby Weir.
Bulk water price path	Ten-year price path projected for bulk water prices based on assumed interest rates and consumption patterns.
Category A water	Category A water is supplied from the SEQ Water Grid at the reliability specified in the LOS objectives. Category A water is used for high priority uses including for urban and some industrial purposes. It includes purified recycled water that is supplied to power stations and those industrial customers that require LOS reliability.
Category B water	Category B water is supplied from the SEQ Water Grid at a lower reliability than that specified in the LOS objectives. Category B water includes purified recycled water that is available from the Western Corridor Recycled Water Scheme for rural irrigation. These supplies will be used to augment Wivenhoe Dam if SEQ Water Grid storage levels decline to 40 per cent of capacity.
Climate independent supply	Climate independent water supplies are not affected by rainfall or inflow patterns. Water from desalination and artesian water are examples of climate independent supplies.
Climate resilient supply	Climate resilient supplies are not likely to be significantly affected by climate variability. Such supplies include: - climate independent supplies, such as desalination - purified recycled water - adopted net inflows to dams and extractions from groundwater aquifers under extended and severe drought conditions. For the Strategy, the climate resilient supply from dams and weirs across SEQ is based on 30 months of inflows equivalent to a drought with a severity of between one in 1000 and one in 10 000 year occurrence, adjusted for evaporation and river transport losses.
Demand management	Any program that reduces water consumption and the demand for water from the region's bulk water sources. Demand management programs may include water use efficiency measures, reductions in water losses, water trading to make better use of existing supplies, and substitution of existing supplies with alternative supplies such as rainwater tanks, recycled water and stormwater.
DERM	Department of Environment and Resource Management.
Destination price point	Under the water price path, councils will reach the final price point at different times, reflecting the fact that councils have different bulk water costs at present. Once the final price point is reached, bulk water increases should only be based on inflation. The years in which the relevant councils reach the final destination price point are: - Lockyer: 2011-12 - Somerset: 2014-15 - Scenic Rim: 2015-16 - Logan: 2015-16 - Gold Coast: 2016-17 - Brisbane, Ipswich, Moreton Bay, Sunshine Coast and Redlands: 2017-18.
DIP	Department of Infrastructure and Planning.
Drought response mode	The mode of operation when the combined regional storage levels drop below the T1 trigger and enter the regional Drought Storage Reserve. This mode has two phases – the preparation phase and the construction phase.
Drought response plan	A pre-determined suite of restrictions, demand management programs and new sources of supply that will be implemented once combined dam levels reach a specified trigger.
Drought storage reserve	Volume of water located below the working storage. The SEQ Water Grid drought storage reserve is sized to provide, in conjunction with climate resilient sources, a minimum of 36 months supply of water at a restricted demand.
Effective evaporation	Losses due to surface evaporation and seepage minus infiltration.
Emergency Regulation	*Water Regulation 2002* (Part 8)

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Term	Definition
Entitlement	A term used to describe some water authorities granted under the *Water Act 2000*. A water entitlement is a water allocation, interim water allocation or a water licence.
Environmental flows	Flow requirements specified in Water Resource Plans necessary to maintain and support aquatic biota and ecosystem processes.
Federation Drought	The drought experienced in SEQ from 1898 to 1903. Prior to the Millennium Drought, it was the most severe drought in recorded history in SEQ.
Greywater	Wastewater from the bath, spa bath, shower, wash basins and laundry, which can be diverted for use on lawns and gardens. It does not include water from the kitchen, swimming pool or toilet, as this water would pose health and environmental risks.
Grid Water	Any water supplied into or extracted from the SEQ Water Grid.
Groundwater	Groundwater, as defined in the Water Regulation 2002, is water from an underground source.
Key Water Grid storages	Baroon Pocket, Ewen Maddock, Cooloolabin, Wappa, Somerset, Wivenhoe, North Pine, Leslie Harrison, Hinze and Little Nerang dams and Lakes McDonald and Kurwongbah. Key Water Grid storages are used to calculate current dam levels and critical drought response triggers.
Levelised cost	The cost of a measure expressed in terms of dollars per megalitre. Levelised cost is generally calculated by dividing the net present value of the cost of the measure by the net present value of the water saved or supplied.
Level of Service (LOS) objectives	LOS objectives provide a basis for establishing a secure water supply. The objectives define inter alia the desirable maximum frequency, duration and severity of water restrictions, and the average amount of water per capita that must be supplied in normal times. For the purposes of the Strategy, LOS objectives are the same as 'desired Level of Service objectives' as defined in the *Water Act 2000*.
L/p/d	Litres per person per day.
LOS system yield	The LOS system yield is the volume of water that can be supplied from the SEQ Water Grid, on average every year and still achieve the LOS objectives.
Logan River system	Wyaralong Dam, Cedar Grove Weir, Bromelton Off-stream Storage and Maroon Dam.
ML	A megalitre or 1 000 000 litres.
ML/yr	Megalitres per year.
Measures	Used to describe initiatives or projects which are expected to achieve a defined outcome.
Millennium Drought	The drought that occurred in SEQ (and other parts of Australia) from 2001 until 2009. The Millennium Drought was declared over in SEQ on 20 May 2009 when Wivenhoe, Somerset and North Pine dams reached 60 per cent of their combined capacities.
Minimum operating level	The minimum operating volume for any storage is included in the appropriate resource operations plan and might be referred to as the dead storage level. Water below the minimum operating level cannot be accessed with existing infrastructure.
Minimum security volume	The minimum security volume is set at 5 per cent by the LOS objective that regional water storages must not be permitted to reach 5 per cent of combined storage capacity.
Normal operating mode	This is the mode of operation when the combined regional water storage level is within the working storage. Most commonly, the region will operate in this mode.
Priority	Groups of water allocations and interim water allocations are assigned a priority, largely based on the performance of the groups and the rules in place to provide for the sharing of available water between the priority groups. High priority A group of water allocations and interim water allocations that perform more reliably than lesser priority groups. High priority water allocations are mainly used for urban purposes and for power generation, although they are also sometimes utilised for irrigation. Medium priority A group of water allocations or interim water allocations that have less security than high priority. Once the available water in a scheme has been set aside for the high priority group, the remainder is divided amongst those in the medium priority group. Access to medium priority water is often prohibited before access to higher priority water begins to reduce. Medium priority allocations are generally used in the rural production sector.
Purified recycled water (PRW)	Purified recycled water is wastewater that has been treated to a very high standard using world's best technology through an advanced water treatment process. The Public Health Regulation 2005 and the *Water quality guidelines for recycled water schemes* specify the water quality standards that must be met for recycled water and drinking water.

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Term	Definition
Queensland Water Commission (QWC)	A statutory authority established to advise the Queensland Government on matters relating to water supply and demand management, and to facilitate and implement the regional water security program.
Regional water security options	Advice from the QWC regarding options to achieve water security in SEQ. Among other things, the options must address: • LOS objectives • demand management for water • the extent to which implementation of the desired LOS objectives would involve modifying existing water supply works or building new water supply works • the likely costs and pricing implications and the preferred ways of sharing the cost.
Regional water security program	A program to achieve water security for the region made and published by the Minister for Natural Resources, Mines and Energy and Minister for Trade within four months of receiving regional water security options from the QWC. A revised regional water security program was made in March 2010.
Reliability of supply	An indication of the proportion of time that a supply system is able to meet the full assumed demand. Reliability may be expressed as the proportion of time over a historical period that the full demand is met or conversely not met.
Resource operating plan (ROP)	A plan that details the water sharing rules, infrastructure operating rules and other water management rules that will be applied in the day-to-day management of water supplies within a catchment or water supply scheme.
Restricted demand	The volume of water required to meet the region's needs if the combined regional storage drops below the T1 trigger. The LOS objective for Medium Level Restrictions is to reduce demand by 15 per cent below the demand when Permanent Water Conservation Measures are in force. See also Water Restrictions.
Regional Plan	*South East Queensland Regional Plan 2009-2031*.
SEQ	South East Queensland, as defined in the SEQ Regional Plan.
SEQ Water Grid	The connected group of bulk supply and transport assets in South East Queensland that when operated conjunctively can deliver the LOS objectives.
SEQ Water Grid Manager	A Government owned, not for profit, entity established to purchase bulk supply, treatment and transport services, sell water and water services to Water Grid customers, and oversee the physical operation of the SEQ Water Grid.
Sewer mining	The extraction of raw sewage effluent from the wastewater collection system for treatment and use as recycled water. Waste from the treatment plant is generally returned to the sewer. The final quality of the water produced can be fit to purpose.
South Maroochy system	Cooloolabin, Poona and Wappa dams.
Standards of service	The characteristics of product delivered by water retailers to their customers. The *Water Act 2000* describes the requirements for establishing standards of service. Examples of standards of service relate to water quality, delivery pressure and continuity of supply.
Stochastic modelling	A stochastic model is a tool for estimating probability distribution of potential outcomes by allowing for random variation in one or more inputs over time. The random variation is usually based on fluctuations observed in historical data for a selected period using standard time-series techniques.
System losses	The difference between the amount of water extracted from water supplies and that delivered to water users. The difference may be due to approved activities such as fire fighting or unapproved such as theft or due to leakage losses.
SEQ System Operating Plan	A plan made under section 360V of the *Water Act 2000* to give effect to the regional water security program. The SEQ System Operating Plan describes rules for operating water supply infrastructure in order to achieve the LOS objectives, as specified in the regional water security program.
Urban activity	A residential, industrial, retail, commercial, sporting, recreation, tourism or community activity within the urban footprint.
Urban footprint	One of the regional land use categories in the Regional Plan. The urban footprint identifies land to provide for the region's urban development needs to 2031.
Waterhub	The SEQ water accounting framework managed by the Queensland Water Commission.
Water harvesting	The taking of unsupplemented water during high flow events. Water harvesting generally involves extraction of water when set flow thresholds are exceeded and pumping and storing the water off-stream for later use.

Term	Definition
Water resource plan (WRP)	Subordinate legislation under the *Water Act 2000* that provides the framework for defining the balance between water for consumptive use and environmental requirements. These plans also provide the basis for establishing tradable water allocations including the specification of: • water allocation security objectives (WASOs) • environmental flow objectives (EFOs).
Water restrictions	Permanent Water Conservation Measures Permanent low level restrictions that will be introduced across SEQ. Medium Level Water Restrictions Initiatives that form part of the drought response plan to reduce demand for SEQ Grid Water by 15 per cent.
Western Corridor Recycled Water Scheme (WCRWS)	Waste water treatment and recycling project that manufactures drought resilient water supplies for emergency use (when the combined volume of SEQ storages falls below 40 per cent of capacity. The project includes: • more than 200 kilometres of large-diameter underground pipeline, reaching from Luggage Point on Brisbane's east to Caboonbah north-west of Ipswich • three advanced water treatment plants at Bundamba, Luggage Point and Gibson Island • the capacity to supply up to 232 million litres of purified recycled water per day When not required for emergency water supply, the WCRWS supplies purified recycled water to power stations
Water year	An annual cycle associated with the natural progression of the hydrologic seasons. It is intended to commence with the start of the season of soil moisture recharge, includes the season of maximum run-off, stream flows and groundwater recharge and concludes with the season of maximum evapo-transpiration. In SEQ, it is generally described as the period 1 June to 31 May but does vary from catchment to catchment.
Working storage	The portion of a dam or weir above the drought storage reserve that is drawn upon in normal operating mode.
Yield	The average annual volume that can be drawn from a supply source or a supply option to meet a specified demand at a specified probability of occurrence. Historical no failure yield (HNFY) The maximum amount that, if it had been extracted in each year for which flow data exists, the storage would not have reached minimum operating level. That is, extraction of the HNFY every year would not cause the dam to be drawn down below the dead storage level during the worst drought on record. This approach does not accommodate a drought worse than the worst drought on record. LOS yield The yield of a dam, weir or other water storage to achieve the LOS objectives. LOS system yield The yield that can be supplied from a system, such as the SEQ Water Grid, on average every year and still achieve the LOS objectives.

Reference List

The following documents have informed the development of the Strategy. The Strategy also drew on a range of technical reports that have been published on the QWC website.

Title	Website
Regional planning framework	
South East Queensland Regional Plan 2009-2031	http://www.dip.qld.gov.au/regional-planning/regional-plan-2009-2031.html
South East Queensland: Infrastructure Plan and Program 2007-2026	http://www.dip.qld.gov.au/regional-planning/south-east-queensland-infrastructure-plan-and-program.html
Our Water – Urban Water Supply Arrangements in South East Queensland May 2007	http://www.qwc.qld.gov.au/Urban+Water+Supply+Arrangements+Report
Planning, Information and Forecasting Unit (PIFU), Population and Housing Fact Sheet for SEQ Region	http://www.oesr.qld.gov.au/queensland-by-theme/demography/population-characteristics/profiles/pop-housing-fact-sheets-reg-planning/pop-housing-fact-sheets-south-east-qld-200908.pdf
Queensland Government Population Projections to 2051: Queensland and Statistical Divisions 2008 Edition	http://www.oesr.qld.gov.au/queensland-by-theme/demography/population/tables/pop-proj/proj-pop-sd-qld/index.shtml
Improving water use efficiency in Queensland urban communities Nov 2000	http://www.derm.qld.gov.au/publications/water_management.html
Related legislation	
Water Act 2000	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WaterA00.pdf
Water Supply (Safety and Reliability) Act 2008	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/S/SouthEQWA07.pdf
Water Regulation 2002	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WaterR02.pdf
South East Queensland Water (Restructuring) Act 2007	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/S/SouthEQWA07.pdf
Sustainable Planning Act 2009	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/S/SustPlanA09.pdf
Queensland Development Code 2003	http://www.dip.qld.gov.au/building/queensland-development-code.html
Water resource plans	
Gold Coast	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WatResGCP06.pdf
Logan Basin	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WatResLBP07.pdf
Mary Basin	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WaterReMaryP06.pdf
Moreton	http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/W/WatResMorP07.pdf
Resource operations licences and interim resource operations licences	
Logan River water supply scheme (rol)	http://www.derm.qld.gov.au/water/management/rols.html
Lower Mary River water supply scheme	http://www.derm.qld.gov.au/water/management/irols.html
Upper Mary River water supply scheme	http://www.derm.qld.gov.au/water/management/irols.html
Nerang water supply scheme	http://www.derm.qld.gov.au/water/management/rols.html
Warrill Valley water supply scheme	http://www.derm.qld.gov.au/water/management/irols.html
Climate	
South East Queensland Drought to 2007	http://www.longpaddock.qld.gov.au/AboutUs/Publications/HiddenArea/seq_drought_2007.pdf
Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Synthesis Report	http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html

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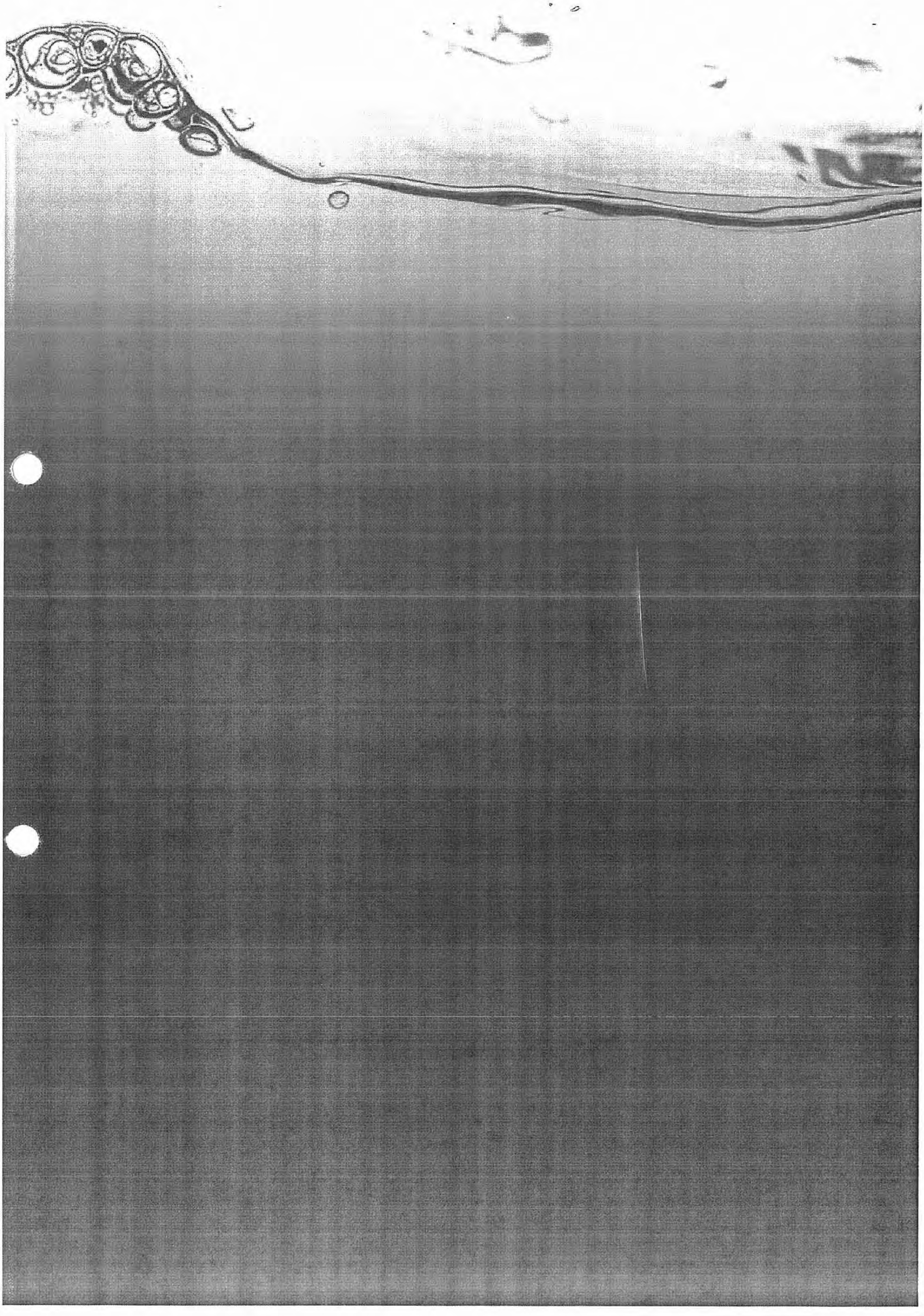
Title	Website
Energy demand and water supply	
Energy use in the provision and consumption of urban water in Australia and New Zealand	http://www.clw.csiro.au/publications/waterforahealthycountry/2008/wfhc-urban-water-energy.pdf
Drinking water quality guidelines	
Australian Drinking Water Guidelines	http://www.nhmrc.gov.au/publications/synopses/eh19syn.htm
Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)	http://www.ephc.gov.au/taxonomy/term/39
Guidance on use of rainwater tanks 2004	http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-publicat-document-metadata-env_rainwater.htm
National Performance Report -: Urban water utilities	https://www.wsaa.asn.au/Publications/Pages/PerformanceReports.aspx



[redacted]

From: Reilly Bob [redacted]
Sent: Tuesday, 18 January 2011 4:29 PM
To: Peter Borrows
Cc: [redacted] Allen Peter; Barry Dennien; Dan Spiller
Subject: RE: Revised Flood Operations Strategy - Lowood Pump Station at 15:30 on Tuesday 18 January 2011

Hi Peter

I confirm my verbal approval at approximately 3 pm this afternoon as indicated in your email below. Please note that this approval only covers the Flood Mitigation Manual-related approval, and not any other approval that you may require from DERM.

Regards

Bob

From: Peter Borrows [redacted]
Sent: Tuesday, 18 January 2011 4:18 PM
To: Reilly Bob
Cc: [redacted]
Subject: RE: Revised Flood Operations Strategy - Lowood Pump Station at 15:30 on Tuesday 18 January 2011

Bob, this E Mail is to confirm that Seqwater requested you to approve a variation to the flood release regime prescribed in the Flood Mitigation Manual for Wivenhoe/Somerset dams, and that you had verbally approved this.

I recommended this variation to enable a constant flow for the Lowood WTP off-take as we have been having difficulties in supplying water from this off-take to the Lowood treatment plant. The plan is to maintain the current releases for a further 12 hours to 'stabilize' the off take for the treatment plant, and to then enable a reasonable 'final close down', to minimise bank slump issues. This close down proposal is consistent particularly with the Brisbane City Council request associated with concerns at Coronation Drive. I note that the WGM's letter to me dated 24 December 2011, advised that the WGM had no in principle objection to Wivenhoe and Somerset dams being drawn down to 95 per cent of their combined full supply level.

When we verbally discussed this, we discussed a final level of 95% FSL at Wivenhoe, and the assumption was 100%FSL at Somerset. Please note that this scenario has now been calculated, and the resulting FSL will be 94.6% at Wivenhoe and 97.3% at Somerset.

Could you please confirm your approval.

Thanks.

N1

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

Ph[redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: Duty Engineer [redacted]
Sent: Tuesday, 18 January 2011 3:36 PM
To: John.Ruffin[redacted] John Tibaldi; Rob Drury; Rob.ayr[redacted] Terry Malone; Peter Borrows
Subject: Revised Flood Operations Strategy - Lowood Pump Station at 15:30 on Tuesday 18 January 2011

Rob/Peter

Revised shutdown sequence applied at 15:00 on Tuesday 18 January 2011 to accommodate a 12 hour hold at current gate settings (Release is 1,450 cumecs)) This will equate to a volume of 62,640 ML resulting in a lake level of around EL 66.85 mAHD by 03:00 on Wednesday 19 January 2011.

If release is then ramped down using 45 minute gate closure intervals the volume released is estimated to be 52,630 ML resulting in a lake level of EL 66.40 mAHD or 94.6% of capacity at 06:00 on Thursday 20 January 2011. This assumes no further runoff from rainfall and that Somerset regulator continues until Thursday morning as well leaving, Somerset dam at EL98.75 mAHD or 97.3%

The closedown sequence could be modified, but I am concerned we get bank slumping if we push too much harder.

Regards

Rob Ayre

Duty Engineer
Flood Operations Centre

Phon[redacted]

Fax: [redacted]

For more information regarding this service, please contact your service provider.

+--+

Think B4U Print

1 ream of paper = 6% of a tree and 5.4kg CO2 in the atmosphere

3 sheets of A4 paper = 1 litre of water

--+

N3

[redacted]

From: Barry Dennien
Sent: Thursday, 20 January 2011 7:42 PM
To: Dan Spiller
Subject: Fwd: Correspondence form Ministe[redacted]
Attachments: Barry Dennien.pdf; ATT00001.htm;[redacted]ATT00002.htm

Regards
Barry Dennien

Begin forwarded message:

> **From:** '[redacted]
> **To:** [redacted], "Barry Dennien"[redacted]
> **Cc:** [redacted]
> **Subject: Correspondence form Minister Robertson**
>
> [redacted] Barry
> Please find correspondence from the Minister attached.
> [redacted]
> <<Barry Dennien.pdf>> <[redacted]>
> [redacted]
> Policy Advisor
> Office of the Minister for Natural Resources,
> Mines and Energy and Minister for Trade
> Phone[redacted]
> Mobil[redacted]
> Fax: ([redacted]

N4

COPY

Hon Stephen Robertson MP
Member for Stretton

Queensland Government

Minister for Natural Resources, Mines and Energy and Minister for Trade

2 0 JAN 2011

Mr [redacted]
Chair
SEQ Water Grid Manager
PO Box 16205
CITY EAST QLD 4002

CC: Mr Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
PO Box 116205
CITY EAST QLD 4002

Dear [redacted]

Please find attached correspondence to Mr [redacted] Chair, SEQ Water.

I would appreciate you providing all necessary assistance to SEQ Water to ensure that the requests in the attached correspondence can be responded to as a matter of priority and with urgency.

Should you have any further enquiries, please do not hesitate to contact [redacted] Principal Advisor, on telephone [redacted]

Yours Sincerely

[redacted]

STEPHEN ROBERTSON MP

Level 17
61 Mary Street Brisbane Qld 4000
PO Box 15216 City East
Queensland 4002 Australia
Telephone +61 7 3225 1861
Facsimilie +61 7 3225 1828
Email nrmet@ministerial.qld.gov.au

COPY

Hon Stephen Robertson MP
Member for Stretton

Queensland Government

Minister for Natural Resources,
Mines and Energy and
Minister for Trade

20 JAN 2011

Ref CTS 00433/11

CC: Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
CITY EAST QLD 4002

CC: Ms Mary Boydell
Commissioner
Queensland Water Commission
PO Box 15087
CITY EAST QLD 4002

CC: [redacted]
Chair
SEQ Water Grid Manager
PO Box 16205
CITY EAST QLD 4002

[redacted]
Chair
Seqwater
PO Box 16146
City East QLD 4002

Dear [redacted]

You will be aware that the Premier recently announced a Commission of Inquiry into Queensland Floods which will consider among other things, compliance with, and the suitability of the operational procedures relating to flood mitigation and dam safety.

The Commission is required to deliver an interim report by 1 August 2011 (on matters associated with flood preparedness to enable early recommendations to be implemented before next summer's wet season); and its final report by 17 January 2012.

However, I am also aware that Seqwater is currently managing the releases from the flood compartment of Wivenhoe and Somerset Dams in South East Queensland, in the context of the company's current Flood Mitigation Manual for those dams. There are three matters I wish to raise with you in this letter:

(1) I note that under the Flood Mitigation Manual for Wivenhoe and Somerset Dams, Seqwater is required to prepare a report on the recent flood event (see clauses 2.9 and 7.4 of the Manual). It is essential that a report (covering the requirements of both clauses 2.9 and 7.4 of the Manual) to the Department of Environment and Resource Management (DERM) is completed within the required timeframe of six weeks from the date of the incident. However in view of the fact that we remain in the middle of the wet season and further significant inflows are possible, I would urge you to complete this review, which should include consideration of the appropriate Full Supply Levels, as a matter of priority and urgency.

Any other changes you propose to the Flood Mitigation Manual, or related matters, eg improved data collection, should be clearly identified in the Review report, along with a timetable to implement them.

Level 17
61 Mary Street Brisbane Qld 4000
PO Box 15216 City East
Queensland 4002 Australia
Telephone +61 7 3225 1861
Facsimilie +61 7 3225 1828
Email nrmet@ministerial.qld.gov.au

COPY

(2) Furthermore, while this review of factors relevant to the operating release strategy and the Full Supply Levels is underway, I would request that you develop a contingency protocol which would ensure that if rainfall, that is likely to result in a flood release from Wivenhoe Dam, is forecast for the catchment then Seqwater will immediately convene a discussion with the Chief Executive Officer of DERM, his dam safety regulatory staff, and other appropriate parties.

(3) I note that the recent preliminary report by Mr Cooper identified a number of improvements that Seqwater could implement to achieve a better outcome in the application of the Draft Communication Protocol between government agencies and local governments. I request that you cont[redacted]eilly, General Manager, Office of the Water Regulator of the department o[redacted] to progress these as a matter of urgency.

I have also written to the Chair of the Water Grid Manager and the Water Commissioner requesting all necessary assistance be afforded to SEQ Water to ensure the matters raised in this letter are responded to as a matter of priority and with urgency.

Should you have any further enquiries[redacted]t hesitate to contact Mr John Bradley, Chief Executive of the Department, on [redacted]

Yours sincerely

[redacted]

STEPHEN ROBERTSON MP

Hon Stephen Robertson MP
Member for Stretton

Queensland Government

Minister for Natural Resources, Mines and Energy and Minister for Trade

2 0 JAN 2011

Mr [redacted]
Chair
SEQ Water Grid Manager
PO Box 16205
CITY EAST QLD 4002

CC: Mr Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
PO Box 116205
CITY EAST QLD 4002

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Yours Sincerely

[redacted]

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Hon Stephen Robertson MP
Member for Stretton

Queensland Government

Minister for Natural Resources,
Mines and Energy and
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2 0 JAN 2011

Ref CTS 00433/11

CC: Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
CITY EAST QLD 4002

CC: Ms Mary Boydell
Commissioner
Queensland Water Commission
PO Box 15087
CITY EAST QLD 4002

CC: [redacted]
Chair
SEQ Water Grid Manager
PO Box 16205
CITY EAST QLD 4002

Mr [redacted]
Chair
Seqwater
PO Box 16146
City East QLD 4002

Dear [redacted]

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The Commission is required to deliver an interim report by 1 August 2011 (on matters associated with flood preparedness to enable early recommendations to be implemented before next summer's wet season); and its final report by 17 January 2012.

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Should you have any further enquiries[redacted]ot hesitate to contact Mr John Bradley, Chief Executive of the Department, on[redacted]

Yours sincerely

STEPHEN ROBERTSON MP

[redacted]

From: Barry Dennien
Sent: Friday, 21 January 2011 10:42 AM
To: Dan Spiller
Subject: Re: Gate releases and supply status

Dan

Can we get a system water security whatnet model run with wivenhoe at 90% and 80% or do we have this

Regards
Barry Dennien

On 21/01/2011, at 10:26 AM, "Dan Spiller" [redacted] wrote:

> All,
>
> To be clear, Mt Crosby is operating well now - and has increased production prior to the peak reaching it. However both we almost certainly need to be taken offline once the peak arrives.
>
> In terms of preparedness, in addition to storage levels, demand remained low - at between 400 and 420 ML/day in central SEQ. By comparison, last week we were anticipating increases to about 450 ML/day and potentially to above 500 ML/day. This results in a significantly slower drawdown once the Mt Crosby WTPs are offline (with SRWP providing 100 ML/day and North Pine about the same).
>
> We will have a better idea about the likely duration of the shutdown this afternoon. It appears to have peaked at Lowood, which indicates that it may not be beyond a day or two. Unfortunately the flood knocked out the Kholo sampling point, meaning that we have reduced information available.
>
> Note also that last week we were addressing mechanical and electric issues at East Bank, not just water quality.
>
> Dan
>
> ---
>
> **From:** Dan Spiller
> **Sent:** Friday, 21 [redacted]
> **To:** Debbie Best [redacted] John Bradley [redacted]
> **Cc:** Barry Dennien
> **Subject:** Gate releases and supply status
>
> John and Debbie,
>
> For information, a minor gate release will recommence this afternoon.
>
> The release rate will be about 100 cubic metres per second, compared to about 1500 cubic metres per second in December 22 when high tides and atmospheric anomalies previously resulted in high river levels. At that time, Seqwater and BoM calculated that a 1500 cubic metres per second release increased river levels by about 50mm.
>
> Seqwater advises that the transit time for a release of this volume is more than 24 hours, meaning that it will not reach Brisbane until after the peak tides have passed.
>
> A technical situation report will be submitted to us shortly. Seqwater is consulting BCC. I have advised Tim, who asked about gate operations this morning.
>
> The release is required due to both dam levels and for water supply reasons.

N11

In relation to water supply, the recent storms have resulted in very turbid water flowing from the Lockyer River (peaking at 4300 NTU at Lowood). The dam releases will dillute this water and assist in flushing it through the system. Even with the release, it is likely that turbidity will be beyond the treatable range for a period (for comparison, peak was about 1700 NTU when we had the teleconference with QH last week). We have prepared by filling our reservoirs and asking QUU to do likewise. The situation is not critical - by comparison, last week reservoirs were only one-third full. We are having a hookup at 1pm about these issues, after which I will provide an update.

Regards,
Dan

N12

Litsupport Brisbane

From: [redacted]
Sent: Tuesday, 25 January 2011 12:21 PM
To: Dan Spiller
Cc: [redacted]
Subject: [redacted] - preliminary results
Attachments: Wivenhoe assessment (Jan-2011).pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Dan,

Please find enclosed a summary of preliminary results regarding Wivenhoe assessment discussed last week with [redacted]
Hope this helps and we will keep you updated with final results.

[redacted]

N12

Hi Dan,

Hope all is well and dry in Albert St and you are getting back to a more "normal" rhythm. As you discussed with [redacted] we are currently undertaking assessments of the impact of increasing flood mitigation storage from Wivenhoe on the performance of the grid.

Preliminary short-term assessments indicate that the probability of SEQ falling to T1 (40%) within 10 years would about double (from 3.5% to 7%) if Wivenhoe's FSL is reduced (to 80%) for flood mitigation purposes (see table 1 and figure 1).

Figure 2 also shows that under the 99% exceedence probability SEQ storages would potentially reach T1 significantly earlier (up to about 4 years earlier) under these operating conditions.

Please note that:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.

We are in the process of finalising the above results and will keep you updated as soon as we can. Please feel free to let us know if you have any questions.

Cheers,

[redacted]

Table 1 Estimated probability of SEQ reaching T1 and T2 within 10 years

Wivenhoe supply capacity	T1	T2
Full current capacity	3.5%	0.8%
90% of current capacity	5.3%	1.1%
80% of current capacity	7%	1.4%

Figure 1 Estimated probability of SEQ reaching T1 and T2 (May-2011 to Apr-2021)

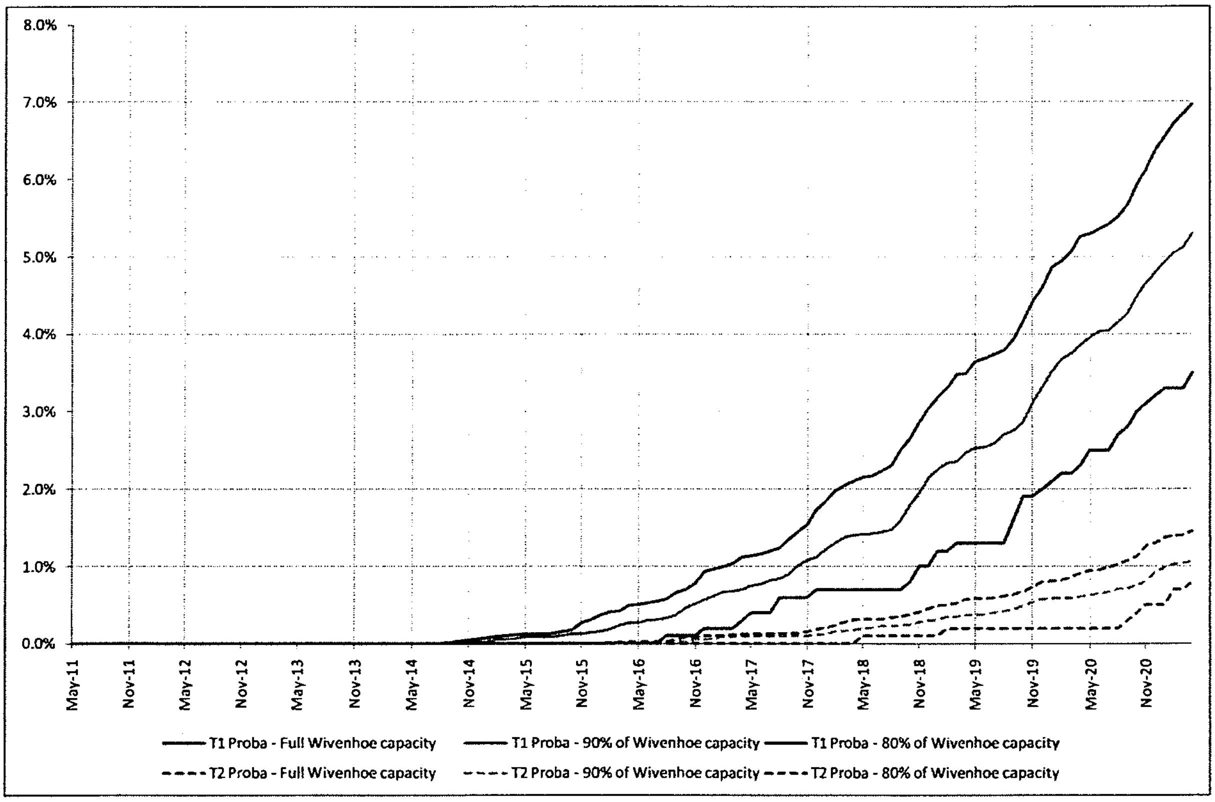
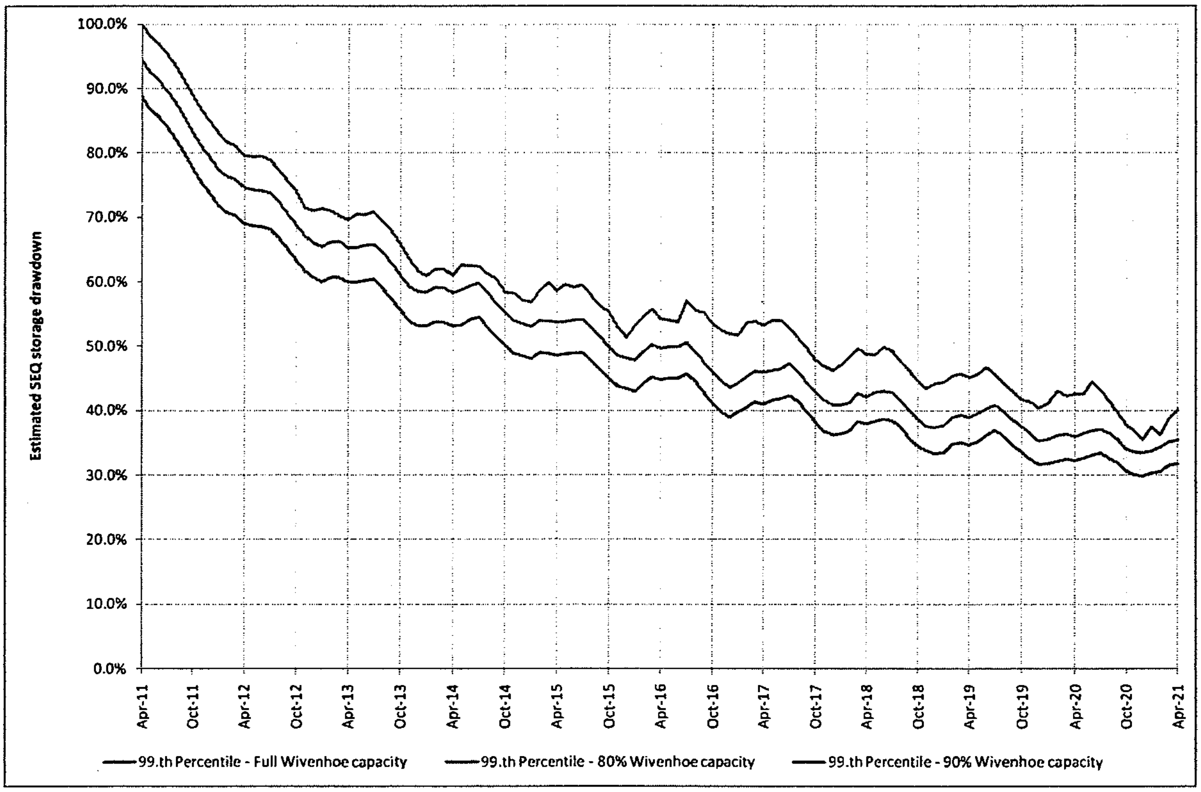


Figure 2 - Estimated 10-year forecast drawdown of SEQ storages, 99th. Percentile based on different scenarios for Wivenhoe supply capacity



Stand Alone Towns - 730am Thursday 13 Jan 2011

Lowood WTP	Lowood CWT – 45% - need to keep majority for plant restart Lowood town Res – 28% est 1 day, can up to 50% if required (7% from onsite CWT) Fernvale Res empty. Balancing storage empty.	Power has been restored to town Operator [redacted]ccessed raw water pump station 7am this morning Isolated everything Advised: water went to halfway up switchboards, halfway up VFD control box. 2 of 3 pumps are submersible so will be ok. Have organised heli to fly in [redacted]parky's to survey. He is liaising with Energex. [redacted] is staying onsite. Operator Trusten can't access site. Will need him there when plant comes on – 24hr online to catch up. Will organise heli to pick him up.
Kilcoy WTP	Est 20% storage in town RES, hard to tell	Power line poles along dirt access rd to weir have washed away, lines down – need to confirm with Energex estimated time to repair. Kilcoy weir pumps have been inundated, probably inoperable Diesel pump, pumping bore water to Wade St, est 3-6 L/s. Filling onsite CWT
Kilcoy – Somerset WTP		Diesel pump container at dam half filled with water. [redacted]nsite overnight with assistance [redacted] Ran plant last night for 4 hrs. Pump failed at 3am Working to fix pump at the moment.
Esk WTP	Esk Res 40% Toogoolawah Res 50%	Raw water pumps have power Esk and WTP have no power [redacted] advised that power will try to be reinstated within 3hrs (energex) Operator [redacted]nsite and has access to home

N15

Jimna WTP	Last Update 930am – Res 65%, est 2 days supply	Operato[redacted]ran plant last night, [redacted]will try to access Kilcoy today for more chemicals – soda ash/ liquid alum
Linville WTP	Incorrect SCADA res reading at Lowood. Checked onsite yesterday 10am, 50% Res, est 2 days supply at that time	[redacted]dvised by Energex 7am today they are working to bring power on today, depends on access to switchgear
Kirkleagh WTP	3m in Res (visual check by helicopter yesterday noon)	Very limited consumption
Wivenhoe WTP	No water in HL res at Wivenhoe WTP Reservoirs at Lumley Hill and Cormorant Bay would be substantially full	Raw water pumps in Dam wall went under, probably inoperable
Dayboro WTP	7am update today. Dayboro town RES: HL = 24% of 0.45ML =0.11 ML LL = 18% of 1.25 ML = 0.22 ML Consumption yesterday = 0.3ML	Operators, electrician, process engineer onsite, working to scour raw pipeline and reinstate plant 3 * 15 kL tankers – meeting demand currently
Kenilworth WTP	RES level 27% 1 day supply Gained 9% overnight	Plant Running 2ntu raw 0.14 FW dropping 2.2 mg/L Cl2 2 * 20kL tankers

N16

[redacted]

From: Dan Spiller
Sent: Tuesday, 25 January 2011 12:40 PM
To: [redacted]
Cc:
Subject: RE: Wivenhoe assessment - preliminary results

[redacted]

Thanks. Please call me when you have a moment. Keen to clarify supply assumptions (such as desalination).

Thanks,
Dan

From: [redacted]
Sent: Tuesday, 25 January 2011 12:21 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment - preliminary results

Hi Dan,

Please find enclosed a summary of preliminary results regarding Wivenhoe assessment discussed last week with [redacted]

Hope this helps and we will keep you updated with final results.

Cheers
[redacted]

N17

Litsupport Brisbane

From: Barry Dennien
Sent: Wednesday, 26 January 2011 9:05 AM
To: Dan Spiller
Subject: Fwd: Courier mail article on rainfall [SEC=UNCLASSIFIED]

Follow Up Flag: Follow up
Flag Status: Completed

Dan

I have thinking about yesterdays meeting

I think the results presented next week by Seqwater could be underwhelming

Last night I spoke to peter again and extended our suggestions about leaving w4 trigger and moving down w1 w2/3 triggers with the fsl reduction I think he got it however he keeps mentioning limited model runs bases on a few key events

... prep for next week can we get 70 60 and 50% runs done so if we have to push for better Modelling we can give very specific fsl's and limit the runs

The more I think about this there is no excuse for government not fully Modelling options if we are wrong great an easy commission hearing if changes are required best coming clean now

Thoughts

Regards
Barry Dennien

Begin forwarded message:

> **From:** Peter Baddiley [redacted]
> **Date:** 26 January 2011 8:32:03 AM AEST
> **To:** Barry Dennien [redacted]
> **Cc:** Dan Spiller [redacted], Peter Baddiley [redacted]
> **Subject: RE: Courier mail article on rainfall [SEC=UNCLASSIFIED]**
>
> Barry
> Yes - recovering - a couple of days away from work (by insistence of may managers) but I am doing a fair bit of flood analysis & documentation.
>
> I haven't seen the paper yet this morning, but a 1974 flood report is at:
> http://www.bom.gov.au/hydro/flood/qld/fld_reports/brisbane_jan1974.pdf
>
> Of course they could also be finding past daily rainfalls on the Bureau website & doing their own analysis.
>
> Regards, peter

N18

Peter Baddiley
Regional Hydrology Manager
Climate & Water Division
Bureau of Meteorology
Level 21, 69 Ann Street
GPO Box 413, BRISBANE, QLD, AUSTRALIA 4001
Phone: [redacted]
EMAI[redacted]
EMAIL for flood matters: flood.qld@bom.gov.au
WWW : www.bom.gov.au

-----Original Message-----
From: Barry Dennie[redacted]
Sent: Wednesday, 26 January 2011 7:02 AM
To: Peter Baddiley
Cc: Dan Spiller
Subject: Courier mail article on rainfall

Peter

I hope you have had time to recover

With regards our conversation last week re getting all the data processed for the event I spoke to Seqwater and they are fast tracking their report so I suspect they will be in touch if they haven't already

Related to this issue the courier today is quoting the BOM re the rainfalls for the event in comparison to 74

Is there a report available on your site with all the data

Regards
Barry Dennien

Dan Spiller

From: Dan Spiller
Sent: [redacted]11 10:42 AM
To:
Cc:
Subject: [redacted]nt - preliminary results

[redacted]

Thanks for the preliminary advice. I would be appreciative if you could undertake more detailed modelling as earlier as possible this week.
I require modelling based on Wivenhoe and Somerset dams being drawn down to:

Full supply level (base case)
- 95%
- 90%
- 80%
- 70%
- 60%
- 50%.

Modelling should be for both a temporary reduction to end June 2011 and for a permanent reduction.

For each level, please model:
- Probability of key Water Grid storages falling to T1 within 5 years
- Probability of key Water Grid storages falling to T1 within 10 years
- Level of Service system yield (permanent reduction only).

For demands, use the SEQ Water Strategy forecasts based on:
- 230 litres per person per day
- Medium series population growth
- No allowance for climate change.

For supply, assume:
- For the WCRWS, augmentation of Wivenhoe Dam when key Water Grid storages are above 40% of capacity
- For desalination, operation in:
  - standby mode when key Water Grid storages are above 60% of capacity (4% of capacity)
  - full capacity when key Water Grid storages are below 60% of capacity
- Supply from the Wyaralong Water Treatment Plant Stage 1 from July 2015
- Demolition of:
  - At end June 2011, the Maleny and Woorim water treatment plants
  - At end June 2014, the Beaudesert and South Maclean water treatment plants

N20

- From end June 2012, operation of the following supplies when key Water Grid storages are below 40% of capacity only:
    - Brisbane Aquifer Project
    - Petrie
    - Capalaba
    - Caboolture.

I would appreciate your advice tomorrow regarding your availability to undertake this work and the likely timeframe and costs.

Thanks for your assistance. Please call me if you require any further information.

Regards,
Dan

From [redacted]
Sent: Tuesday, 25 January 2011 12:21 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment - preliminary results

Hi Dan,

Please find enclosed a summary of preliminary results regarding Wivenhoe assessment discussed last week with [redacted]
Hope this helps and we will keep you updated with final results.

Cheers,
[redacted]

N21

Litsupport Brisbane

From: [redacted]
Sent: Thursday, 27 January 2011 5:43 PM
To: Dan Spiller
Cc: [redacted]
Subject: Re: Wivenhoe assessment - preliminary results

Follow Up Flag: Follow up
Flag Status: Completed

Hi Dan,

It'[redacted]eplying from [redacted]mail as I don't have access to my work email).

Thank you for your email. We will need to clarify some assumptions (see below), but should be able to get some preliminary results by tuesday for the probabilistic assessments. The LOS assessments will take more time, likely a week or more. Costs are likely to be of the order of about $5,000-$7,500.

Just checking the following assumptions:

- Temporary reduction of Wivenhoe and Somerset FSL to end June 2011 – it is an initial condition, not a recurrent reduction each year after the wet season?

- Are assumed demands to include the "rebound" from current levels up 230 l/p/d by 2018?

- Petrie, Capalaba and Caboolture WTPs: at this stage the model is not able to reflect a "standby" operating regime. Shall we maintain them online? The only other option would be assuming demolition from the start. Likely slightly faster drawdown of system storage under this latter assumption.

- Supply capacities for:

    - Brisbane Aquifer Project: 5 ML/d ?
    - Wyaralong WTP Stage 1: 25,000 ML/a ? Also, is the Stage 1 infrastructure to include connection to the Grid, and if so is this 2-way or transfer out only? And if different to the WTP capacity, what transfer capacity is proposed?

Hope this is in line with what you are trying to achieve and any questions let us know.

Kind Regards,
[redacted]

[redacted]Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust**www.access.gs | Download vCard

N22

On 27/01/2011, at 10:41 AM, Dan Spiller wrote:

[redacted]

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Full supply level (base case)

- 95%
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- 50%.

Modelling should be for both a temporary reduction to end June 2011 and for a permanent reduction.

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  - At end June 2014, the Beaudesert and South Maclean water treatment plants
- From end June 2012, operation of the following supplies when key Water Grid storages are below 40% of capacity only:
  - Brisbane Aquifer Project
  - Petrie

- Capalaba
- Caboolture.

I would appreciate your advice tomorrow regarding your availability to undertake this work and the likely timeframe and costs.

Thanks for your assistance. Please call me if you require any further information.

Regards,
Dan

From: [redacted]
Sent: Tuesday, 25 January 2011 12:21 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment - preliminary results

Hi Dan,

Please find enclosed a summary of preliminary results regarding Wivenhoe assessment discussed last week with Owen. Hope this helps and we will keep you updated with final results.

Cheers,
[redacted]

Dan Spiller

From: Dan Spiller
Sent: Thursday, 27 January 2011 6:14 PM
To: [redacted]
Cc:
Subject: RE: Wivenhoe assessment - preliminary results

[redacted]

Thanks. Timing and cost acknowledged - there are funds remaining under the existing purchase order.

In terms of assumptions:

- Please model the reduction as both a temporary reduction and a permanent one. Initial priority is on temporary results (that is, for the current wet season)
- As you suggest, use the gradual rebound to 2018
- As a compromise, assume no supply from the Capalaba and Caboolture WTPs
- BAP capacity is about 20 ML/day - you should be able to confirm from the base version licensed by the QWC
- Wyaralong WTP Stage 1 is 25,000 ML/a.

[redacted]he constraint on modeling facilities in standby mode is problematic. Would you be able to make the necessary changes to the model? If so, what would be the timeframe and cost? If reasonable, I may make the offer to the QWC. Are there any other major constraints that need to be addressed, based on the types of modeling that I have been requesting for the Operating Strategy?

Thanks,
Dan

From [redacted]
Sent: Thursday, January 27, 2011 5:43 PM
To: Dan Spiller
Cc [redacted]
Subject: Re: Wivenhoe assessment - preliminary results

Dan,

It's [redacted] (replying from [redacted]ail as I don't have access to my work email).

Thank you for your email. We will need to clarify some assumptions (see below), but should be able to get some preliminary results by tuesday for the probabilistic assessments. The LOS assessments will take more time, likely a week or more. Costs are likely to be of the order of about $5,000-$7,500.

Just checking the following assumptions:

- Temporary reduction of Wivenhoe and Somerset FSL to end June 2011 – it is an initial condition, not a recurrent reduction each year after the wet season?

- Are assumed demands to include the "rebound" from current levels up 230 l/p/d by 2018?

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- Supply capacities for:

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Hope this is in line with what you are trying to achieve and any questions let us know.

Kind Regards,

[redacted] Director/Principal Water Resource Engineer **B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust** www.access.gs | Download vCard

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Wurtulla Q4575
Phone 07 5493 9911
Fax 07 5493 9877

ROBINA
5/232 Robina Town Centre Dr.
PO Box 4115
Robina Q4230
Phone 07 5578 9944
Fax 07 5578 9945

CAIRNS
43-47/20-32 Lake Street
PO Box 5985
Cairns Q4870
Phone 07 4031 8117
Fax 07 4041 6784

GILBERT SUTHERLAND

On 27/01/2011, at 10:41 AM, Dan Spiller wrote:

[redacted]

Thanks for the preliminary advice. I would be appreciative if you could undertake more detailed modelling as earlier as possible this week.
I require modelling based on Wivenhoe and Somerset dams being drawn down to:

Full supply level (base case)
- 95%
- 90%
- 80%
- 70%
- 60%
- 50%.

Modelling should be for both a temporary reduction to end June 2011 and for a permanent reduction.

For each level, please model:
- Probability of key Water Grid storages falling to T1 within 5 years
- Probability of key Water Grid storages falling to T1 within 10 years
- Level of Service system yield (permanent reduction only).

For demands, use the SEQ Water Strategy forecasts based on:
- 230 litres per person per day
- Medium series population growth
- No allowance for climate change.

For supply, assume:

- For the WCRWS, augmentation of Wivenhoe Dam when key Water Grid storages are above 40% of capacity
- For desalination, operation in:
  - standby mode when key Water Grid storages are above 60% of capacity (4% of capacity)
  - full capacity when key Water Grid storages are below 60% of capacity
- Supply from the Wyaralong Water Treatment Plant Stage 1 from July 2015
- Demolition of:
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I would appreciate your advice tomorrow regarding your availability to undertake this work and the likely timeframe and costs.

Thanks for your assistance. Please call me if you require any further information.

Regards,

From: [redacted]
Sent: Tuesday, 25 January 2011 12:21 PM
To: Dan Spiller
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Subject: Wivenhoe assessment - preliminary results

Hi Dan,

Please find enclosed a summary of preliminary results regarding Wivenhoe assessment discussed last week with [redacted]

Hope this helps and we will keep you updated with final results.

Cheers
[redacted]

[redacted]

From: [redacted]
Sent: Friday, 28 J[redacted]M
To: Dan Spiller; [redacted]
Cc: [redacted]
Subject: Contingency arrangements for dams in SEQ

[redacted] and Dan
I 'm told that there is a statewide disaster planning meeting this afternoon and the DG DERM has requested a brief on SEQ arrangements by 1 pm co-ordinated by SWI.

The Water Grid Manager is coordinating the SEQ water entity inputs.

WAP SE and QWC both need to be in the loop to highlight where there may be a need to identify constraints or consequences of the ROPs and the SOP eg if release from Wivenhoe is greater than remaining entitlement then could severely impact on water security even in the short term unless emergency provisions specifically cover before steps are taken.

[redacted] you might liaise with [redacted]
an - please copy me in to draft

[redacted]
Acting General Manager
Regional Planning and Policy
Queensland Water Commission
L16 53 Albert Street
Brisbane QLD 4000
Phone: [redacted]
Mobile [redacted]
www.qwc.qld.gov.au

[redacted]

From: Dan Spiller
Sent: Friday, 28 January 2011 9:12 AM
To: [redacted]
Cc:
Subject: RE: Contingency arrangements for dams in SEQ

[redacted]

Happy to copy you on the response.

I do not expect that it will address Wivenhoe Dam levels, other than to state that a review is currently underway. As you know, Seqwater is preparing separate advice on this issue. While we can flag this advice today, I do not think we can pre-empt the outcomes.

Dan

From: [redacted]
Sent: Friday, 28 January 2011 8:39 AM
To: Dan Spiller [redacted]
Cc: [redacted]
Subject: Contingency arrangements for dams in SEQ

[redacted] and Dan
I 'm told that there is a statewide disaster planning meeting this afternoon and the DG DERM has requested a brief on SEQ arrangements by 1 pm co-ordinated by SWI.

The Water Grid Manager is coordinating the SEQ water entity inputs.

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Regional Planning and Policy
Queensland Water Commission
L16 53 Albert Street
Brisbane QLD 4000
Phone [redacted]
Mobile [redacted]
www.qwc.qld.gov.au

N29

If you have received this message in error, you are asked to inform the sender as quickly as possible and delete this message and any copies of this message from your computer and/or your computer system network.
****

N30

From: [redacted]
Sent: Monday, January 31, 2011 7:06 AM
To: Dan Spiller [redacted]
Cc: [redacted]
Subject: Results

Dan,

Just a quick update to let you know that [redacted] has undertaken the modelling with a 70% Wivenhoe FSL and is forwarding to me for a final check. There was a couple of outcomes that [redacted] felt needed further scrutiny but hopefully all ok and we will be able to forward within the next half an hour or so. If there are stills issues we are not comfortable with I will give you a call and discuss without forwarding the results. I feel better to have fully reviewed information only.

Just as a bit of perspective:

- 10% of Wivenhoe FSL = approx 16 mm of runoff (from the entire catchment)
- 20% = approx 33 mm of runoff
- 30% = approx 45 mm

In terms of overall effect on inflow to Wivenhoe in an extreme event case, whilst not insignificant volumes, I believe the above do not represent a "silver bullet" but merely provide some extra flood storage capacity.

Cheers,

[redacted]
Director/Principal Water Resource Engineer
B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust
www.access.gs | Download vCard

BRISBANE
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Fax 07 3852 3933

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PO Box 318
Wurtulla Q4575
Phone 07 5493 9911
Fax 07 5493 9877

ROBINA
5/232 Robina Town Centre Dr.
PO Box 4115
Robina Q4230
Phone 07 5578 9944
Fax 07 5578 9945

CAIRNS
43-47/20-32 Lake Street
PO Box 5985
Cairns Q4870
Phone 07 4031 8117
Fax 07 4041 6784

[redacted] GILBERT SUTHERLAND

Litsupport Brisbane

From: [redacted]
Sent: Monday, 31 January 2011 7:42 AM
To: Dan Spiller
Cc: [redacted]
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
- Tugun is assumed to operate at one third capacity when key SEQ storages are above 60%, and full capacity below 60% [updates with mothball regime are underway]
- PRW into Wivenhoe when total system storage is below 40% of capacity
- All current WTPs assumed operating (i.e. none of the shut-downs as discussed for next set of modelling scenarios)
- Wyaralong Dam constructed without WTP (i.e. no additional supply to grid)
- No Hinze raise
- NTP transfer capacity = 65 ML/d SC to Central when Northern key storages > 70% of capacity, and 65 ML/d Central to SC when northern key storages < 40%
- SRWP transfer capacity = 25 ML/d GC to Central when Southern key storages > 40%, 55 ML/d Central to GC when Southern key storages < 40%
- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted]irector/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust**www.access.gs | Download vCard

Litsupport Brisbane

From: [redacted]
Sent: Monday, 31 January 2011 8:01 AM
To: Dan Spiller
Cc: [redacted]
Subject: Re: Modelling assumptions

Follow Up Flag: Follow up
Flag Status: Completed

Dan,

Yes - the reduction in FSL is assumed to be permanent.

Cheers,

[redacted]

[redacted]irector/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAus**www.access.gs | [Download vCard]()

On 31/01/2011, at 7:48 AM, Dan Spiller wrote:

[redacted]

Just to confirm, does the FSL assumption include a permanent reduction in the FSL of Wivenhoe and Somerset dams?

Dan

On 31/01/2011, at 7:41 AM, '[redacted] wrote:

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
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Regards,

[redacted]Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust****www.access.gs | Download vCard**

Litsupport Brisbane

From: [redacted]
Sent: Monday, 31 January 2011 4:40 PM
To: Dan Spiller
Cc: [redacted]
Subject: RE: Wivenhoe assessment - preliminary results

Follow Up Flag: Follow up
Flag Status: Completed

Hi again Dan,

As discussed this afternoon, I am undertaking runs looking at temporary reduction of Wivenhoe FSL to end June 2011 [the issues mentioned in the below email arise with permanent reduction scenarios, not temporary].
I will try to send through results by tomorrow midday.

Cheers and speak soon,
[redacted]

From: [redacted]
To: Dan Spiller [redacted]
Cc: [redacted]
Sent: Mon, 31 Jan 2011 14:18:19 +1100
Subject: RE: Wivenhoe assessment - preliminary results

Hi Dan,

Hope the preliminary estimates [redacted] sent through this morning were helpful.

After further review of the model, we have discovered some issues which will need to be addressed before carrying on with the scenarios discussed below. This means we will have to extend timing to ensure robustness of modelling and outcomes. At this stage, I am hoping we can resolve these issues by early next week and complete runs with verified model by the end of next week.

Sorry for the inconvenience. We will keep you informed of our progress as we go and please feel free to contact [redacted] or myself if you have any questions.

Kind Regards,
[redacted]

From: Dan Spiller [redacted]
To: [redacted]
Cc: [redacted]
Sent: Thu, 27 Jan 2011 19:14:06 +1100
Subject: RE: Wivenhoe assessment - preliminary results

[redacted]

Thanks. Timing and cost acknowledged - there are funds remaining under the existing purchase order.

In terms of assumptions:

- Please model the reduction as both a temporary reduction and a permanent one. Initial priority is on temporary results (that is, for the current wet season)
- As you suggest, use the gradual rebound to 2018
- As a compromise, assume no supply from the Capalaba and Caboolture WTPs
- BAP capacity is about 20 ML/day - you should be able to confirm from the base version licensed by the QWC
- Wyaralong WTP Stage 1 is 25,000 ML/a.

[redacted] The constraint on modeling facilities in standby mode is problematic. Would you be able to make the necessary changes to the model? If so, what would be the timeframe and cost? If reasonable, I may make the offer to the QWC. Are there any other major constraints that need to be addressed, based on the types of modeling that I have been requesting for the Operating Strategy?

Thanks,

Dan

From: [redacted]
Sent: Thursday, January 27, 2011 5:43 PM
To: Dan Spiller
Cc: [redacted]
Subject: Re: Wivenhoe assessment - preliminary results

Hi Dan,

It's [redacted] replying from [redacted] mail as I don't have access to my work email).

Thank you for your email. We will need to clarify some assumptions (see below), but should be able to get some preliminary results by tuesday for the probabilistic assessments. The LOS assessments will take more time, likely a week or more. Costs are likely to be of the order of about $5,000-$7,500.

Just checking the following assumptions:

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- Are assumed demands to include the "rebound" from current levels up 230 l/p/d by 2018?

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- Supply capacities for:

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Hope this is in line with what you are trying to achieve and any questions let us know.

Kind Regards,

[redacted]

[redacted]Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust**www.access.gs | [Download vCard]()

On 27/01/2011, at 10:41 AM, Dan Spiller wrote:

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I require modelling based on Wivenhoe and Somerset dams being drawn down to:

Full supply level (base case)

- 95%
- 90%

- 80%
- 70%
- 60%
- 50%.

Modelling should be for both a temporary reduction to end June 2011 and for a permanent reduction.

For each level, please model:

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- Probability of key Water Grid storages falling to T1 within 10 years
- Level of Service system yield (permanent reduction only).

¯or demands, use the SEQ Water Strategy forecasts based on:

- 230 litres per person per day
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- No allowance for climate change.

For supply, assume:

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    - Petrie

- Capalaba
- Caboolture.

I would appreciate your advice tomorrow regarding your availability to undertake this work and the likely timeframe and costs.

Thanks for your assistance. Please call me if you require any further information.

Regards,

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Sent: Tuesday, 25 January 2011 12:21 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment - preliminary results

Hi Dan,

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Hope this helps and we will keep you updated with final results.

Cheers,

[redacted]

This email, together with any attachments, is intended for the named recipient(s) only; and may contain privileged and confidential information. You understand that any privilege or confidentiality attached to this message is not waived, lost or destroyed because you have received this message in error. If received in error, you are asked to inform the sender as quickly as possible and delete this email and any copies of this from your computer system network.
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While all care has been taken, the SEQ Water Grid Manager disclaims all liability for loss or damage to person or property arising from this message being infected by a computer virus or other contamination. Unless stated otherwise, this email represents only the views of the sender and not the views of the SEQ Water Grid Manager and/or the Queensland Government.

Litsupport Brisbane

From: [redacted]
Sent: Tuesday, 1 February 2011 12:03 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment_temporary FSL reduction
Attachments: Wivenhoe assessment_temporary FSL reduction (Feb-2011).ppt

Hi Dan,

As discussed yesterday, we have undertaken runs assessing **temporary** reduction of Wivenhoe FSL to end June 2011. Key assumptions are as described in email below, except for **Tugun whose operation is assumed as standby** (4%) when key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.

Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. *see attached Figure 1*

Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers,
[redacted]

From: [redacted]
To: Dan Spiller [redacted]
Cc: [redacted]
Sent: Mon, 31 Jan 2011 08:41:46 +1100
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
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- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

N41

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted] Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust**[**www.access.gs**](#) **|** [**Download vCard**](#)

N42

Figure 1 Estimated probability of SEQ reaching T1 and T2 (May-2011 to Apr-2021)

*impact of **temporary** reduction of Wivenhoe FSL to end June 2011*

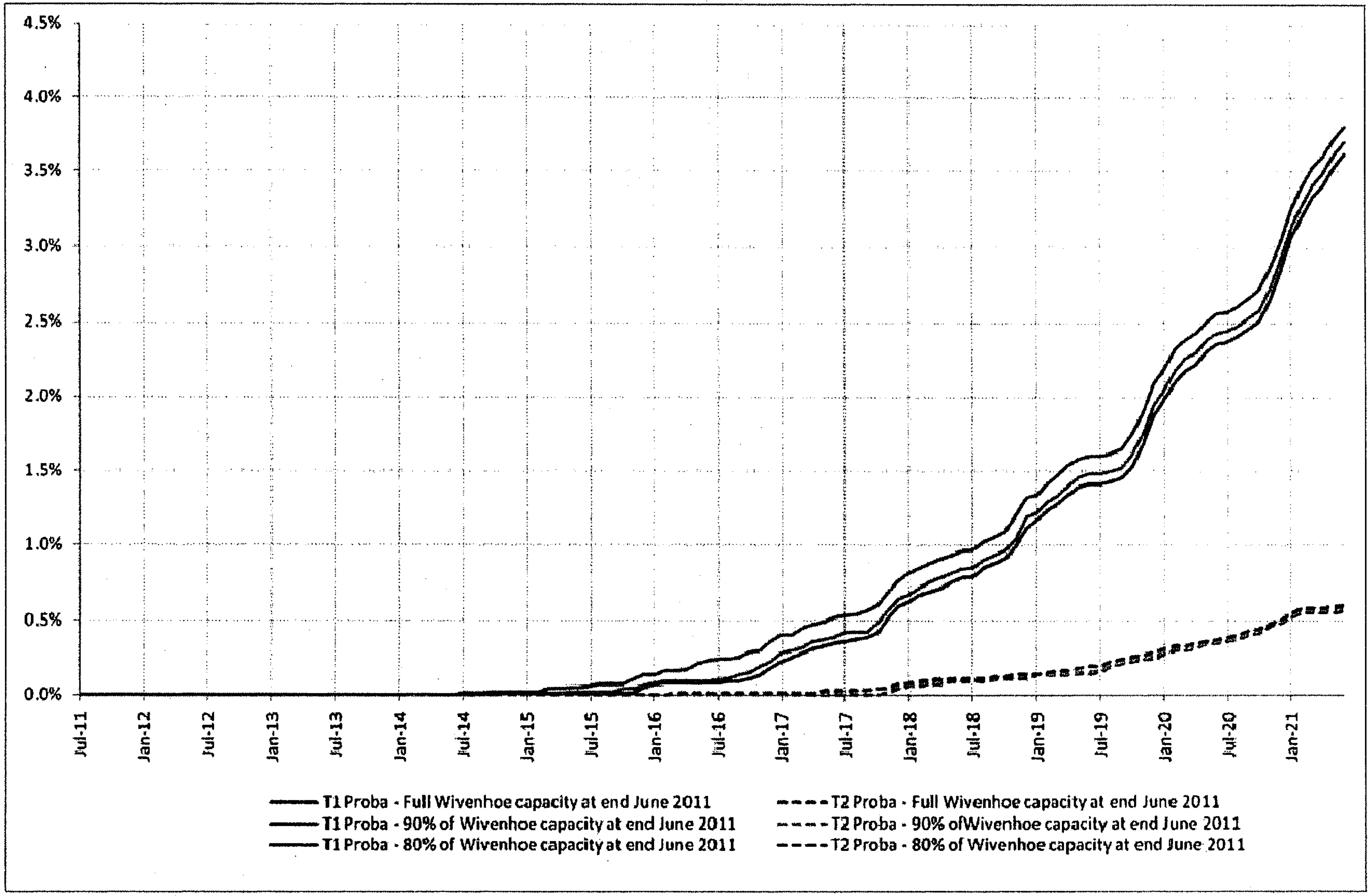
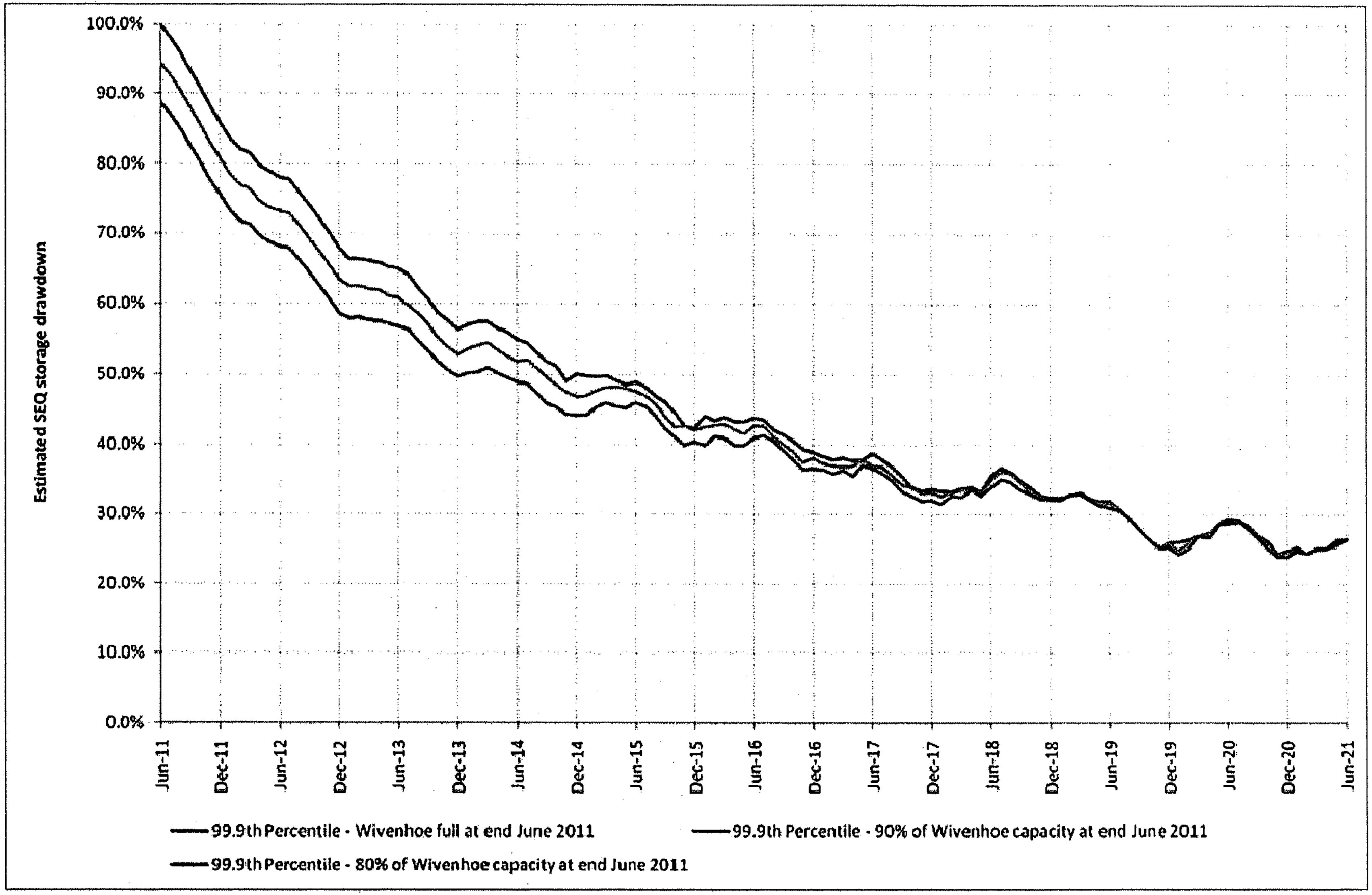


Figure 2 Estimated 10-year forecast drawdown of SEQ storages, 99.9th. Percentile
impact of ***<u>temporary</u>*** *reduction of Wivenhoe FSL to end June 2011*



Litsupport Brisbane

From: [redacted]
Sent: Tuesday, 1 February 2011 12:36 PM
To: Dan Spiller
Cc: [redacted]
Subject: RE: Wivenhoe assessment - preliminary results

Dan,

As mentioned in below email, we have identified issues in the modelling undertaken to date for **permanent** reduction of Wivenhoe FSL. We are confident that advice provided re temporary reduction of Wivenhoe FSL is consistent, but please disregard results provided re permanent reduction of Wivenhoe FSL since last week.

Thank you in advance for your understanding,
[redacted]

From [redacted]
To: Dan Spiller [redacted]
Cc [redacted]
Sent: Mon, 31 Jan 2011 14:18:19 +1100
Subject: RE: Wivenhoe assessment - preliminary results

Hi Dan,

Hope the preliminary estimates [redacted] sent through this morning were helpful.

After further review of the model, we have discovered some issues which will need to be addressed before carrying on with the scenarios discussed below. This means we will have to extend timing to ensure robustness of modelling and outcomes. At this stage, I am hoping we can resolve these issues by early next week and complete runs with verified model by the end of next week.

Sorry for the inconvenience. We will keep you informed of our progress as we go and please feel free to contact [redacted] or myself if you have any questions.

Kind Regards,
[redacted]

From: Dan Spille [redacted]
To: [redacted]
Cc: [redacted]
Sent: Thu, 27 Jan 2011 19:14:06 +1100
Subject: RE: Wivenhoe assessment - preliminary results

[redacted]

Thanks. Timing and cost acknowledged - there are funds remaining under the existing purchase order.

N45

In terms of assumptions:

- Please model the reduction as both a temporary reduction and a permanent one. Initial priority is on temporary results (that is, for the current wet season)
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.hanks,

Dan

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Sent: Thursday, January 27, 2011 5:43 PM
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Cc: [redacted]
Subject: Re: Wivenhoe assessment - preliminary results

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N46

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Kind Regards,

[redacted]

[redacted] Director/Principal Water Resource Engineer **B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust** **www.access.gs | Download vCard**

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- 80%

- 70%
- 60%
- 50%.

Modelling should be for both a temporary reduction to end June 2011 and for a permanent reduction.

For each level, please model:

- Probability of key Water Grid storages falling to T1 within 5 years
- Probability of key Water Grid storages falling to T1 within 10 years
- Level of Service system yield (permanent reduction only).

For demands, use the SEQ Water Strategy forecasts based on:

- 230 litres per person per day
- Medium series population growth
- No allowance for climate change.

For supply, assume:

- For the WCRWS, augmentation of Wivenhoe Dam when key Water Grid storages are above 40% of capacity
- For desalination, operation in:
  - standby mode when key Water Grid storages are above 60% of capacity (4% of capacity)
  - full capacity when key Water Grid storages are below 60% of capacity
- Supply from the Wyaralong Water Treatment Plant Stage 1 from July 2015
- Demolition of:
  - At end June 2011, the Maleny and Woorim water treatment plants
  - At end June 2014, the Beaudesert and South Maclean water treatment plants
- From end June 2012, operation of the following supplies when key Water Grid storages are below 40% of capacity only:
  - Brisbane Aquifer Project
  - Petrie
  - Capalaba

- Caboolture.

I would appreciate your advice tomorrow regarding your availability to undertake this work and the likely timeframe and costs.

Thanks for your assistance. Please call me if you require any further information.

Regards,

Dan

From: [redacted]
Sent: Tuesday, 25 January 2011 12:21 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment - preliminary results

Hi Dan,

Please find enclosed a summary of preliminary results regarding Wivenhoe assessment discussed last week wit[redacted]

Hope this helps and we will keep you updated with final results.

Cheers,

[redacted]

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From:	Dan Spiller [redacted]
Sent:	Tuesday, February 1, 2011 2:55 PM
To:	Bradley John [redacted]
Cc:	Best Debbie <[redacted] Barry Dennien [redacted]
Subject:	Cabinet-in-confidence: Water security impacts
Attach:	Wivenhoe assessment_temporary FSL reduction (Feb-2011).ppt

All,

The WGM has modelled the impact of a temporary reduction in the storage level of Wivenhoe Dam until the end of the current wet season. It assumes no permanent reduction, as the operation beyond the current water year is a matter for the Commission of Inquiry.

The modelling shows that this once off reduction has a negligible impact on the probability of triggering the re-introduction of restrictions over either a five or 10 year timeframe (T1). There is even less impact on the probability of triggering the construction of drought response infrastructure (T2). The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011.

The second figure shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

The modelling assumptions are conservative (that is, the impact may be overstated). Key assumptions are:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to average residential consumption of 230 litres per person per day by 2018 (this is a conservative planning assumption)
- Operation of the desalination facility in standby mode when storages are above 60% and full capacity when they are below
- PRW into Wivenhoe when total system storage is below 40% of capacity
- All current WTPs assumed operating
- Wyaralong Dam constructed without WTP
- No allowance for the Hinze dam raising
- Constant supply of 10,000 ML/a to Toowoomba.

In terms of implementation, we would suggest that a staged approach be considered. Depending upon Seqwater advice and recommendations, this could be along the lines of:

Stage 1: Preparedness)

- Reduce to 90% by end week (up to maximum of 1500 cumec maximum release, Strategy W1D)
- Reduce W1, W2 and W3 trigger levels to match (for example, W2 commences at 108%, with target flows at Moggill of 3500 cumecs). No change to W4 trigger level
- Minimal releases from dam at time that an event is forecast to reach SEQ, minimising the risk of releases coinciding with peak downstream flows
- Maintain at 90% until end wet season
- Beyond end wet season, option to reduce should a major event be forecast (pending detailed consideration as part of the Inquiry)

Stage 2: High alert

- Reduce to 80% if this there is a high probability that a major event will impact upon central SEQ within 24 to 48 hours

- Reduce W1, W2 and W3 trigger levels to match (for example, W2 commences at 98%, with target flows at Moggill of 3500 cumecs). No change to W4 trigger level
- Minimal releases from dam at time that event is forecast to reach SEQ, minimising the risk of releases coinciding with peak downstream flows
- Return storage levels to 90%
- Beyond end wet season, option to reduce should a major event be forecast (pending detailed consideration as part of the Inquiry)

Please call Barry or I if you require further information.

Regards,
Dan

Daniel Spiller
Director, Operations
SEQ Water Grid Manager
Phone [redacted]
Email: [redacted]
Visit: [redacted]
Post: PO Box 16205, City East QLD 4002
ABN: 14783 317 630

Figure 1 Estimated probability of SEQ reaching T1 and T2 (May-2011 to Apr-2021)
*impact of **temporary** reduction of Wivenhoe FSL to end June 2011*

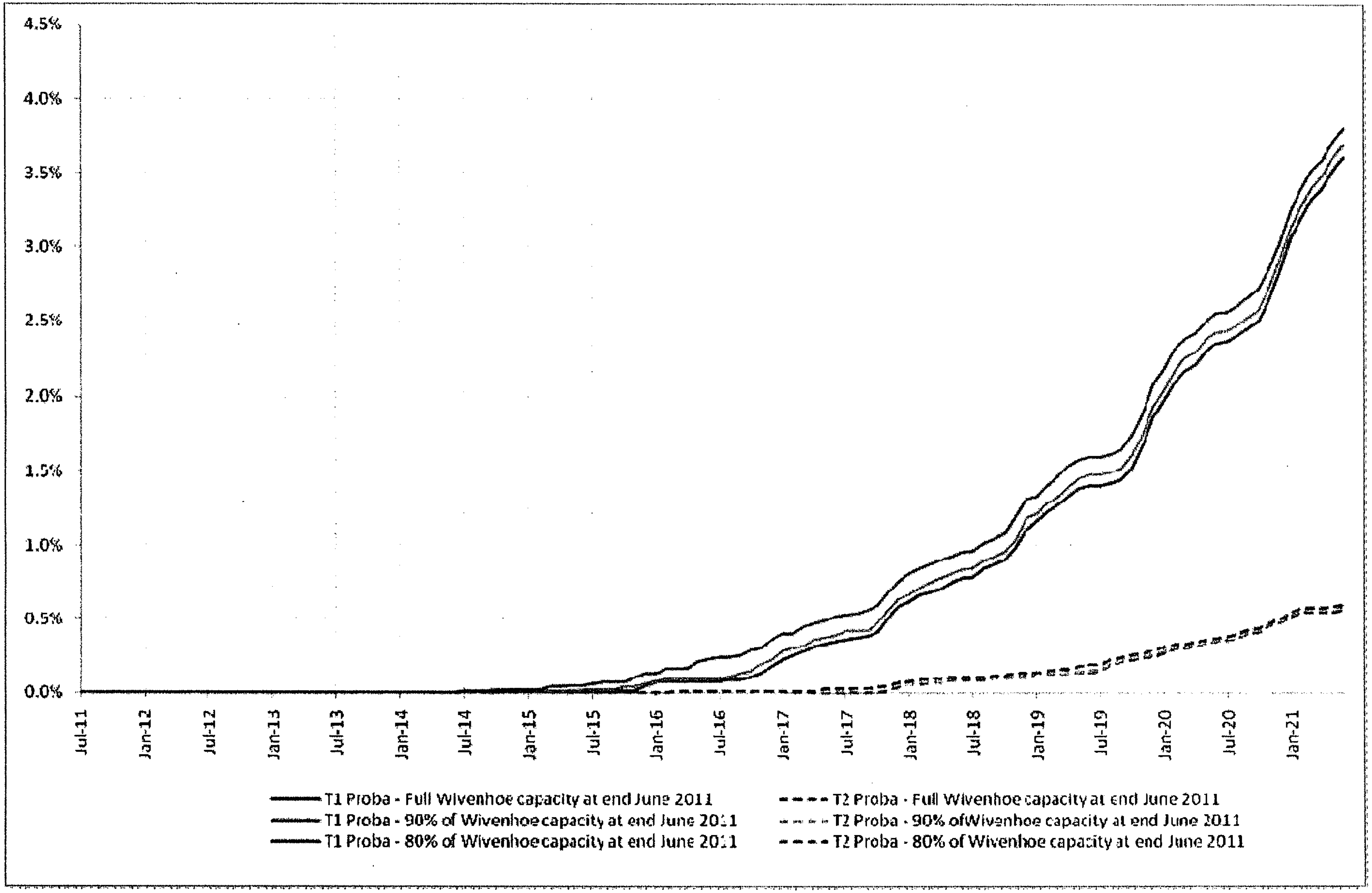
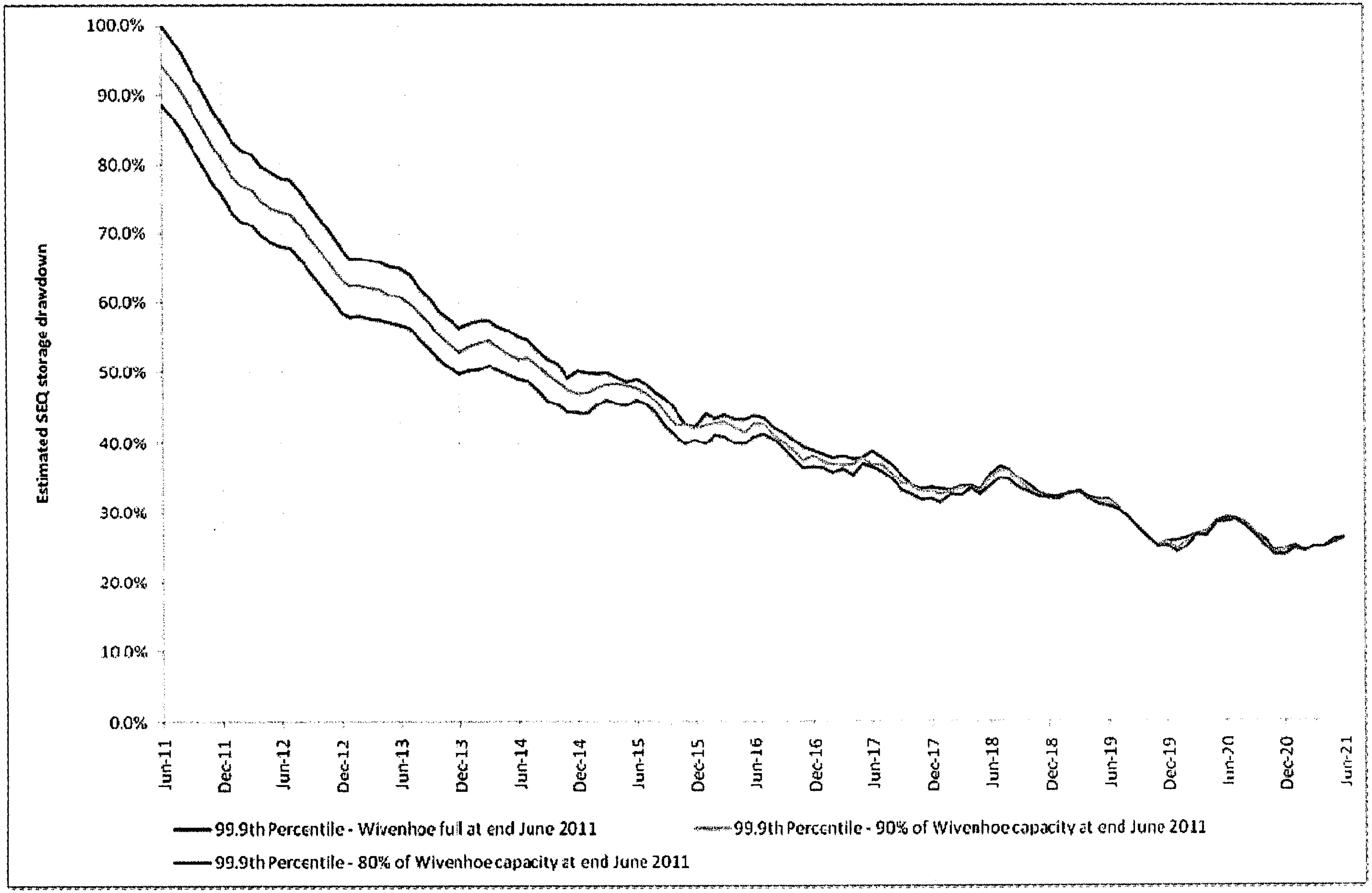


Figure 2 Estimated 10-year forecast drawdown of SEQ storages, 99.9th. Percentile *impact of **temporary** reduction of Wivenhoe FSL to end June 2011*



Litsupport Brisbane

From: [redacted]
Sent: Tuesday, 1 February 2011 1:40 PM
To: Dan Spiller
Cc: [redacted]
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Hi again,

As discussed on the phone, a preliminary assessment has been carried out for temporary reduction of Wivenhoe FSL to **50%** to end June 2011.
According to preliminary results (1000 replicates) such a reduction shows an impact on the security of the grid in the short term, with the main effects of more extreme temporary conditions (i.e. 50% FSL) to increase likelihood of drawdown over the short to medium term. Specific outcomes include:
- first simulated occurence of SEQ drawdown to T1 within the next 2 years and probability of drawdown to T1 increasing to about 2% within 5 years. This is compared with less than 0.2% probability of drawdown to T1 within the next 5 years for scenarios with temporary FSL of 100%, 90% and 80%.
- Probability of SEQ falling to T1increasing to about 5% within 10 years, as opposed to approx 3.5-4% for 80%-100% FSL scenarios.

al runs for temporary Wivenhoe FSL of 70% and 50% at end June 2011 are underway and results should be available by tomorrow morning.

Cheers,
[redacted]

From: [redacted]
To: Daniel.Spiller[redacted]
Cc:[redacted]
Sent: Tue, 01 Feb 2011 13:02:44 +1100
Subject: Wivenhoe assessment_temporary FSL reduction

Hi Dan,

As discussed yesterday, we have undertaken runs assessing **temporary** reduction of Wivenhoe FSL to end June 2011. Key assumptions are as described in email below, except for **Tugun whose operation is assumed as standby** (4%) hen key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.

Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. *see attached Figure 1*

Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers,
[redacted]

N55

From: [redacted]
To: Dan Spiller [redacted]
Cc: [redacted]
Sent: Mon, 31 Jan 2011 08:41:46 +1100
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
- Tugun is assumed to operate at one third capacity when key SEQ storages are above 60%, and full capacity below 60% [updates with mothball regime are underway]
- PRW into Wivenhoe when total system storage is below 40% of capacity
- All current WTPs assumed operating (i.e. none of the shut-downs as discussed for next set of modelling scenarios)
- Wyaralong Dam constructed without WTP (i.e. no additional supply to grid)
- No Hinze raise
- NTP transfer capacity = 65 ML/d SC to Central when Northern key storages > 70% of capacity, and 65 ML/d Central to SC when northern key storages < 40%
- SRWP transfer capacity = 25 ML/d GC to Central when Southern key storages > 40%, 55 ML/d Central to GC when Southern key storages < 40%
- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted] Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust**www.access.gs | Download vCard

N56

Litsupport Brisbane

From: [redacted]
Sent: Wednesday, 2 February 2011 10:26 AM
To: Dan Spiller
Cc: [redacted]
Subject: Re: Wivenhoe assessment_temporary FSL reduction
Attachments: Wivenhoe assessment_temporary FSL reduction (Feb-2011) - Final.ppt

Good morning Dan,

Runs for scenarios with temporary Wivenhoe FSL of 100%, 90%, 80%, 70% and 50% are now all finalised (10,000 replicates, see attached figures).
Results are in line with preliminary outcomes, that is:
- Increased likelihood of drawdown over the short to medium term with temporary FSL reduction to 50%
- Probability of SEQ falling to T1 within 10 years increasing from approx 3.5%-4% for 70%-100% FSL scenarios to about 5% for 50% FSL scenario

Hope this covers it for temporary reduction assessments and we will update you of our progress re permanent reduction assessments.

Cheers,
[redacted]

<u>Note - reminder of key modelling assumptions as detailed in emails below</u>:
- Demands as per QWC *<u>Strategy baseline</u>* (medium series pop growth, "rebound" from 2009 recorded consumption levels to 230 lpd res by 2018)
- Supply as per 2010 operating strategy, except for Tugun which is assumed to operate on *<u>standby</u>* (4%) when key grid storages are above 60% of capacity and at full capacity when key Grid storages are below 60% of capacity

---

From: [redacted]
To: Daniel.Spiller[redacted]
Cc: [redacted]
Sent: Tue, 01 Feb 2011 14:39:54 +1100
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Hi again,

As discussed on the phone, a preliminary assessment has been carried out for temporary reduction of Wivenhoe FSL to **<u>50%</u>** to end June 2011.
According to preliminary results (1000 replicates) such a reduction shows an impact on the security of the grid in the short term, with the main effects of more extreme temporary conditions (i.e. 50% FSL) to increase likelihood of drawdown over the short to medium term. Specific outcomes include:
- first simulated occurence of SEQ drawdown to T1 within the next 2 years and probability of drawdown to T1 increasing to about 2% within 5 years. This is compared with less than 0.2% probability of drawdown to T1 within the next 5 years for scenarios with temporary FSL of 100%, 90% and 80%.
- Probability of SEQ falling to T1increasing to about 5% within 10 years, as opposed to approx 3.5-4% for 80%-100% FSL scenarios.

Final runs for temporary Wivenhoe FSL of 70% and 50% at end June 2011 are underway and results should be available by tomorrow morning.

Cheers,
[redacted]

From: [redacted]
To: Daniel Spiller [redacted]
Cc: [redacted]
Sent: Tue, 01 Feb 2011 13:02:44 +1100
Subject: Wivenhoe assessment_temporary FSL reduction

Hi Dan,

As discussed yesterday, we have undertaken runs assessing **temporary** reduction of Wivenhoe FSL to end June 2011. Key assumptions are as described in email below, except for **Tugun whose operation is assumed as standby** (4%) when key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.

Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. *see attached Figure 1*

Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers
[redacted]

From [redacted]
To: Dan Spiller [redacted]
Cc: [redacted]
Sent: Mon, 31 Jan 2011 08:41:46 +1100
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
- Tugun is assumed to operate at one third capacity when key SEQ storages are above 60%, and full capacity below 60% [updates with mothball regime are underway]
- PRW into Wivenhoe when total system storage is below 40% of capacity
- All current WTPs assumed operating (i.e. none of the shut-downs as discussed for next set of modelling scenarios)
- Wyaralong Dam constructed without WTP (i.e. no additional supply to grid)
- No Hinze raise
- NTP transfer capacity = 65 ML/d SC to Central when Northern key storages > 70% of capacity, and 65 ML/d Central to SC when northern key storages < 40%
- SRWP transfer capacity = 25 ML/d GC to Central when Southern key storages > 40%, 55 ML/d Central to GC when Southern key storages < 40%
- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

N58

[redacted] Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust**www.access.gs | Download vCard

Figure 1 Estimated probability of SEQ reaching T1 and T2 (Jul-2011 to Jun-2021)
*impact of **temporary** reduction of Wivenhoe FSL to end June 2011*

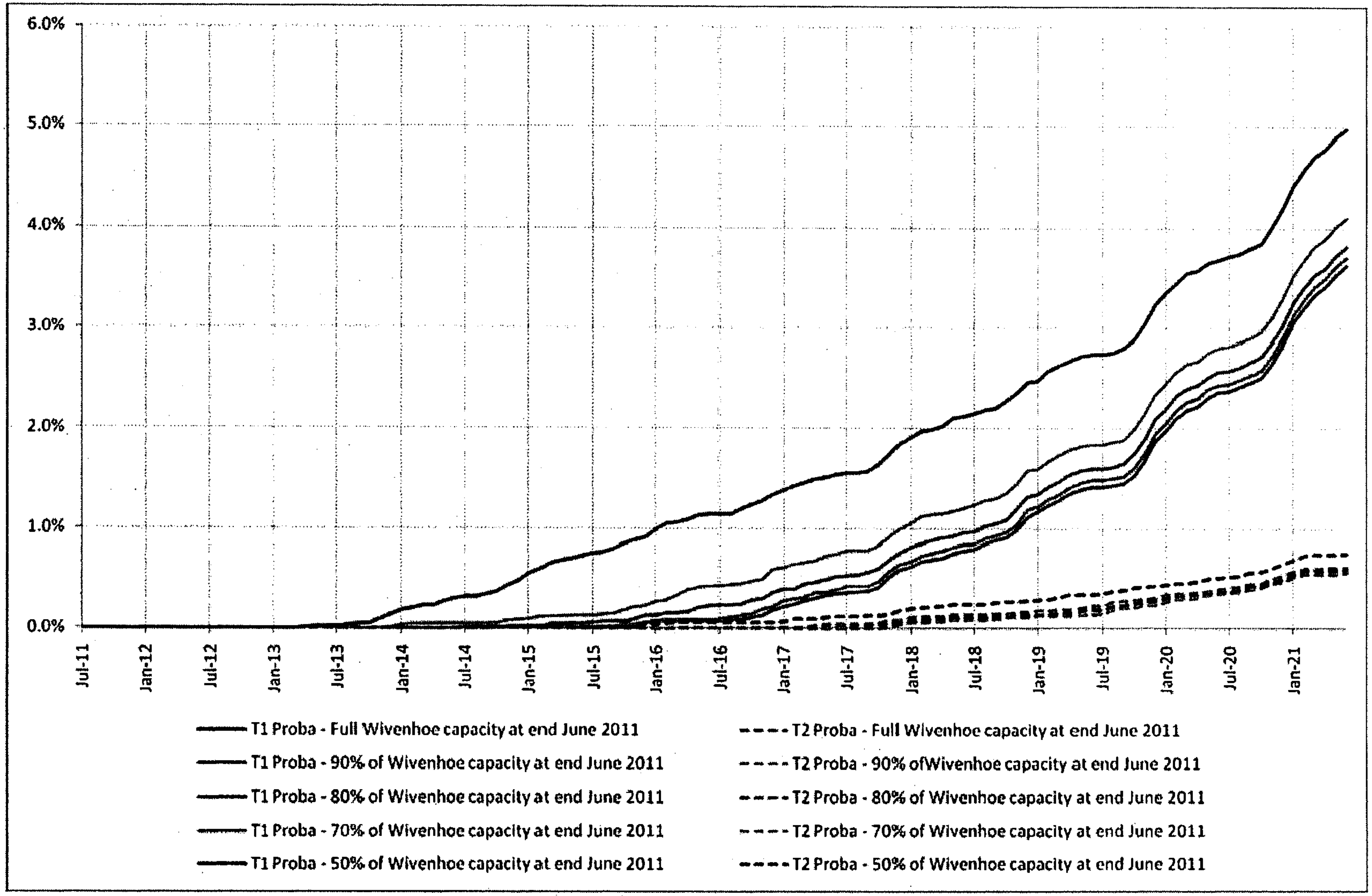
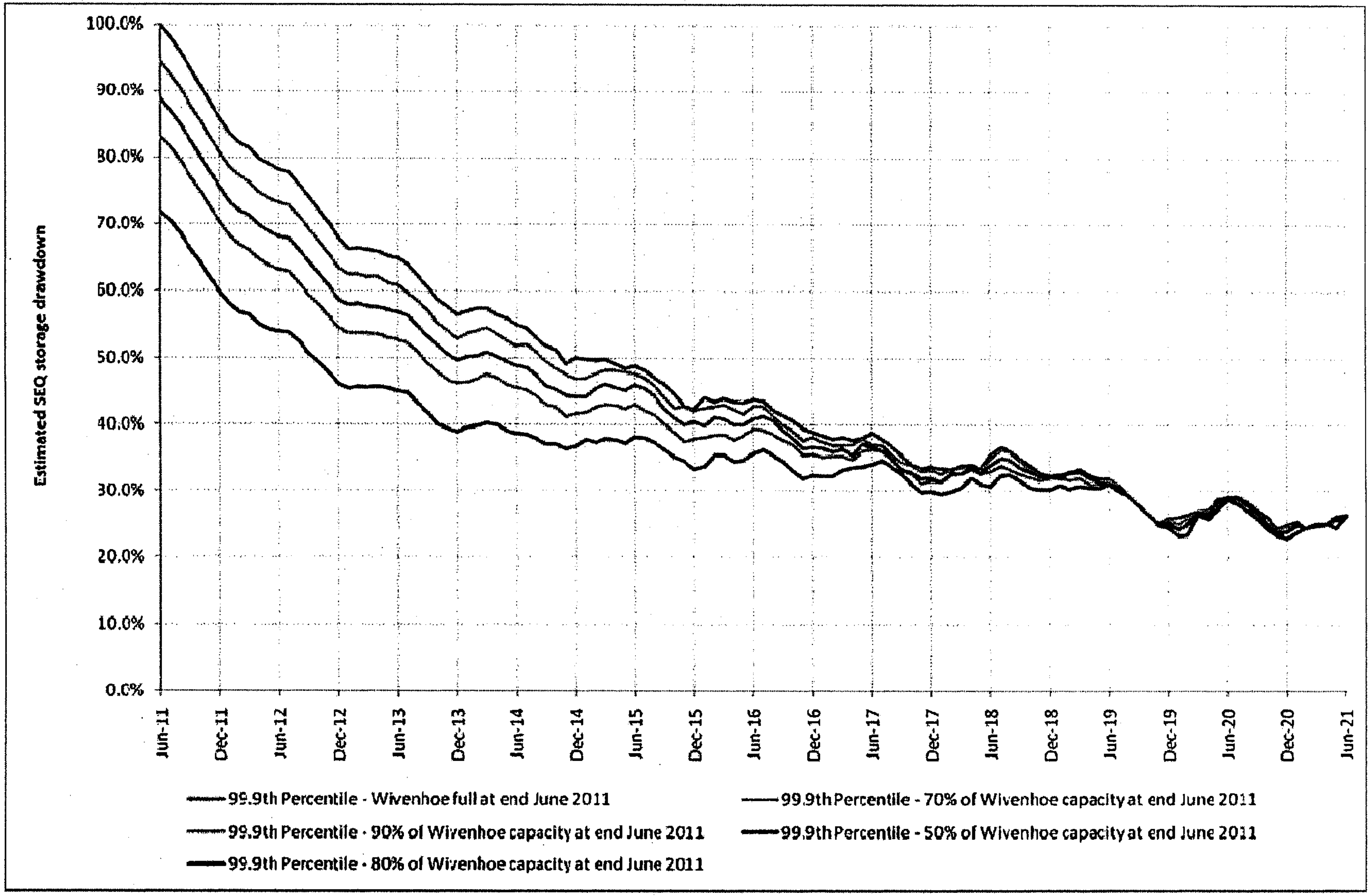


Figure 2 Estimated 10-year forecast drawdown of SEQ storages, 99.9th. Percentile
*impact of **temporary** reduction of Wivenhoe FSL to end June 2011*



N61

[redacted]

From: Best Debbie [redacted]
Sent: Monday, 7 February 2011 5:36 PM
To: Dan Spiller; Barry Dennien
Subject: FW: Contigency Protocols
Attachments: Level3Scanner@seqwater.com.au_20110207_170200.pdf

Categories: T14: Continuation

Debbie Best
Deputy Dir[redacted]tcomes Division
Telep[redacted]
Emai[redacted]
www.derm.qld.gov.au

Department of Environment and Resource Management
Level 13, 400 George Street, Brisbane Q 4000
GPO Box 2454, Brisbane Q 4001

From: Peter Borrows [redacted]
Sent: Monday, 7 Feb[redacted]
To: Bradley John
Cc: Best Debbie; Allen Peter
Subject: Contigency Protocols

Hello John.

Please find attached a revised draft of the Contingency Protocol following our meeting last Friday 4 February 2011.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

Ph [redacted]
Lev[redacted]
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

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3 sheets of A4 paper = 1 litre of water

+---+

7 February 2011

Mr John Bradley
Department of Environment and Resource Management
Director General
GPO Box 2454
BRISBANE QLD 4000

John

Dear Mr Bradley,

Please find attached a revised draft of the Contingency Protocol (Protocol) following our meeting last Friday 4 February 2011.

I confirm that the Protocol documents the process to initiate discussions between Seqwater and DERM, including the Dam Safety Regulator, on the options to be considered in the event of a predicted rainfall event greater than 100mm in any one day in the Wivenhoe/Somerset catchments (Trigger Rainfall Event).

The Protocol highlights a number of key issues to be consider including:

- Pre-release of water from Wivenhoe Dam based on predicted rainfall and possible release scenarios; and
- Possible changes to release procedures in relation to normal operations and to operations under the Flood Operations manuals, including accelerated releases.

The earlier draft of the Protocol has been discussed with the Dam Safety Regulator and we will be happy to finalise the Protocol with all appropriate representatives from DERM after they have had an opportunity to review the further draft.

Yours sincerely,

[redacted]

Peter Borrows
Chief Executive Officer

Contingency Protocol in the event of possible Wivenhoe Dam Gate Operations for Flood Releases

Objective
The purpose of this Contingency Protocol (Protocol) is to document the process to initiate discussions between Seqwater and DERM, including the Dam Safety Regulator and any other agencies as determined by DERM, on the options to be considered, in the event of a predicted rainfall event greater than 100mm in any one day in the Wivenhoe/Somerset catchments (Trigger Rainfall Event).

Background
The Minister for DERM has requested the development of the Protocol subsequent to the recent floods in SEQ in January 2011.

Protocol
Once the Seqwater Duty Flood Operations Engineer is aware of a Trigger Rainfall Event, Seqwater will contact the Dam Safety Regulator to determine if a meeting between the parties is required to be held. Depending on the size and intensity of the Trigger Rainfall Event, both parties may agree that a meeting is not necessary and email notification from Seqwater will suffice.

It should be noted that forecasts are not always accurate and an actual rainfall event greater than 100mm in any one day in the Wivenhoe/Somerset catchments may occur that was not predicted. In such an event, Seqwater will notify the Dam Safety Regulator immediately such an event occurs.

In the event that a meeting is held the purpose of the meeting would be for DERM to consider:

- The likelihood of releases from Wivenhoe Dam;
- The probable size of any releases from Wivenhoe Dam;
- The potential impacts of such releases from Wivenhoe Dam;
- Options including:
  - Pre-release of water from Wivenhoe Dam based on predicted rainfall and possible release scenarios ;
  - Possible changes to release procedures in relation to normal operations and to operations under the Flood Operations Manual including accelerated releases;
- Communications, including with Councils and other downstream stakeholders.

Briefing and Information
At the meeting, other parties may be requested to provide information, e.g. the Bureau of Meteorology, Brisbane City Council. These will be included with DERM's approval. Seqwater will provide to DERM all relevant information that is available in terms of predicted rainfall and provide impacts of any release strategies in terms of bridges and communities downstream.

Communications
Depending on the outcome of the discussion, further communications and discussions with other agencies may be required, in particular Brisbane City Council, Ipswich City Council Somerset Regional Council and Government agencies e.g. Bureau of Meteorology, Local Governments/Local Disaster Management Groups, SEQ Water Grid Manager, Queensland Police Service, and the Department of Premier and Cabinet (extreme events **only**). This will be required as there may be impacts of pre- releases on works downstream.

Review of Protocol
This protocol will be reviewed annually by Seqwater and DERM, or more frequently as determined by the parties.

N65

[redacted]

From: Best Debbi[redacted]
Sent: Tuesday, 8 February 2011 2:50 PM
To: Dan Spiller
Subject: Fw: Flood Discharge Scenarios
Attachments: image001.png; image002.jpg; Letter to DERM (John Bradley), dated 7 February 2011 - Impact of Reducing the FSL of Wivenhoe Dam on Flood Discharges PLUS ENCLOSURE.pdf

Categories: T14: Continuation

----- Original Messa[redacted]
From: Peter Borrow[redacted]
To: Bradley Joh[redacted]
Cc: Best Debbie[redacted] Allen Peter
Sent: Tue Feb 08 08:44:44 2011
Subject: Flood Discharge Scenarios

John.

Information as requested from the meeting held on Friday 11th February.

Regards, Peter.

Peter Borrows

Chief Executive Officer

Queensland Bulk Water Supply Authority trading <<image001.png>> as Seqwater

Ph [redacted]

Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002

Website | www.seqwater.com.au <http://www.seqwater.co <<image002.jpg>> m.au/>

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3 sheets of A4 paper = 1 litre of water

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N67

seqwater
WATER FOR LIFE

7 February 2011

Mr John Bradley
Director General
Department of Environment and Resource Management
Level 13
400 George Street
BRISBANE QLD 4000

Dear John,

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

I refer to correspondence from The Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy, and Minister for Trade, dated 20 January 2011. I confirm that, as requested, Seqwater has undertaken further simulation modelling to assist DERM in its consideration of the appropriate Full Supply Level (***FSL***) for Wivenhoe Dam. The purpose of the modelling is to provide information to assist DERM in formulating a policy position by providing an indicative assessment of a range of FSLs and pre-release strategies to pre-emptively reduce the FSL of Wivenhoe Dam.

I enclose a memorandum *Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges*, which provides a summary of Seqwater's preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. A number of scenarios are presented in the memorandum for consideration by DERM in determining, from a policy perspective, whether the FSLs for Wivenhoe Dam should be changed.

The scenarios presented in the memorandum provide an approximate analysis to help inform discussion and for further consideration by DERM. The review is intended only to provide an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose. More accurate estimates would require a detailed investigation and analysis of the entire river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models.

The analysis is based upon computer modelling of simulated gate opening sequences specified in the Flood Mitigation Manual during a "loss of communications" scenario. For the reasons noted in section 2 of the enclosed memorandum, while this scenario provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event. The model utilised adopts flood inflows that have been derived from an analysis of past historic events, in combination with design hydrographs developed previously for design and planning purposes by the Wivenhoe Alliance (2005).

The applicable assumptions for the modelled options, presented in section 2 of the memorandum, apply [redacted] scenario set out in the correspondence from Seqwater's Chairman, [redacted] to Minister Robertson, dated 4 February 2011.

Yours sincerely,

[redacted]

Peter Borrows
Chief Executive Officer

Encl.

Impact of Reducing the Full Supply Level of Wivenhoe Dam on Flood Discharges

1 Introduction

This memo provides a summary of a preliminary assessment into the impact of reducing the initial storage level of Wivenhoe Dam on the downstream discharges for major flood events. Information is provided on the impacts of reducing the Wivenhoe Dam initial storage level to 95%, 90%, 85%, 75% and 50% of the normal full supply level (EL67.0M AHD).

2 Assumptions and Caveats

The analysis was undertaken using a computer model to simulate the gate opening sequence as provided in the Flood Manual during a "loss of communications" situation. During a loss of communications between the dam operators and the Flood Control Centre, operators would use predefined gate openings based solely on the Lake Level information available to them at the dams. It should be noted that in practice gate operations would normally seek to take advantage of additional information related to rainfall forecasts and tributary flows to ensure that flood peaks are reduced as far as possible without causing coincident flooding with downstream tributaries. Thus, while using the "loss of communications" flood operation rules provides a consistent means of comparing the efficacy of different mitigation options, the actual degree of flood reduction achievable is dependent on the characteristics of the specific event.

Flood inflows to the model were derived from an analysis of past historic events (1974, 1999, and 2011), in combination with "design hydrographs" developed previously for design and planning purposes (Wivenhoe Alliance, 2005[1]). These "design hydrographs" are obtained from models of both the rainfall and flood generation process, whereby floods of a given magnitude are assigned a specified probability of exceedance (eg a "1 in 200" event).

It should be stressed that the information presented here is based on approximate analyses to help inform discussion. More accurate estimates would require a detailed investigation and analysis of the whole river system utilising multiple flood events and a combination of hydrologic, hydraulic, and routing models. This review should thus be seen as providing an order of magnitude assessment of impacts and the results should not be utilised beyond that purpose.

[1] Wivenhoe Alliance, "Design Discharges and Downstream Impacts of the Wivenhoe Dam Upgrade, Q1091, September 2005

3 Options Considered

Five options are explored in this paper, as summarised in the following table:

There are five options considered going forward.

Option	Description	Comments
0 "Do nothing"	Continue with the current approved flood operation rules – that is, maintain the status quo and continue to utilise the dam as originally designed.	This option has utilised the existing strategies that have been implemented and refined over several flood events and the manual was developed by a comprehensive study.
1 "Early release"	Change the flood operating rules to ignore the early strategies designed to minimise disruption to the rural communities	Increase the release from the dam up to 1600 m^3/s as soon as practicable after gate operations commence; it is assumed that no attempt would be made to maintain bridge access downstream of the dam other than Mt Crosby Weir Bridge and the Brisbane Valley Highway Bridge.
2 "Pre-release"	Implementing a significant release of water once the notification of a major rainfall event has been received.	The reliability of forecasts by the Bureau of Meteorology are such that they do not allow the reservoir to be drawn down in a timely manner without potentially causing appreciable "artificial" flooding downstream.
3 "75% FSL"	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level, and operate the dam under the current operating rules.	To safely lower the storage it is proposed that this option would be implemented by "Sunny Day" releases at a rate low enough to minimise disruption to the rural areas. This would be difficult to implement during a wet year where the risk of major flooding is greater. Once the storage level reached EL67 gate operations would commence as per the current flood manual.
4 "85% FSL amended"	Lower the storage level in Wivenhoe Dam to 85% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL65.25	The amended flood operating rules would retain the key level in the manual of EL74m, where the gates are opened until the flood level stops rising. This would require a change by the Queensland Government to the regulatory requirements and levels of service that the storage is operated under.
5 "75% FSL amended"	Lower the storage level in Wivenhoe Dam to 75% of the current full supply level and amend the current flood manual to commence releases once the storage level exceeds EL64.00	Same comment as for Option 4.

4 Results

The results of this analysis is summarised in Table 1 and Table 2.

Flood Event			Option 0 - Existing Rules		Option 1			Option 4			Option 5		
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,613	71.27	6%	2,639	70.66	32%	1,971	70.24	49%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,915	72.09	4%	4,028	71.53	21%	3,446	71.17	33%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,854	72.68	3%	5,031	72.16	17%	4,504	71.83	26%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,994	74.66	1%	8,535	74.37	6%	8,217	74.17	10%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,101	74.1	1%	7,821	73.92	5%	7,609	73.79	7%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,426	73.67	2%	7,135	73.49	5%	6,916	73.35	8%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	6,986	73.39	4%	6,751	73.25	7%	6,635	73.17	9%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,452	74.95	1%	5,746	74.62	24%	4,512	74.25	40%
1974 historic	5,953	1,410,000	3,275	73.31	3,159	73.26	4%	2,737	72.91	16%	2,493	72.71	24%
1999 historic	6,358	1,220,000	2,312	72.23	2,251	72.504	3%	1,814	71.89	22%	1,561	71.48	32%

Table 1 – Option Results

* Design events taken from the Wivenhoe Alliance (2005)

Flood Event			Option 0 - Existing Rules (Storage Level 100%)		Storage Level 95%		Storage Level 90%		Storage Level 85%		Storage Level 75% (Option 3)		Storage Level 50%	
Event description	Maximum Inflow (m^3/s)	Flood Volume (ML)	Maximum Outflow (m^3/s)	Maximum Lake Level (m AHD)	Maximum Outflow (m^3/s)	Flow Reduction %	Maximum Outflow (m^3/s)	Flow Reduction %	Maximum Outflow (m^3/s)	Flow Reduction %	Maximum Outflow (m^3/s)	Flow Reduction %	Maximum Outflow (m^3/s)	Flow Reduction %
36 hour 1 in 200 design*	8,214	1,544,119	3,861	71.43	3,579	7%	3,237	16%	2,965	23%	2,356	39%	1,134	71%
36 hours 1 in 500 design	10,455	1,624,119	5,125	72.22	4,863	5%	4,531	12%	4,271	17%	3,693	28%	2,213	57%
36 hours 1 in 1000 design	12,031	1,772,752	6,049	72.8	5,795	4%	5,478	9%	5,235	13%	4,705	22%	3,329	45%
48 hours 1 in 5000 design	14,278	2,562,553	9,083	74.71	8,949	1%	8,779	3%	8,645	5%	8,339	8%	7,397	19%
72 hours 1 in 5000 design	13,181	2,880,602	8,204	74.16	8,111	1%	7,995	3%	7,902	4%	7,689	6%	7,071	14%
96 hours 1 in 5000 design	11,870	2,948,032	7,550	73.75	7,447	1%	7,325	3%	7,233	4%	7,017	7%	6,404	15%
120 hours 1 in 5000 design	12,727	3,005,136	7,265	73.57	7,098	2%	6,911	5%	6,829	6%	6,702	8%	6,360	12%
January 2011 historic	10,470	2,650,000	7,528	74.98	7,453	1%	6,756	10%	5,876	22%	5,748	24%	4,209	44%
1974 historic	5,953	1,410,000	3,275	73.31	3,153	4%	2,974	9%	2,810	14%	2,618	20%	2,067	37%
1999 historic	6,358	1,220,000	2,312	72.23	2,132	8%	2,003	13%	1,920	17%	1,687	27%	1,007	56%

Table 2 – Routing Results for Storage Levels using the current Flood Manual Rules

5 Conclusions

Reductions in outflow flood can be achieved by the adoption of different storage levels and release strategies. However, due to the large volumes of water associated with major flood events, it is necessary to consider large changes to the full supply level to achieve appreciable reductions in flood magnitude. The impact of different initial storage levels reduces as the magnitude of the event increases.

[redacted]

From:	Barry Dennien
Sent:	Tuesday, 8 February 2011 3:57 PM
To:	Peter Baddiley
Cc:	Dan Spiller
Subject:	Summer forecast
Attachments:	image001.gif
Categories:	T14: Continuation

Hi Peter

I hope things have settled a little.

You may have this data on your website however, do you have a 2/3 month rainfall forecast for SEQ Queensland.

Regards

Barry Dennien
Chief Executive Officer
SEQ W[redacted]
Phone:
Email:
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

Litsupport Brisbane

From: [redacted]
Sent: Tuesday, 8 February 2011 4:11 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment_update
Attachments: Wivenhoe assessment_permanent FSL reduction (Feb-2011) - Prelim.ppt

Hi Dan,

Here is a quick update on our progress re Wivenhoe/Somerset FSL reduction assessments:

1. Temporary FSL reduction of Wivenhoe only to 75% of capacity at end June 2011

In addition to the temporary FSL reduction scenarios (Wivenhoe only) described in email below, a preliminary run has been undertaken for temporary reduction of Wivenhoe FSL to **75%** at end June 2011.
Preliminary results are within the impact range of the 80% and 70% scenarios, with a probability of SEQ falling to T1 of the order of 4% within 10 years.

I will send through final results (10,000 replicates) 1st thing tomorrow morning (run should be completed overnight).
Results will also be sent tomorrow for
- FSL reduction to 75% of Wivenhoe and Somerset
- Wivenhoe 75%, other storages 95%

2. Permanent FSL reduction of Wivenhoe only

After review of modelling issues identified last week, we have undertaken further runs and have prepared preliminary results for scenarios with temporary FSL of 100%, 90%, 80%, 70% and 50%. We still need to do some adjustments on Wivenhoe's evaporation characteristics to finalise the results, but we anticipate there won't be major changes to the preliminary outcomes observed thus far.
Preliminary results (see attached) suggest that permanent FSL reduction of Wivenhoe would have a greater impact on the security of the grid with effects persisting in the medium to long term (beyond initial memory of the system).
Probability of SEQ falling to T1 is estimated to from 3.5-4% for 100% FSL scenario, to more than 10% (about 14%)for 70% FSL scenario and more than 30% (about 35%) for 50% FSL scenario.

Hope this makes sense and if you have any questions let us know,

Regards,
[redacted]

From: [redacted]
To: Daniel.Spiller[redacted]
Cc: [redacted]
Sent: Wed, 02 Feb 2011 11:26:03 +1100
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Good morning Dan,

N76

Runs for scenarios with temporary Wivenhoe FSL of 100%, 90%, 80%, 70% and 50% are now all finalised (10,000 replicates, see attached figures).
Results are in line with preliminary outcomes, that is:
- Increased likelihood of drawdown over the short to medium term with temporary FSL reduction to 50%
- Probability of SEQ falling to T1 within 10 years increasing from approx 3.5%-4% for 70%-100% FSL scenarios to about 5% for 50% FSL scenario

Hope this covers it for temporary reduction assessments and we will update you of our progress re permanent reduction assessments.

Cheers,
[redacted]

Note - reminder of key modelling assumptions as detailed in emails below:
- Demands as per QWC *Strategy baseline* (medium series pop growth, "rebound" from 2009 recorded consumption levels to 230 lpd res by 2018)
- Supply as per 2010 operating strategy, except for Tugun which is assumed to operate on *standby* (4%) when key grid storages are above 60% of capacity and at full capacity when key Grid storages are below 60% of capacity

---

From: [redacted]
To: Daniel.Spiller [redacted]
Cc: [redacted]
:nt: Tue, 01 Feb 2011 14:39:54 +1100
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Hi again,

As discussed on the phone, a preliminary assessment has been carried out for temporary reduction of Wivenhoe FSL to **50%** to end June 2011.
According to preliminary results (1000 replicates) such a reduction shows an impact on the security of the grid in the short term, with the main effects of more extreme temporary conditions (i.e. 50% FSL) to increase likelihood of drawdown over the short to medium term. Specific outcomes include:
- first simulated occurence of SEQ drawdown to T1 within the next 2 years and probability of drawdown to T1 increasing to about 2% within 5 years. This is compared with less than 0.2% probability of drawdown to T1 within the next 5 years for scenarios with temporary FSL of 100%, 90% and 80%.
- Probability of SEQ falling to T1increasing to about 5% within 10 years, as opposed to approx 3.5-4% for 80%-100% FSL scenarios.

Final runs for temporary Wivenhoe FSL of 70% and 50% at end June 2011 are underway and results should be available by tomorrow morning.

Cheers,
[redacted]

From: [redacted]
To: Daniel.Spiller [redacted]
Cc [redacted]
Sent: Tue, 01 Feb 2011 13:02:44 +1100
Subject: Wivenhoe assessment_temporary FSL reduction

Hi Dan,

As discussed yesterday, we have undertaken runs assessing **temporary** reduction of Wivenhoe FSL to end June 2011. Key assumptions are as described in email below, except for **Tugun whose operation is assumed as standby** (4%) when key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.

N77

Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. *see attached Figure 1*

Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers
[redacted]

From: [redacted]
To: Dan Spiller [redacted]
Cc: [redacted]
Sent: Mon, 31 Jan 2011 08:41:46 +1100
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
- Tugun is assumed to operate at one third capacity when key SEQ storages are above 60%, and full capacity below 60% [updates with mothball regime are underway]
- PRW into Wivenhoe when total system storage is below 40% of capacity
- All current WTPs assumed operating (i.e. none of the shut-downs as discussed for next set of modelling scenarios)
- Wyaralong Dam constructed without WTP (i.e. no additional supply to grid)
- No Hinze raise
- NTP transfer capacity = 65 ML/d SC to Central when Northern key storages > 70% of capacity, and 65 ML/d Central to SC when northern key storages < 40%
- SRWP transfer capacity = 25 ML/d GC to Central when Southern key storages > 40%, 55 ML/d Central to GC when Southern key storages < 40%
- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted] Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ,**
[redacted]ccess.gs | **Download vCard**

Figure 1 Estimated probability of SEQ reaching T1 and T2 (Jul-2011 to Jun-2021)
impact of ***permanent*** *reduction of Wivenhoe FSL*

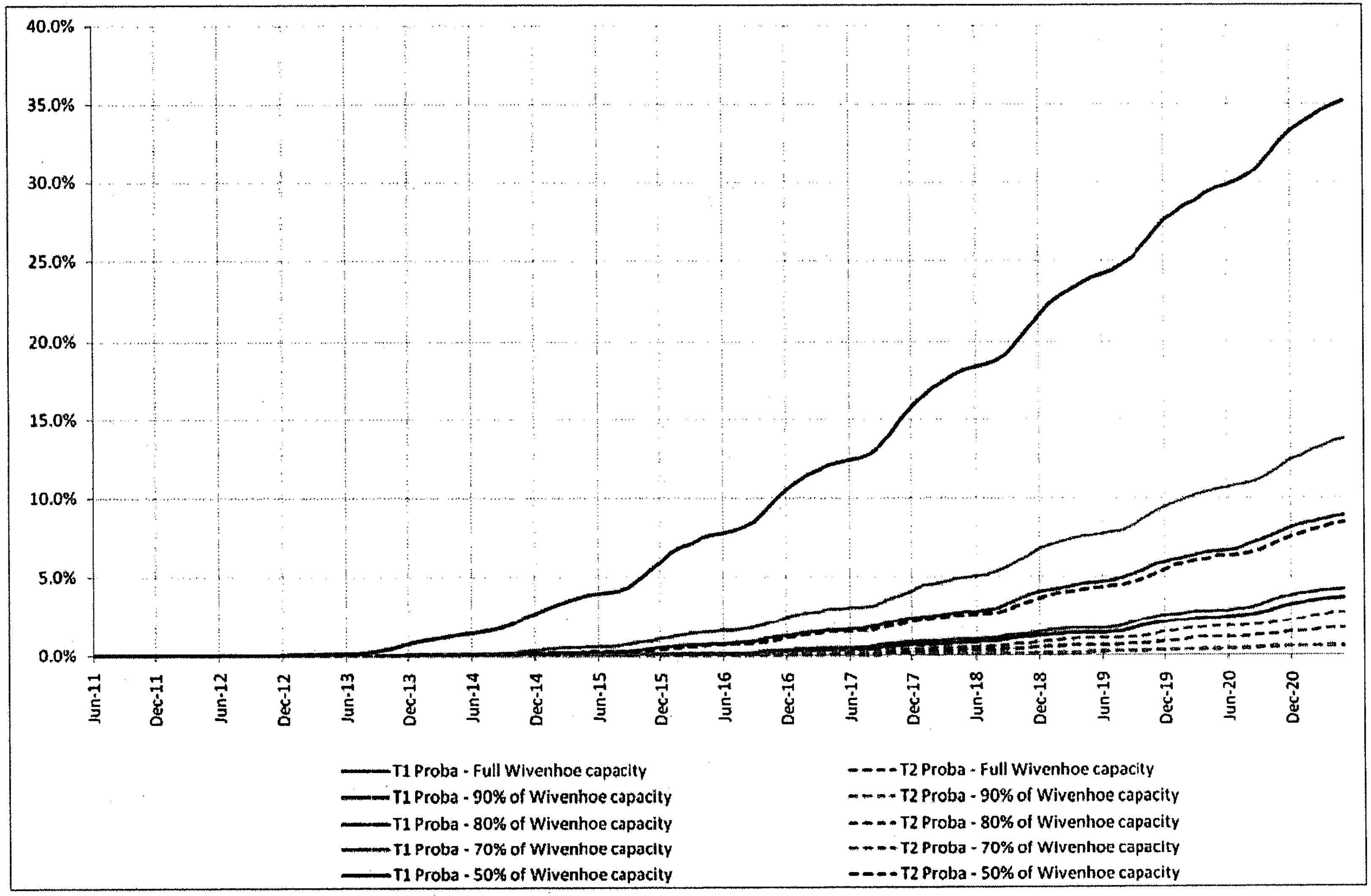
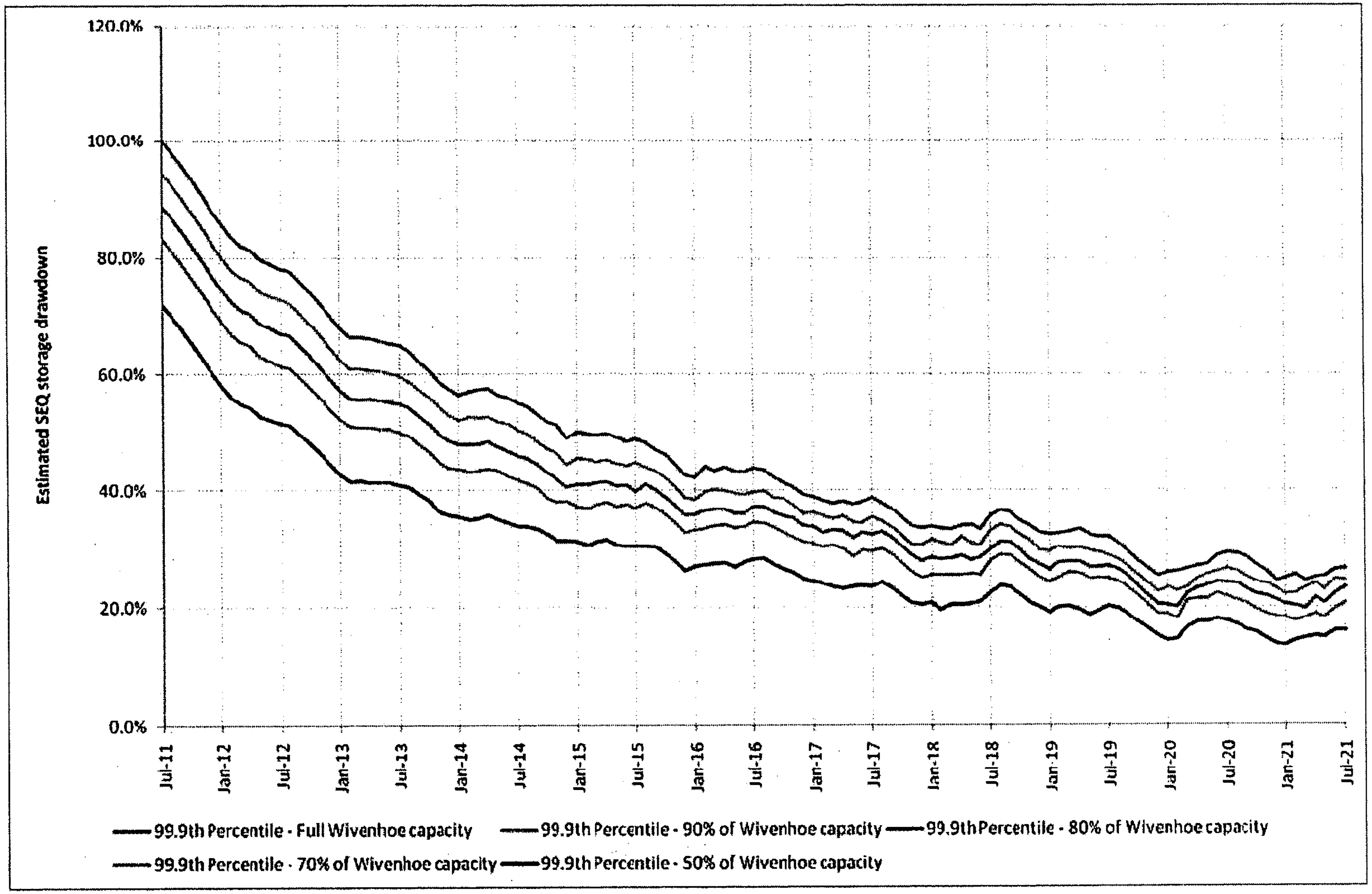


Figure 2 Estimated 10-year forecast drawdown of SEQ storages, 99.9th. Percentile *impact of* ***permanent*** *reduction of Wivenhoe FSL*



N80

[redacted]

From: Barry Dennien
Sent: Tuesday, 8 February 2011 5:22 PM
To: pborrows[redacted]
Cc: Dan Spiller
Subject: Short Term Security advice

Categories: T14: Continuation

Peter
As discussed we will get you formal advice on short term security implications of Wivenhoe at 75% fsl by late morning tomorrow

We will also will give our view on how the risks associated with releasing this quantity of water supply may be reduced by staging releases

Regards
Barry Dennien

N81

[redacted]

From: Peter Baddiley [redacted]
Sent: Tuesday, 8 February 2011 6:04 PM
To: Barry Dennien
Cc: Dan Spiller
Subject: RE: Summer forecast [SEC=UNCLASSIFIED]
Attachments: image001.gif

Categories: T14: Continuation

Barry
Forecasts for 2 to 3 months are given as "seasonal outlooks" by the Bureau, looking 3 months ahead (and updated each month).

Refer to http://www.bom.gov.au/climate/ahead/rain_ahead.shtml

More detailed rainfall outlooks with probabilities are given at:
http://www.bom.gov.au/watl/rainfall/exceedance.shtml

regards, peter

Peter Baddiley
Regional Hydrology Manager
Climate & Water Division
Bureau of Meteorology
Level 21, 69 Ann Street
GPO Box 413, BRISBANE, QLD, AUSTRALIA 4001
Phone: [redacted]
EMAIL:
EMAIL for flood matters: flood.qld@bom.gov.au
WWW : www.bom.gov.au

·om: Barry Dennie[redacted]
Sent: Tuesday, 8 February 2011 3:57 PM
To: Peter Baddiley
Cc: Dan Spiller
Subject: Summer forecast

Hi Peter

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You may have this data on your website however, do you have a 2/3 month rainfall forecast for SEQ Queensland.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Email:
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

Litsupport Brisbane

From: Peter Borrows [redacted]
Sent: Tuesday, 8 February 2011 8:04 PM
To: Barry Dennien
Cc: Dan Spiller
Subject: RE: Short Term Security advice

Look forward to the letter - thanks.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority trading as Seqwater

Ph [redacted] Level 3, 240 Margaret St, Brisbane City QLD 4000 PO Box 16146, City East QLD 4002 Website | www.seqwater.com.au

-----Original Message-----
From: Barry Dennien [redacted]
Sent: Tuesday, 8 February 2011 5:22 PM
To: Peter Borrows
Cc: Dan Spiller
Subject: Short Term Security advice

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We will also will give our view on how the risks associated with releasing this quantity of water supply may be reduced by staging releases

Regards
Barry Dennien

Your Anti-virus Service scanned this email. It is safe from known viruses.
For more information regarding this service, please contact your service provider.

Litsupport Brisbane

From: [redacted]
Sent: Wednesday, 9 February 2011 7:30 AM
To: Dan Spiller
Subject: Re: Wivenhoe assessment_update

Dan,

My understanding is that Marine is modelling a 10-year forward planning window, however we can report results for any period up to 10 years. Marine will no doubt clarify when she gets in.

Cheers,

[redacted]

[redacted] Director/Principal Water Resource Engineer **B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust** **www.access.gs | Download vCard**

On 09/02/2011, at 7:26 AM, Dan Spiller wrote:

[redacted]

To be clear, are the permanent reductions modeled over 5 or 10 years?

Dan

On 08/02/2011, at 4:10 PM, [redacted] wrote:

Hi Dan,

Here is a quick update on our progress re Wivenhoe/Somerset FSL reduction assessments:

1. Temporary FSL reduction of Wivenhoe only to 75% of capacity at end June 2011

In addition to the temporary FSL reduction scenarios (Wivenhoe only) described in email below, a preliminary run has been undertaken for temporary reduction of Wivenhoe FSL to 75% at end June 2011.

Preliminary results are within the impact range of the 80% and 70% scenarios, with a probability of SEQ falling to T1 of the order of 4% within 10 years.

I will send through final results (10,000 replicates) 1st thing tomorrow morning (run should be completed overnight).

Results will also be sent tomorrow for

- FSL reduction to 75% of Wivenhoe and Somerset
- Wivenhoe 75%, other storages 95%

2. Permanent FSL reduction of Wivenhoe only

After review of modelling issues identified last week, we have undertaken further runs and have prepared preliminary results for scenarios with temporary FSL of 100%, 90%, 80%, 70% and 50%. We still need to do some adjustments on Wivenhoe's evaporation characteristics to finalise the results, but we anticipate there won't be major changes to the preliminary outcomes observed thus far.

Preliminary results (see attached) suggest that permanent FSL reduction of Wivenhoe would have a greater impact on the security of the grid with effects persisting in the medium to long term (beyond initial memory of the system). Probability of SEQ falling to T1 is estimated to from 3.5-4% for 100% FSL scenario, to more than 10% (about 14%)for 70% FSL scenario and more than 30% (about 35%) for 50% FSL scenario.

Hope this makes sense and if you have any questions let us know,

Regards,

[redacted]

From: [redacted]

To: Daniel.Spiller[redacted]

Cc: [redacted]

Sent: Wed, 02 Feb 2011 11:26:03 +1100

Subject: Re: Wivenhoe assessment_temporary FSL reduction

Good morning Dan,

Runs for scenarios with temporary Wivenhoe FSL of 100%, 90%, 80%, 70% and 50% are now all finalised (10,000 replicates, see attached figures).

Results are in line with preliminary outcomes, that is:

- Increased likelihood of drawdown over the short to medium term with temporary FSL reduction to 50%

- Probability of SEQ falling to T1 within 10 years increasing from approx 3.5%-4% for 70%-100% FSL scenarios to about 5% for 50% FSL scenario

Hope this covers it for temporary reduction assessments and we will update you of our progress re permanent reduction assessments.

Cheers,

[redacted]

Note - reminder of key modelling assumptions as detailed in emails below:

- Demands as per QWC Strategy baseline (medium series pop growth, "rebound" from 2009 recorded consumption levels to 230 lpd res by 2018)

- Supply as per 2010 operating strategy, except for Tugun which is assumed to operate on standby (4%) when key grid storages are above 60% of capacity and at full capacity when key Grid storages are below 60% of capacity

---

From: [redacted]

To: Daniel.Spiller[redacted]

Cc: [redacted]

Sent: Tue, 01 Feb 2011 14:39:54 +1100

Subject: Re: Wivenhoe assessment_temporary FSL reduction

Hi again,

As discussed on the phone, a preliminary assessment has been carried out for temporary reduction of Wivenhoe FSL to 50% to end June 2011.

According to preliminary results (1000 replicates) such a reduction shows an impact on the security of the grid in the short term, with the main effects of more extreme temporary conditions (i.e. 50% FSL) to increase likelihood of drawdown over the short to medium term. Specific outcomes include:

- first simulated occurence of SEQ drawdown to T1 within the next 2 years and probability of drawdown to T1 increasing to about 2% within 5 years. This is compared with less than 0.2%

probability of drawdown to T1 within the next 5 years for scenarios with temporary FSL of 100%, 90% and 80%.

- Probability of SEQ falling to T1increasing to about 5% within 10 years, as opposed to approx 3.5-4% for 80%-100% FSL scenarios.

Final runs for temporary Wivenhoe FSL of 70% and 50% at end June 2011 are underway and results should be available by tomorrow morning.

Cheers,

[redacted]

From: [redacted]

To: Daniel.Spiller[redacted]

Cc: [redacted]

Sent: Tue, 01 Feb 2011 13:02:44 +1100

Subject: Wivenhoe assessment_temporary FSL reduction

Hi Dan,

As discussed yesterday, we have undertaken runs assessing temporary reduction of Wivenhoe FSL to end June 2011.

Key assumptions are as described in email below, except for Tugun whose operation is assumed as standby (4%) when key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.

Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. see attached Figure 1

Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers,

[redacted]

From[redacted]
To: Dan Spiller
[mailto[redacted]
Cc: [redacted]
Sent: Mon, 31 Jan 2011 08:41:46 +1100
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

* Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
* All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
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* PRW into Wivenhoe when total system storage is below 40% of capacity
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* Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted]Director/Principal Water Resource EngineerB.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAustwww.access.gs<http://www.access.gs/> | Download vCard<http://vcards.groupgs.com/files/Owen%20Droop.vcf>

<Wivenhoe assessment_permanent FSL reduction (Feb-2011) - Prelim.ppt>

[redacted]

From: [redacted]
Sent: Wednesday, 9 February 2011 9:02 AM
To: Dan Spiller
Cc: [redacted]
Subject: Re: Wivenhoe assessment_update

Categories: T14: Continuation

Dan,

Sorry about the confusion, the permanent reductions are modeled over 10 years.

[redacted]

From: Dan Spiller [redacted]
To: [redacted]
Cc: [redacted]
ent: Wed, 09 Feb 2011 08:26:40 +1100
Subject: Re: Wivenhoe assessment_update

[redacted]

To be clear, are the permanent reductions modeled over 5 or 10 years?

Dan

On 08/02/2011, at 4:10 PM, "[redacted] wrote:

> Hi Dan,
>
> Here is a quick update on our progress re Wivenhoe/Somerset FSL reduction assessments:
>
> 1. Temporary FSL reduction of Wivenhoe only to 75% of capacity at end June 2011
>
· In addition to the temporary FSL reduction scenarios (Wivenhoe only) described in email below, a preliminary run has been undertaken for temporary reduction of Wivenhoe FSL to 75% at end June 2011.
> Preliminary results are within the impact range of the 80% and 70% scenarios, with a probability of SEQ falling to T1 of the order of 4% within 10 years.
>
> I will send through final results (10,000 replicates) 1st thing tomorrow morning (run should be completed overnight).
> Results will also be sent tomorrow for
> - FSL reduction to 75% of Wivenhoe and Somerset
> - Wivenhoe 75%, other storages 95%
>
> 2. Permanent FSL reduction of Wivenhoe only
>
> After review of modelling issues identified last week, we have undertaken further runs and have prepared preliminary results for scenarios with temporary FSL of 100%, 90%, 80%, 70% and 50%. We still need to do some adjustments on Wivenhoe's evaporation characteristics to finalise the results, but we anticipate there won't be major changes to the preliminary outcomes observed thus far.
> Preliminary results (see attached) suggest that permanent FSL reduction of Wivenhoe would have a greater impact on

N92

the security of the grid with effects persisting in the medium to long term (beyond initial memory of the system). Probability of SEQ falling to T1 is estimated to from 3.5-4% for 100% FSL scenario, to more than 10% (about 14%)for 70% FSL scenario and more than 30% (about 35%) for 50% FSL scenario.
>
> Hope this makes sense and if you have any questions let us know,
>
> Regards,
> [redacted]
>
>
>
>
>
>
> ______
> From [redacted]
> To: Daniel.Spiller [redacted]
> Cc [redacted]
> Sent: Wed, 02 Feb 2011 11:26:03 +1100
> Subject: Re: Wivenhoe assessment_temporary FSL reduction
>
> Good morning Dan,

> Runs for scenarios with temporary Wivenhoe FSL of 100%, 90%, 80%, 70% and 50% are now all finalised (10,000 replicates, see attached figures).
> Results are in line with preliminary outcomes, that is:
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> - Probability of SEQ falling to T1 within 10 years increasing from approx 3.5%-4% for 70%-100% FSL scenarios to about 5% for 50% FSL scenario
>
> Hope this covers it for temporary reduction assessments and we will update you of our progress re permanent reduction assessments.
>
> Cheers,
> [redacted]
>
> Note - reminder of key modelling assumptions as detailed in emails below:
> - Demands as per QWC Strategy baseline (medium series pop growth, "rebound" from 2009 recorded consumption levels to 230 lpd res by 2018)
> - Supply as per 2010 operating strategy, except for Tugun which is assumed to operate on standby (4%) when key grid storages are above 60% of capacity and at full capacity when key Grid storages are below 60% of capacity
> ______
> From: [redacted]
> To: Daniel.Spiller [redacted]
> C [redacted]
> Sent: Tue, 01 Feb 2011 14:39:54 +1100
> Subject: Re: Wivenhoe assessment_temporary FSL reduction
> Hi again,
>
> As discussed on the phone, a preliminary assessment has been carried out for temporary reduction of Wivenhoe FSL to 50% to end June 2011.
> According to preliminary results (1000 replicates) such a reduction shows an impact on the security of the grid in the short term, with the main effects of more extreme temporary conditions (i.e. 50% FSL) to increase likelihood of drawdown over the short to medium term. Specific outcomes include:
> - first simulated occurence of SEQ drawdown to T1 within the next 2 years and probability of drawdown to T1 increasing to about 2% within 5 years. This is compared with less than 0.2% probability of drawdown to T1 within the next 5 years for scenarios with temporary FSL of 100%, 90% and 80%.
> - Probability of SEQ falling to T1increasing to about 5% within 10 years, as opposed to approx 3.5-4% for 80%-100%

FSL scenarios.
>
> Final runs for temporary Wivenhoe FSL of 70% and 50% at end June 2011 are underway and results should be available by tomorrow morning.
>
> Cheers,
>[redacted]
>
>
> ______
> From:[redacted]
> To: Daniel.Spiller[redacted]
> Cc: [redacted]
> Sent: Tue, 01 Feb 2011 13:02:44 +1100
> Subject: Wivenhoe assessment_temporary FSL reduction
>
> Hi Dan,
>
> As discussed yesterday, we have undertaken runs assessing temporary reduction of Wivenhoe FSL to end June 2011.
> Key assumptions are as described in email below, except for Tugun whose operation is assumed as standby (4%) when key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.
>
Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. see attached Figure 1
>
> Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.
>
> Hope this helps and any questions let us know.
>
> Cheers,
>[redacted]
>
>
> ______
> From[redacted]
> To: Dan Spiller[redacted]
> Cc: [redacted]
> Sent: Mon, 31 Jan 2011 08:41:46 +1100
> Subject: Modelling assumptions

> Dan,
>
> Assumptions adopted in modelling you have received results for to date:
>
>
> * Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
> * All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
> * Tugun is assumed to operate at one third capacity when key SEQ storages are above 60%, and full capacity below 60% [updates with mothball regime are underway]
> * PRW into Wivenhoe when total system storage is below 40% of capacity
> * All current WTPs assumed operating (i.e. none of the shut-downs as discussed for next set of modelling scenarios)
> * Wyaralong Dam constructed without WTP (i.e. no additional supply to grid)
> * No Hinze raise
> * NTP transfer capacity = 65 ML/d SC to Central when Northern key storages > 70% of capacity, and 65 ML/d Central to SC when northern key storages < 40%

> * SRWP transfer capacity = 25 ML/d GC to Central when Southern key storages > 40%, 55 ML/d Central to GC when Southern key storages < 40%
> * Wivenhoe to Toowoomba: 10,000 ML/a constant supply
>
> Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.
>
> Regards,
>
> [redacted]roopDirector/Principal Water Resource EngineerB.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAustwww.access.gs<http://www.access.gs/> | Download vCard<http://vcards.groupgs.com/file[redacted]
>
>
>
>
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>
>
> <Wivenhoe assessment_permanent FSL reduction (Feb-2011) - Prelim.ppt>

From: [redacted]
Sent: Wednesday, February 9, 2011 9:20 AM
To: Dan Spiller [redacted]
Subject: RE: Wivenhoe assessment_update

Good morning Dan,

Please see table below completed. As expected, results show that the likelihood of SEQ falling to trigger levels is driven by the system as a whole: Scenarios with SEQ storages temporarily reduced to 83% provide similar outcomes in terms of trigger probabilities whether the reduction is applied to Wivenhoe only (wivenhoe 70%, other storages 100%) or distributed across storages (wivenhoe 75%, other storages 94%).

Hope this makes sense and any questions let us know,
[redacted]

From: [redacted]
To: [redacted]
Sent: Tue, 08 Feb 2011 17:14:37 +1100
Subject: RE: Wivenhoe assessment_update

Wivenhoe Dam storage level	Other Grid 12 storage levels	Total Grid 12 storage levels	Probability of Grid 12 storages reaching 60% by end June 2016, triggering operation of desalination at capacity	Probability of Grid 12 storages reaching 40% by end June 2016, triggering Medium Level Restrictions and use of purified recycled water
100%	100%	100%	4.8%	0.1%
75%	100%	86%	8.8%	0.4%
75%	94%	83%	10.5%	0.4%
70%	100%	83%	10.5%	0.4%

From: [redacted]
Sent: Tuesday, 8 February 2011 4:11 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment_update

Hi Dan,

Here is a quick update on our progress re Wivenhoe/Somerset FSL reduction assessments:

<u>1. Temporary FSL reduction of Wivenhoe only to 75% of capacity at end June 2011</u>

In addition to the temporary FSL reduction scenarios (Wivenhoe only) described in email below, a preliminary run has been undertaken for temporary reduction of Wivenhoe FSL to **<u>75%</u>** at end June 2011. Preliminary results are within the impact range of the 80% and 70% scenarios, with a probability of SEQ falling to T1 of the order of 4% within 10 years.

I will send through final results (10,000 replicates) 1st thing tomorrow morning (run should be completed overnight).
Results will also be sent tomorrow for
- FSL reduction to 75% of Wivenhoe and Somerset
- Wivenhoe 75%, other storages 95%

2. Permanent FSL reduction of Wivenhoe only

After review of modelling issues identified last week, we have undertaken further runs and have prepared preliminary results for scenarios with temporary FSL of 100%, 90%, 80%, 70% and 50%. We still need to do some adjustments on Wivenhoe's evaporation characteristics to finalise the results, but we anticipate there won't be major changes to the preliminary outcomes observed thus far.
Preliminary results (see attached) suggest that permanent FSL reduction of Wivenhoe would have a greater impact on the security of the grid with effects persisting in the medium to long term (beyond initial memory of the system). Probability of SEQ falling to T1 is estimated to from 3.5-4% for 100% FSL scenario, to more than 10% (about 14%)for 70% FSL scenario and more than 30% (about 35%) for 50% FSL scenario.

Hope this makes sense and if you have any questions let us know,

Regards,
[redacted]

From: [redacted]
To: Daniel.Spiller[redacted]
Cc: [redacted]
Sent: Wed, 02 Feb 2011 11:26:03 +1100
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Good morning Dan,

Runs for scenarios with temporary Wivenhoe FSL of 100%, 90%, 80%, 70% and 50% are now all finalised (10,000 replicates, see attached figures).
Results are in line with preliminary outcomes, that is:
- Increased likelihood of drawdown over the short to medium term with temporary FSL reduction to 50%
- Probability of SEQ falling to T1 within 10 years increasing from approx 3.5%-4% for 70%-100% FSL scenarios to about 5% for 50% FSL scenario

Hope this covers it for temporary reduction assessments and we will update you of our progress re permanent reduction assessments.

Cheers,
[redacted]

Note - reminder of key modelling assumptions as detailed in emails below:
- Demands as per QWC *Strategy baseline* (medium series pop growth, "rebound" from 2009 recorded consumption levels to 230 lpd res by 2018)
- Supply as per 2010 operating strategy, except for Tugun which is assumed to operate on *standby* (4%) when key grid storages are above 60% of capacity and at full capacity when key Grid storages are below 60% of capacity

---

From: [redacted]
To: Da[redacted]
Cc:[redacted]
Sent: Tue, 01 Feb 2011 14:39:54 +1100
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Hi again,

As discussed on the phone, a preliminary assessment has been carried out for temporary reduction of Wivenhoe FSL to **50%** to end June 2011.
According to preliminary results (1000 replicates) such a reduction shows an impact on the security of the grid in the short term, with the main effects of more extreme temporary conditions (i.e. 50% FSL) to increase likelihood of drawdown over the short to medium term. Specific outcomes include:
- first simulated occurence of SEQ drawdown to T1 within the next 2 years and probability of drawdown to T1 increasing to about 2% within 5 years. This is compared with less than 0.2% probability of drawdown to T1 within the next 5 years for scenarios with temporary FSL of 100%, 90% and 80%.
- Probability of SEQ falling to T1increasing to about 5% within 10 years, as opposed to approx 3.5-4% for 80%-100% FSL scenarios.

Final runs for temporary Wivenhoe FSL of 70% and 50% at end June 2011 are underway and results should be available by tomorrow morning.

Cheers,
[redacted]

From: [redacted]
To: Daniel.Spiller[redacted]
Cc:[redacted]
Sent: [redacted]3:02:44 +1100
Subject: Wivenhoe assessment_temporary FSL reduction

Hi Dan,

As discussed yesterday, we have undertaken runs assessing **temporary** reduction of Wivenhoe FSL to end June 2011.
Key assumptions are as described in email below, except for **Tugun whose operation is assumed as standby** (4%) when key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.

Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. *see attached Figure 1*

Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers,
[redacted]

From:[redacted]
To: Dan Spiller [redacted]
Cc:[redacted]

Sent: Mon, 31 Jan 2011 08:41:46 +1100
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
- Tugun is assumed to operate at one third capacity when key SEQ storages are above 60%, and full capacity below 60% [updates with mothball regime are underway]
- PRW into Wivenhoe when total system storage is below 40% of capacity
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- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted], Director/Principal Water Resource Engineer B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust www.access.gs | Download vCard

From: [redacted]
Sent: Wednesday, February 9, 2011 7:30 AM
To: Dan Spiller [redacted]
Subject: Re: Wivenhoe assessment_update

Dan,

My understanding is that [redacted] is modelling a 10-year forward planning window, however we can report results for any period up to 10 years. Marine will no doubt clarify when she gets in.

Cheers,

[redacted]

[redacted]
Director/Principal Water Resource Engineer
B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust
www.access.gs | Download vCard

BRISBANE
20 /115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933

KAWANA
1/6 Innovation Parkway
PO Box 318
Wurtulla Q4575
Phone 07 5493 9911
Fax 07 5493 9877

ROBINA
5/232 Robina Town Centre Dr.
PO Box 4115
Robina Q4230
Phone 07 5578 9944
Fax 07 5578 9945

CAIRNS
43-47/20-32 Lake Street
PO Box 5985
Cairns Q4870
Phone 07 4031 8117
Fax 07 4041 6784

GILBERT SUTHERLAND

On 09/02/2011, at 7:26 AM, Dan Spiller wrote:

> [redacted]
>
> To be clear, are the permanent reductions modeled over 5 or 10 years?
>
> Dan
>
> On 08/02/2011, at 4:10 PM, "[redacted] wrote:
>
> > Hi Dan,
> >
> > Here is a quick update on our progress re Wivenhoe/Somerset FSL reduction assessments:
> >
> > 1. Temporary FSL reduction of Wivenhoe only to 75% of capacity at end June 2011
> >
> > In addition to the temporary FSL reduction scenarios (Wivenhoe only) described in email below, a preliminary run has been undertaken for temporary reduction of Wivenhoe FSL to 75% at end June 2011.
> >
> > Preliminary results are within the impact range of the 80% and 70% scenarios, with a

probability of SEQ falling to T1 of the order of 4% within 10 years.

I will send through final results (10,000 replicates) 1st thing tomorrow morning (run should be completed overnight).

Results will also be sent tomorrow for

- FSL reduction to 75% of Wivenhoe and Somerset

- Wivenhoe 75%, other storages 95%

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Hope this makes sense and if you have any questions let us know,

Regards,

[redacted]

From: [redacted]
[mailt[redacted]

To: Daniel.Spiller[redacted]

Cc[redacted]

Sent: Wed, 02 Feb 2011 11:26:03 +1100

Subject: Re: Wivenhoe assessment_temporary FSL reduction

Good morning Dan,

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are now all finalised (10,000 replicates, see attached figures).

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Cheers,

[redacted]

Note - reminder of key modelling assumptions as detailed in emails below:

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---

From: [redacted]
[mailt[redacted]

To: Daniel.Spiller[redacted]

Cc: [redacted]

Sent: Tue, 01 Feb 2011 14:39:54 +1100

Subject: Re: Wivenhoe assessment_temporary FSL reduction

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Cheers,

[redacted]

From: [redacted]
[mailt[redacted]

To: Daniel.Spiller[redacted]

Cc: [redacted]>

Sent: Tue, 01 Feb 2011 13:02:44 +1100

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Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers,

[redacted]

From: [redacted]

To: Dan Spiller

[mailt[redacted]

Cc: [redacted]

Sent: Mon, 31 Jan 2011 08:41:46 +1100

Subject: Modelling assumptions

Dan,

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* Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018

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* PRW into Wivenhoe when total system storage is below 40% of capacity

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* Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted]Director/Principal Water Resource EngineerB.E.(Civil) (Hons)/B.Nat.Res. RPEQ, MIEAustwww.access.gs<http://www.access.gs/> | Download vCard<http://vcards.groupgs.com/files/Owen%20Droop.vcf>

<Wivenhoe assessment_permanent FSL reduction (Feb-2011) - Prelim.ppt>

From: Barry Dennien
Sent: Wednesday, 9 February 2011 12:47 PM
To: john.bradley[redacted]
Cc: Dan Spiller; debbie.best[redacted]
Subject: FW: Summer forecast [[redacted]
Attachments: image001.gif

Categories: T14: Continuation

Guys

The second web site is very useful. Parts of SEQ have a 75% probability of exceeding 400 to 600 mm of rain Feb to April 2011.

Barry

From: Peter Baddiley [redacted]
Sent: Tuesday, 8 February 2011 6:04 PM
To: Barry Dennien
Cc: Dan Spiller
Subject: RE: Summer forecast [SEC=UNCLASSIFIED]

Barry
Forecasts for 2 to 3 months are given as "seasonal outlooks" by the Bureau, looking 3 months ahead (and updated each month).

Refer to http://www.bom.gov.au/climate/ahead/rain_ahead.shtml

More detailed rainfall outlooks with probabilities are given at:
http://www.bom.gov.au/watl/rainfall/exceedance.shtml

regards, peter

Peter Baddiley
Regional Hydrology Manager
Climate & Water Division
Bureau of Meteorology
Level 21, 69 Ann Street
GPO Box 413, BRISBANE, QLD, AUSTRALIA 4001
Phone: [redacted]
EMAIL for flood matters: flood.qld@bom.gov.au
WWW : www.bom.gov.au

From: Barry Dennien [redacted]
Sent: Tuesday, 8 February 2011 3:57 PM

To: Peter Baddiley
Cc: Dan Spiller
Subject: Summer forecast

Hi Peter

I hope things have settled a little.

You may have this data on your website however, do you have a 2/3 month rainfall forecast for SEQ Queensland.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

[redacted]

From: Barry Dennien
Sent: Wednesday, 9 February 2011 1:01 PM
To: Peter Borrows
Cc: Dan Spiller
Subject: FW: Summer forecast [SEC=UNCLASSIFIED]
Attachments: image001.gif

Categories: T14: Continuation

Peter

FYI – You may have this already.

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arry

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Cc: Dan Spiller
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http://www.bom.gov.au/watl/rainfall/exceedance.shtml

regards, peter

Peter Baddiley
Regional Hydrology Manager
Climate & Water Division
Bureau of Meteorology
Level 21, 69 Ann Street
GPO Box 413, BRISBANE, QLD, AUSTRALIA 4001
Phone: [redacted]
EMAIL:
EMAIL for flood matters: flood.qld@bom.gov.au
WWW : www.bom.gov.au

[redacted]

From: Peter Borrows [redacted]
Sent: Wednesday, 9 February 2011 1:06 PM
To: Barry Dennien
Cc: Dan Spiller
Subject: RE: Summer forecast [SEC=UNCLASSIFIED]
Attachments: image001.gif; image002.png; image003.jpg

Categories: T14: Continuation

Yes thanks Barry – printed a copy earlier today.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

Ph[redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: Barry Dennien [redacted]
Sent: Wednesday, 9 February 2011 1:01 PM
To: Peter Borrows
Cc: Dan Spiller
Subject: FW: Summer forecast [SEC=UNCLASSIFIED]

Peter

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From: Peter Baddiley [redacted]
Sent: Tuesday, 8 February 2011 6:04 PM
To: Barry Dennien

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Subject: RE: Summer forecast [SEC=UNCLASSIFIED]

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More detailed rainfall outlooks with probabilities are given at:
http://www.bom.gov.au/watl/rainfall/exceedance.shtml

regards, peter

Peter Baddiley
Regional Hydrology Manager
Climate & Water Division
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vel 21, 69 Ann Street
GPO Box 413, BRISBANE, QLD, AUSTRALIA 4001
Phone [redacted]
EMAIL for flood matters: flood.qld@bom.gov.au
WWW : www.bom.gov.au

Litsupport Brisbane

From: [redacted]
Sent: Wednesday, 9 February 2011 2:24 PM
To: Dan Spiller
Subject: Seqwater letter
Attachments: Water security impacts of lowering FSL at Wivenhoe Dam (2).pdf

Kind regards,

[redacted]
Board Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Visit: Level 15, 53 Albert Street Brisbane
Post: PO Box 16205, City East QLD 4002
ABN: 14783 317 630

SEQ Water Grid manager

TRIM ref: D/11/502

Secure and efficient water through partnership and innovation

9 February 2010

Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear Mr Borrows

I refer to Seqwater's Chair's letter to Minister Robertson dated 4 February 2011, regarding Seqwater's consideration of the appropriate Full Supply Levels (FSL) for Wivenhoe and Somerset dams. We acknowledge having recently received a copy of this letter from you.

I write regarding the water security impacts of lowering the FSL of Wivenhoe Dam, in light of the SEQ Water Grid Manager's obligation to manage water supplied from its water entitlements in accordance with Sections 6 and 7 (Desired Levels of Service Objectives and Risk Criteria) in the *South East Queensland System Operating Plan*. We understand that this is being considered as an interim measure for the current wet season.

I confirm previous verbal advice that, from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75 per cent of its FSL. The water security implications of a temporary draw down are unlikely to impact our ability to comply with the *South East Queensland System Operating Plan* or our Grid Contract obligations.

If a permanent reduction of Wivenhoe Dam's FSL is later considered, this may have an impact on the *South East Queensland System Operating Plan's* desired levels of service objectives and we would suggest that you also engage with the Queensland Water Commission on this matter.

I trust that this advice is su[redacted]u have any qu[redacted]
contact me by telephone on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Dennien
Chief Executive Officer

CC: Karen Waldman, Chief Executive Officer, Queensland Water Commission.

PO Box 16205, City East QLD 4002 Tel: +61 7 3247 3012 Fax: +61 7 3405 0373 www.seqwgm.qld.gov.au
ABN: 14 783 317 630

N113

Litsupport Brisbane

From: [redacted]
Sent: Wednesday, 9 February 2011 3:04 PM
To: Dan Spiller
Cc: [redacted]
Subject: Fw: Wivenhoe assessment_update

Hi Dan,

As discussed yesterday, results have been added in table below for scenario with temporary reduction of SEQ FSL to about 80% at end Jun 2011 (Wivenhoe and Somerset to 75%, other storages full). As expected results show just a slight increase in trigger probabilities in comparison to the 83% SEQ FSL scenario.

Wivenhoe Dam storage level	Other Grid 12 storage levels	Total Grid 12 storage levels	Probability of Grid 12 storages reaching 60% by end June 2016, triggering operation of desalination at capacity	Probability of Grid 12 storages reaching 40% by end June 2016, triggering Medium Level Restrictions and use of purified recycled water
100%	100%	100%	4.8%	0.1%
75%	100%	86%	8.8%	0.4%
75%	94%	83%	10.5%	0.4%
70%	100%	83%	10.5%	0.4%
75%	Somerset 75% Other 100%	81%	11.7%	0.5%

Cheers,
[redacted]

From: [redacted]
To: Dan Spiller [redacted]
Sent: Wed, 09 Feb 2011 10:20:01 +1100
Subject: RE: Wivenhoe assessment_update

ood morning Dan,

Please see table below completed. As expected, results show that the likelihood of SEQ falling to trigger levels is driven by the system as a whole: Scenarios with SEQ storages temporarily reduced to 83% provide similar outcomes in terms of trigger probabilities whether the reduction is applied to Wivenhoe only (wivenhoe 70%, other storages 100%) or distributed across storages (wivenhoe 75%, other storages 94%).

Hope this makes sense and any questions let us know,
[redacted]

From: Dan Spiller [redacted]
To: [redacted]
Sent: Tue, 08 Feb 2011 17:14:37 +1100
Subject: RE: Wivenhoe assessment_update

Wivenhoe Dam storage level	Other Grid 12 storage levels	Total Grid 12 storage levels	Probability of Grid 12 storages reaching 60% by end June 2016, triggering operation of desalination at capacity	Probability of Grid 12 storages reaching 40% by end June 2016, triggering Medium Level Restrictions and use of purified recycled water
100%	100%	100%	4.8%	0.1%
75%	100%	86%	8.8%	0.4%
75%	94%	83%	10.5%	0.4%
70%	100%	83%	10.5%	0.4%

From: [redacted]
Sent: Tuesday, 8 February 2011 4:11 PM
To: Dan Spiller
Cc: [redacted]
Subject: Wivenhoe assessment_update

Hi Dan,

Here is a quick update on our progress re Wivenhoe/Somerset FSL reduction assessments:

.. Temporary FSL reduction of Wivenhoe only to 75% of capacity at end June 2011

In addition to the temporary FSL reduction scenarios (Wivenhoe only) described in email below, a preliminary run has been undertaken for temporary reduction of Wivenhoe FSL to **75%** at end June 2011.

Preliminary results are within the impact range of the 80% and 70% scenarios, with a probability of SEQ falling to T1 of the order of 4% within 10 years.

I will send through final results (10,000 replicates) 1st thing tomorrow morning (run should be completed overnight).

Results will also be sent tomorrow for

- FSL reduction to 75% of Wivenhoe and Somerset

- Wivenhoe 75%, other storages 95%

2. Permanent FSL reduction of Wivenhoe only

After review of modelling issues identified last week, we have undertaken further runs and have prepared preliminary results for scenarios with temporary FSL of 100%, 90%, 80%, 70% and 50%. We still need to do some adjustments on Wivenhoe's evaporation characteristics to finalise the results, but we anticipate there won't be major changes to the preliminary outcomes observed thus far.

Preliminary results (see attached) suggest that permanent FSL reduction of Wivenhoe would have a greater impact on the security of the grid with effects persisting in the medium to long term (beyond initial memory of the system). Probability of SEQ falling to T1 is estimated to from 3.5-4% for 100% FSL scenario, to more than 10% (about 14%)for 70% FSL scenario and more than 30% (about 35%) for 50% FSL scenario.

Hope this makes sense and if you have any questions let us know,

Regards,

[redacted]

From: [redacted]
To: Daniel.Spiller [redacted]
Cc: [redacted]
Sent: Wed, 02 Feb 2011 11:26:03 +1100
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Good morning Dan,

Runs for scenarios with temporary Wivenhoe FSL of 100%, 90%, 80%, 70% and 50% are now all finalised (10,000 replicates, see attached figures).

Results are in line with preliminary outcomes, that is:

- Increased likelihood of drawdown over the short to medium term with temporary FSL reduction to 50%

- Probability of SEQ falling to T1 within 10 years increasing from approx 3.5%-4% for 70%-100% FSL scenarios to about 5% for 50% FSL scenario

Hope this covers it for temporary reduction assessments and we will update you of our progress re permanent reduction assessments.

Cheers,

[redacted]

Note - reminder of key modelling assumptions as detailed in emails below:

- Demands as per QWC *Strategy baseline* (medium series pop growth, "rebound" from 2009 recorded consumption levels to 230 lpd res by 2018)

- Supply as per 2010 operating strategy, except for Tugun which is assumed to operate on *standby* (4%) when key grid storages are above 60% of capacity and at full capacity when key Grid storages are below 60% of capacity

---

From: [redacted]
To: Daniel.Spiller [redacted]
Cc: [redacted]
Sent: Tue, 01 Feb 2011 14:39:54 +1100
Subject: Re: Wivenhoe assessment_temporary FSL reduction

Hi again,

As discussed on the phone, a preliminary assessment has been carried out for temporary reduction of Wivenhoe FSL to **50%** to end June 2011.

According to preliminary results (1000 replicates) such a reduction shows an impact on the security of the grid in the short term, with the main effects of more extreme temporary conditions (i.e. 50% FSL) to increase likelihood of drawdown over the short to medium term. Specific outcomes include:

- first simulated occurence of SEQ drawdown to T1 within the next 2 years and probability of drawdown to T1 increasing to about 2% within 5 years. This is compared with less than 0.2% probability of drawdown to T1 within the next 5 years for scenarios with temporary FSL of 100%, 90% and 80%.

- Probability of SEQ falling to T1increasing to about 5% within 10 years, as opposed to approx 3.5-4% for 80%-100% FSL scenarios.

Final runs for temporary Wivenhoe FSL of 70% and 50% at end June 2011 are underway and results should be available by tomorrow morning.

Cheers,

[redacted]

From: [redacted]
To: Daniel.Spiller[redacted]
Cc: [redacted]
Sent: Tue, 01 Feb 2011 13:02:44 +1100
Subject: Wivenhoe assessment_temporary FSL reduction

Hi Dan,

As discussed yesterday, we have undertaken runs assessing **temporary** reduction of Wivenhoe FSL to end June 2011.

Key assumptions are as described in email below, except for **Tugun whose operation is assumed as standby** (4%) when key Grid storages are above 60%, and full capacity when key Grid storages are below 60%.

Results suggest little impact of Wivenhoe temporary reduction on probabilities of SEQ reaching trigger levels. The probability of SEQ falling to T1 (40%) within 10 years would increase by less than 0.5% (from about 3.6% to 3.8%) if Wivenhoe's FSL is temporarily reduced to 80% to end June 2011. *see attached Figure 1*

Attached Figure 2 shows that under 99.9% exceedance probability, SEQ storages would reach T1 less than a year (about 6 months) earlier under these operating conditions.

Hope this helps and any questions let us know.

Cheers,

[redacted]

From: [redacted]
To: Dan Spiller [redacted]
Cc: [redacted]
Sent: Mon, 31 Jan 2011 08:41:46 +1100
Subject: Modelling assumptions

Dan,

Assumptions adopted in modelling you have received results for to date:

- Demands are based on the QWC Strategy baseline: medium series population growth and linear increase from 2009 recorded consumption to 230 lpd res by 2018
- All probabilistic assessments start from May-2011 and assume full initial storages following the wet season.
- Tugun is assumed to operate at one third capacity when key SEQ storages are above 60%, and full capacity below 60% [updates with mothball regime are underway]
- PRW into Wivenhoe when total system storage is below 40% of capacity
- All current WTPs assumed operating (i.e. none of the shut-downs as discussed for next set of modelling scenarios)
- Wyaralong Dam constructed without WTP (i.e. no additional supply to grid)
- No Hinze raise
- NTP transfer capacity = 65 ML/d SC to Central when Northern key storages > 70% of capacity, and 65 ML/d Central to SC when northern key storages < 40%
- SRWP transfer capacity = 25 ML/d GC to Central when Southern key storages > 40%, 55 ML/d Central to GC when Southern key storages < 40%
- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Hopefully that covers it, however please let us know if there are any other components that you needed assumptions for.

Regards,

[redacted] Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust**www.access.gs | Download vCard

N119

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N120

From: Dan Spiller[redacted]
Sent: Friday, February 11, 2011 2:09 PM
To: [redacted]
Subject:
Attach: Ministerial statement FS1 110211 FINAL v3.docx

Not sure it made it the first time.

Daniel Spiller
Director, Operations
SEQ [redacted]
Visit: Level 15, 53 Albert Street Brisbane
Post: PO Box 16205, City East QLD 4002
ABN: 14783 317 630

Minister for Natural Resources, Mines and Energy and Minister for Trade

Stephen Robertson MP

MINISTERIAL STATEMENT

Wivenhoe Dam Full Supply Level Wivenhoe Dam Full Supply Level

- In October 2010, I requested advice from the Water Grid Manager about whether South East Queensland's improved water security provided an opportunity to reduce the volume stored in key dams as a temporary measure to assist in flood mitigation.
- The Water Grid Manager consulted Seqwater, as owner and operator of the dam, about available options and likely benefits.
- Seqwater advised the Water Grid Manager that:
  - for minor inflow events releasing water to below Full Supply Level may provide some minimal benefits;
  - for major inflow events, much more substantial releases, in the order of at least 250,000 megalitres, would be required to make a significant difference
  - the Manual of Flood Mitigation for Wivenhoe and Somerset dams should not be modified without suitable engineering investigations being undertaken

Author	[Author's Name, Position]	Approved	[Name, Position – ADG/DDG/Associate DG]
Business Unit	[Business Unit]	Business Unit	[Business Unit]
Telephone	[Number]	Date	[Date approved]
Approved	[Name, Position - ED/RSD/GM]	Approved	John Bradley, Director-General
Business Unit	[Business Unit]	Business Unit	Department of Environment and Resource Management
Date	[Date approved]	Date	[Date approved]
CTS:			

- Seqwater needed to undertake a major study to quantify the benefits of the larger releases. The detailed study would involve a range of issues.

- Based on this advice, in December 2010, the Water Grid Manager advised me and Seqwater that, from a water security perspective, it had no objection to Seqwater reducing Wivenhoe and Somerset dams' combined Full Supply Levels to 95 per cent and North Pine's Full Supply Level to 97.5 per cent. These levels were based on modelling provided to it about the likely benefits of dam reductions during minor inflow events.

- Seqwater decided not to seek the necessary regulatory changes to facilitate a temporary reduction in Wivenhoe and Somerset dams to these levels, based on its assessment that such a small reduction would have little or no identifiable benefit for flood mitigation purposes.

- The first part of Seqwater's detailed study involved the modelling of water flow rates from Wivenhoe Dam for a range of flood events. This has now been completed and peer reviewed by external experts.

- The study recommended that Wivenhoe Dam be drawn down to 75 per cent of its Full Supply Level, delivering

- From a water security perspective, the Water Grid Manager advised it had no objection to this reduction.

- In view of this, Seqwater has recommended the State Government support a temporary reduction in the FSL to 75% to increase Wivenhoe Dam's flood mitigation capability, acknowledging the size of the benefit is dependent on the rainfall conditions and inflows downstream of the dam.
- Seqwater is working with the Department of Environment and Resource Management on the processes and regulatory requirements to implement the change.
- In addition, as required by the Dam Safety Regulator, Seqwater is already undertaking a detailed report into the operation of Wivenhoe and Somerset Dam during the January flood event,
- Both this report and the study to quantify the long term benefits of reducing the Wivenhoe Dam FSL will be provided to the Commission of Inquiry.

[redacted]

From: Barry Dennien
Sent: Friday, 11 February 2011 3:02 PM
To: Dan Spiller
Subject: Fwd: Letter from Seqwater (11/02/11)
Attachments: cidimage001.png@01CA733B.9F0685F0; ATT00001.htm; cidimage008.png@01CB8736.F84905B0; ATT00002.htm; Letter to SEQWGM, 11 February 2011.pdf; ATT00003.htm

Categories: T14: Continuation

Regards
Barry Dennien

Begin forwarded message:

> **From:** [redacted]
> **To:** "Barry Dennien" [redacted]
> **Cc:** [redacted]
> **Subject: Letter from Seqwater (11/02/11)**
>
> Dear Barry,
>
> Please find attached a letter for your attention.
>
> Thank you.
>
> Regards, [redacted]
>
> [redacted]
>
> Executive Assistant to the CEO
>
> Queensland Bulk Water Supply Authority *trading as* Seqwater

N125

seqwater
WATER FOR LIFE

11 February 2011

Mr Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
PO Box 16205
City East Qld 4002

Barry

Dear Mr Dennien

We refer to your letter dated 3 February 2011 regarding SEQ Water Grid Manager review of proposed capital and renewal projects for 2011/12.

In response to your request for provision of project information, and in order to more strongly support the consultation process proposed by the Chair of the SEQ Water Grid Manager in his letter to the Minister of 17 December 2010, we have currently scheduled a workshop between Seqwater and SEQ Water Grid Manager for 16 February 2011 at 2:00pm. At this workshop, Seqwater will present the current proposed capital investment program, including projects with an estimated budget of greater than $2 million for review and discussion. Level of development and future program for development and delivery of these projects will also be discussed.

In this regard we will not be supplying the requested project documentation by 11 February 2011, but rather will provide project documentation to the SEQ Water Grid Manager as required as part of that workshop.

I understand that this approach has been agreed between Dan Spiller and [redacted] at their meeting of 9 February 2011, and trust that this meets your requirements.

In the meantime, please do not hesitate to contact me should you have any concerns with the proposed approach.

Yours sincerely

[redacted]

Peter Borrows
Chief Executive Officer

Litsupport Brisbane

From: [redacted]
Sent: Friday, 11 February 2011 3:50 PM
To: Dan Spiller
Cc: [redacted]
Subject: Assessment results - Temporary reduction of Wiv to 75% & North Pine 50%)

Dan,

Please find email below from [redacted] with results for assessment as discussed this morning.

If you have any queries or wished to discuss anything further please do not hesitate to call.

Regards,

[redacted] Director/Principal Water Resource Engineer**B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust****www.access.gs | Download vCard**

[redacted]

As discussed on the phone here are the final results (10,000 replicates) from the run requested by Dan this morning looking at temporary reduction of initial storage volumes (at end June 2011) of:

- Wivenhoe to 75%
- North Pine to 50%
- All other storages full

This scenario represents a total reduction of the SEQ System stored volume to 81% of total capacity and as expected presents similar outcomes as previous scenarios with similar overall initial system storage volumes.

Wivenhoe Dam storage level	Other Grid 12 storage levels	Total Grid 12 storage level	Probability of Grid 12 storages reaching 60% before end June 2016	Probability of Grid 12 storages reaching 40% before end June 2016
100%	100%	100%	4.8%	0.1%

N127

75%	100%	86%	8.8%	0.4%
75%	94%	83%	10.5%	0.4%
70%	100%	83%	10.5%	0.4%
75%	North Pine 50% Other 100%	81%	12.1%	0.5%

As further context to the results, the estimated probability of storage reaching T1 before end of June 2021 = 4.2%

All assumptions are consistent with previously reported scenarios (e.g. Tugun on standby mode above 60% total system storage, medium series demand, etc).

Kinds regards,

[redacted]

[redacted]

From: Barry Dennien
Sent: Saturday, 12 February 2011 4:40 PM
To: Dan Spiller
Subject: Fwd: MEETING TOMORROW AND MIN OFF QUESTIONS

Categories: T14: Continuation

Will ring
Regards
Barry Dennien

Begin forwarded message:

> **From:** [redacted]
> **Date:** [redacted]
> **To:** Bradley John [redacted], Barry Dennien
> [redacted]
> **Cc:** "pborrows [redacted]
> **Subject:** [redacted] AND MIN OFF QUESTIONS
>
> John, I'll be in the office before then if you have any problems. Has everyone signed off on the draft MR. I would like to forward it to GMU asap
>
> **From:** Bradley John [redacted]
> **Sent:** Saturday, 12 [redacted] February 2011 3:50 PM
> **To:** Dennien Barry @ SEQWGM
> **Cc:** pborrows [redacted]
> **Subject:** MEETING TOMORROW AND MIN OFF QUESTIONS
>
> Barry /Peter
>
> Min will meet us tomorrow at 10 am in his ministerial office. I will meet you downstairs at 10 am outside 61 Mary Street and walk up with you.
>
> Barry
>
> Can you please add these to the Q&As being coordinated by Seqwater.
>
> Feel free to clarify any with Lance directly thanks
>
> John B

N129

[redacted] questions -

-The net cost of water in real terms

-The total production capacity of the grid - in aggregate and broken down by component (PWR/Desal)

-estimate bulk $ value of water being voided and how that

a) would compare to the capital works estimate raise Wivenhoe's walls to provide same flood mitigation improvement as FSL reduction; and

b) is minute compared to $X billion damage bill should we have another flood event

Thanks

+---+

+---+

N130

From: [redacted]
Sent: [redacted]
To: [redacted]u;
Cc: Barry Dennien[redacted]
<Daniel.Spille[redacted]an Spiller
[redacted]
Subject: Ministerial Statement - Wivenhoe Dam's full supply level
Attach: February_Ministerial_statement_FSl_120211_Seqwater_FINAL[1].docx

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Dear Board members

On Thursday, Minister Robertson's office requested that Seqwater and the Water Grid Manager jointly prepare a Ministerial Statement regarding the dam release advice provided to the Minister in December 2010, and the advice recently provided by Seqwater on temporarily reducing Wivenhoe Dam's full supply level to 75% (which we had no objection to from a water security perspective). The Statement is to prepare Minister Robertson for next week's Parliamentary sitting.

Attached is the Ministerial Statement that was finalised between us and Seqwater today.

Further, DERM has been liaising with Seqwater and ourselves in preparing a press release on the State's decision to reduce Wivenhoe Dam's full supply level to 75%. We are waiting to receive an updated press release after discussions with DERM. There may also be a press conference at 11am tomorrow regarding this matter.

Regards

[redacted]
Director, Governance and Regulatory Compliance
SEQ Water Grid Manager
Phone[redacted]
Email: [redacted]
Visit: [redacted] Brisbane
Post: PO Box 16205, City East QLD 4002
ABN: 14783 317 630

Minister for Natural Resources, Mines and Energy and Minister for Trade

Stephen Robertson MP

MINISTERIAL STATEMENT

Wivenhoe Dam Full Supply Level

- In October 2010, I requested advice from the Water Grid Manager about whether South East Queensland's improved water security provided an opportunity to temporarily reduce the volume stored in key dams to assist in flood mitigation.
- In preparing this advice, the Water Grid Manager consulted Seqwater, as owner and operator of South East Queensland's dams, about the available options to reduce the volume in key dams and the likely benefits.
- In response, Seqwater advised the Water Grid Manager that:
  - for minor inflow events, releasing water below the Full Supply Level may provide some minimal benefits;
  - for major inflow events, more substantial releases, in the order of at least 250,000 mega litres, would be required to realise a significant benefit;

Author	[Author's Name, Position]	Approved	[Name, Position – ADG/DDG/Associate DG]
Business Unit	[Business Unit]	Business Unit	[Business Unit]
Telephone	[Number]	Date	[Date approved]
Approved	[Name, Position - ED/RSD/GM]	Approved	John Bradley, Director-General
Business Unit	[Business Unit]	Business Unit	Department of Environment and Resource Management
Date	[Date approved]	Date	[Date approved]
CTS:			

- Seqwater needed to undertake a major study to quantify the benefits of larger releases, which would involve looking at a range of issues; and
- the Flood Mitigation Manual for Wivenhoe and Somerset Dams should not be modified without the major study, including suitable engineering investigations, being undertaken.

- Based on this advice, in December 2010, the Water Grid Manager advised myself and Seqwater that, from a water security perspective, it had no objection to Seqwater reducing Wivenhoe and Somerset Dams' combined Full Supply Levels to 95 per cent, and North Pine's Full Supply Level to 97.5 per cent. These levels were based on Seqwater's modelling of the likely benefits of dam reductions during minor inflow events.

- Given the assessment that a small reduction would have minimal flood mitigation benefits during minor inflow events, any necessary regulatory changes for the reduction of Full Supply Levels were to be considered upon receipt of the major study.

- The first part of Seqwater's major study involved modelling water flow rates from Wivenhoe Dam for a range of flood events.

- This has now been completed and peer reviewed by external experts.

- As a result, on 4 February 2011, I received a letter from Seqwater stating that should it be possible for Wivenhoe Dam's Full Supply Level to be temporarily reduced to 75% without compromising water security, then Seqwater could confirm this would provide flood mitigation benefits.
- Subsequently, the Water Grid Manager advised that it had no objection, from a water security perspective, to Wivenhoe Dam's Full Supply Level being temporarily reduced to 75%.
- In view of this, Seqwater has recommended that the State Government support a temporary reduction in Wivenhoe Dam's Full Supply Level to 75%, to increase Wivenhoe Dam's flood mitigation capability, acknowledging the size of the benefit is dependent on the rainfall conditions and inflows downstream of the dam.
- Seqwater is working with the Department of Environment and Resource Management on the processes and regulatory requirements to implement the change.
- In addition, as required by the Dam Safety Regulator, Seqwater is already preparing a detailed report into the operation of Wivenhoe and Somerset Dams during the January flood event.

- Both this report and the study to quantify the long term benefits of reducing Wivenhoe Dam's Full Supply Level will be provided to the Commission of Inquiry.

Litsupport Brisbane

From: Best Debbie [redacted]
Sent: Sunday, 13 February 2011 5:53 PM
To: Dan Spiller
Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.

----- Original Message -----
From: [redacted]
To: Bradley John
Cc: Best Debbie; Reilly Bob; [redacted] Allen Peter
Sent: Sun Feb 13 16:13:43 2011
Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.

Hi John

Please see Bob and [redacted] comments below. Suggest if we intend to follow the outlined draft amendment to the interim program we need to prepare responses to the issues raised by Bob

[redacted]

----- Original Message -----
From: [redacted]
To: [redacted]
Cc: Allen Peter; Reilly Bob; Best Debbie
Sent: Sun Feb 13 15:07:56 2011
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

[redacted]

Not an issue that needs to be resolved today, but I didn't think there was any room for further negotiation on this. If Bob and Peter have concerns about SEQwater's proposal, I suggest that you talk to the Dg with a view to arranging further discussions with SEQwater on Monday.

[redacted]

----- Original Message -----
From: [redacted]
To: [redacted]
Cc: Allen Peter; Reilly Bob; Best Debbie
Sent: Sun Feb 13 12:29:01 2011
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

[redacted]

Please see Bob's comments below. I am not sure of the timing but is this an issue that needs to be sorted today or do we have a bit more time.

[redacted]

-----Original Message-----
From: Reilly Bob
Sent: Sunday, 13 February 2011 12:10 PM
To: [redacted] Allen Peter
Cc: Best Debbie
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

Hi everyone

It could be desirable if the proposed interim program is adjusted to allow for the equivalents of w1c to w1e, but with an "initiation level" of 64 rather than 67 m e.g. Once the lake level reaches 65 m have a maximum release of 1,900 cumecs.

Also the proposed interim program would, on my understanding--and I could be wrong, potentially result in a reduction of releases once 67.25m (but below 67.5.)is reached--if I am correct, this may appear a bit odd to some people.

Regards

Bob

--- Original Message -----
From: [redacted]
To: Reilly Bob; Allen Peter
Sent: Sun Feb 13 09:05:15 2011
Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.

Fyi

----- Original Message -----
From: Bradley John
To: Bradley John; [redacted]
Cc: Best Debbie; [redacted]
Sent: Sun Feb 13 08:49:22 2011
Subject: RE: Update on Governor in Council Process - and Draft ROP amendment.

Further to last - as provided to Min Robertson for info

---

om: Bradley John
Sent: Sunday, 13 February 2011 8:48 AM
To: 'stephen robertson [redacted]
Cc: [redacted] Best Debbie
Subject: FW: Draft interim program wording

FYI

John Bradley

Director-General

N137

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

DRAFT AMENDMENT TO THE INTERIM PROGRAM - APPROVED BY DG DERM AFTER ROP IS AMENDED.

·qwater will, between 14 February and 31 March 2011 ("2011 Summer Season") and subject to the operational constraints specified below, make the following releases from infrastructure -

(a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and

(b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level.

The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable.

If, after releases specified in (a) or (b) have commenced, the level in Wivenhoe Dam exceeds 67.25 m AHD and a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) would be recommenced.

For the purpose of the above, "Interim Supply Security Level" means 64 m AHD.

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sen[redacted]
To: [redacted]
Cc: Best Debbie; [redacted]
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

[redacted] et al,

Pls note below, let me know if any problem with delivering execution copy at 8.30 AM tomorrow to Min R's office (needs to be through me by then – but that should be a formality.

Thanks for your efforts this weekend

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sent: Sunday, 13 February 2011 8:44 AM
To: [redacted] 'stephen.robertson[redacted]
Cc: Best Debbie
Subject: Update on Governor in Council Process - and Draft ROP amendment.

Minister [redacted]

Just for information -

1. I am liaising with [redacted] about the Governor In Council process.

- It will be you attending plus one other Minister.
- We are currently planning on having the ECM to your office by 8.30 AM Monday - does this timeframe suit Min Robertson to get an early signature to allow to go to Governor early in the day in advance.

2. The current draft of the ROP amendment is attached below. Please note that:

- The ROP amendment itself won't specify the 75 pc level. It will allow the DERM DG to approve an amendment to the current "Interim Program" which Seqwater already has in place under the ROP specifying how dam will be managed.

Only the ROP amendment (not the Interim Program) needs to be approved by Governor-I-C. It is just one sentence (see below) inserting a new subsection 6(A) into section 13 of the ROP.

3. I will send through a copy of the interim program in a separate email now.

Thanks

John B

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

) Box 2454, Brisbane Q 4001

From: Bradley John
Sent: Sunday, 13 February 2011 8:22 AM
To: Ken Smith
Subject: FW: draft ROP amendment wording

Ken

As promised - the proposed amendment to the ROP inserts a new subsection (6A) to section 13 of the ROP.

See below -

13 Interim program

(1) The chief executive and the resource operations licence holder must implement requirements of this plan as soon as is practical within the timeframes stated below.

(2) Subsections 3 to 11 apply where a resource operations licence holder is unable to meet the requirements of this plan on the day this plan commences.

(3) The resource operations licence holder must—

(a) within 2 months of commencement of this plan, submit a statement of programs currently in existence, to the chief executive for approval; and

(b) within 6 months of commencement of this plan, submit a program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

(4) The resource operations licence holder may, where an emergency or operational incident results in an inability to comply with any rules or requirements of this plan, submit an interim program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

(5) Where the submitted program relates to the Water Monitoring Data Collection Standards, ıe program must include the accuracy of methods currently used.

(6) The chief executive, in considering any submitted program, may request additional information.

Section 6A

Despite anything in subsections (2), (3) or (4), a resource operations licence holder with an approved interim program may submit to the chief executive a revised program for consideration under subsection (7).

(7) The chief executive, in considering any submitted program, may either—

(a) approve the program with or without conditions;

(b) amend and approve the amended program; or

:) require the resource operations licence holder to submit a revised program.

(8) Within 10 business days of making a decision on a program submitted under this section, the chief executive must notify the resource operations licence holder of the decision.

(9) Following approval of the program by the chief executive, the resource operations licence holder must—

(a) implement and operate in accordance with the approved program; and

(b) make public details of the approved program on their internet site.

+--+
Think B4U Print
1 ream of paper = 6% of a tree and 5.4kg CO2 in the atmosphere
3 sheets of A4 paper = 1 litre of water
+--+

From: Dan Spiller [redacted]
Sent: Sunday, February 13, 2011 7:33 PM
To: Best Debbie [redacted]
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

Debbie,

Now that I don't have a lazy three year old on my shoulders...

I agree with Bob, unless there are changes to Manual also. At first appearance, this seems inconsistent with the reductions quoted in the Seqwater advice.

I will call Bob tomorrow, but am not across the details - we do not have a copy of the latest advice.

Dan

On 13/02/2011, at 5:53 PM, "Best Debbie" [redacted] wrote:

>
>
> ----- Original Message -----
> From[redacted]
> To: Bradley John
> Cc: Best Debbie; Reilly Bob;[redacted] Allen Peter
> Sent: Sun Feb 13 16:13:43 2011
> Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.
>
> Hi John
>
> Please see Bob an[redacted]omments below. Suggest if we intend to follow the outlined draft amendment to the interim program we need to prepare responses to the issues raised by Bob

>
> [redacted]
>
> ----- Original Message -----
> From:[redacted]
> To: Douglas Penny;[redacted]
> Cc: Allen Peter; Reilly Bob; Best Debbie
> Sent: Sun Feb 13 15:07:56 2011
> Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.
> [redacted]
>
> Not an issue that needs to be resolved today, but I didn't think there was any room for further negotiation on this. If Bob and Peter have concerns about SEQwater's proposal, I suggest that you talk to the Dg with a view to arranging further discussions with SEQwater on Monday.

>
> [redacted]
> ----- Original Message -----

> From:[redacted]
> T[redacted]
> Cc: Allen Peter; Reilly Bob; Best Debbie
> Sent: Sun Feb 13 12:29:01 2011
> Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.
>[redacted]
>
> Please see Bob's comments below. I am not sure of the timing but is this an issue that needs to be sorted today or do we have a bit more time.

>
[redacted]
>
> -----Original Message-----
> From: Reilly Bob
> Sent: Sunday, 13 February 2011 12:10 PM
> To: Douglas Penny; Allen Peter
> Cc: Best Debbie
> Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.
>
> Hi everyone
>
> It could be desirable if the proposed interim program is adjusted to allow for the equivalents of w1c to w1e, but with an "initiation level" of 64 rather than 67 m e.g. Once the lake level reaches 65 m have a maximum release of 1,900 cumecs.

>
> Also the proposed interim program would, on my understanding--and I could be wrong, potentially result in a reduction of releases once 67.25m (but below 67.5.)is reached--if I am correct, this may appear a bit odd to some people.

>
> Regards
>
> Bob
>
> ----- Original Message -----
> From [redacted]
> To: Reilly Bob; Allen Peter
> Sent: Sun Feb 13 09:05:15 2011
> Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.
>
> Fyi
>
> ----- Original Message -----
> From: Bradley Jo[redacted]
> To: Bradley Joh[redacted]
> Cc: Best Debbie[redacted]
> Sent: Sun Feb 13 08:49:22 2011
> Subject: RE: Update on Governor in Council Process - and Draft ROP amendment.
>
> Further to last – as provided to Min Robertson for info
>
> ________________________________
>
> From: Bradley John
> Sent: Sunday, 13 February 2011 8:48 AM
> To: 'stephen.robertson([redacted]
> Cc:[redacted]Best Debbie

> Subject: FW: Draft interim program wording
>
>
>
> FYI
>
>
>
> John Bradley
>
> Director-General
>
> Department of Environment and Resource Management
>
> Telephone: [redacted]
>
> Email: [redacted]
>
> www.derm.qld.gov.au <http://www.derm.qld.gov.au>
>
>
>
> Department of Environment and Resource Management
>
> 400 George Street, Brisbane Q 4000
>
> GPO Box 2454, Brisbane Q 4001
>
>
>
> DRAFT AMENDMENT TO THE INTERIM PROGRAM - APPROVED BY DG DERM AFTER ROP IS AMENDED.
>
>
>
> Seqwater will, between 14 February and 31 March 2011 ("2011 Summer Season") and subject to the operational constraints specified below, make the following releases from infrastructure –

>
> (a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and
>
> (b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level.

>
> The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable.

>
> If, after releases specified in (a) or (b) have commenced, the level in Wivenhoe Dam exceeds 67.25 m AHD and a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) would be recommenced.

>
> For the purpose of the above, "Interim Supply Security Level" means 64 m AHD.
>
>
>
>
>
>

>
> John Bradley
>
> Director-General
>
> Department of Environment and Resource Management
>
> Telephone: [redacted]
>
> Email: [redacted]
>
> www.derm.qld.gov.au <http://www.derm.qld.gov.au>
>
>
>
> Department of Environment and Resource Management
>
> 400 George Street, Brisbane Q 4000
>
> GPO Box 2454, Brisbane Q 4001
>
> ________________________________
>
> From: Bradley John
> Sent: Sunday, 13 February 2011 8:47 AM
> To: [redacted]
> Cc: Best Debbie; [redacted]
> Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.
>
>
>
> [redacted] et al,
>
>
>
> Pls note below, let me know if any problem with delivering execution copy at 8.30 AM tomorrow to Min R's office (needs to be through me by then – but that should be a formality.

>
>
>
> Thanks for your efforts this weekend
>
>
>
> John Bradley
>
> Director-General
>
> Department of Environment and Resource Management
>
> Telephone: [redacted]
>
> www.derm.qld.gov.au <http://www.derm.qld.gov.au>
>
>
>
> Department of Environment and Resource Management
>
> 400 George Street, Brisbane Q 4000

>
> GPO Box 2454, Brisbane Q 4001
>
> ________________________________
>
> From: Bradley John
> Se[redacted]ary 2011 8:44 AM
> T[redacted]stephen.robertson[redacted]
> Cc: Best Debbie
> Subject: Update on Governor in Council Process - and Draft ROP amendment.
>
>
>
> Minister[redacted]
>
>
>
> Just for information -
>
>
>
> 1. I am liaising with [redacted]bout the Governor In Council process.
>
>
>
> · It will be you attending plus one other Minister.
>
> · We are currently planning on having the ECM to your office by 8.30 AM Monday – does this timeframe suit Min Robertson to get an early signature to allow to go to Governor early in the day in advance.

>
>
>
>
>
> 2. The current draft of the ROP amendment is attached below. Please note that:
>
>
>
> · The ROP amendment itself won't specify the 75 pc level. It will allow the DERM DG to approve an amendment to the current "Interim Program" which Seqwater already has in place under the ROP specifying how dam will be managed.

>
>
>
> · Only the ROP amendment (not the Interim Program) needs to be approved by Governor-I-C. It is just one sentence (see below) inserting a new subsection 6(A) into section 13 of the ROP.

>
>
>
> 3. I will send through a copy of the interim program in a separate email now.
>
>
>
> Thanks
>
> John B
>
>
>
>

N148

>
>
>
> John Bradley
>
> Director-General
>
> Department of Environment and Resource Management
>
> Telephone: [redacted]
>
> Email: [redacted]
>
> www.derm.qld.gov.au <http://www.derm.qld.gov.au>
>
>
>
> Department of Environment and Resource Management
>
> 400 George Street, Brisbane Q 4000
>
> GPO Box 2454, Brisbane Q 4001
>
> ________________________________
>
> From: Bradley John
> Sent: Sunday, 13 February 2011 8:22 AM
> To: Ken Smith
> Subject: FW: draft ROP amendment wording
>
>
>
> Ken
>
>
>
> As promised – the proposed amendment to the ROP inserts a new subsection (6A) to section 13 of the ROP.
>
>
>
> See below -
>
>
>
>
>
> 13 Interim program
>
> (1) The chief executive and the resource operations licence holder must implement requirements of this plan as soon as is practical within the timeframes stated below.

>
>
>
> (2) Subsections 3 to 11 apply where a resource operations licence holder is unable to meet the requirements of this plan on the day this plan commences.

>
>
>
> (3) The resource operations licence holder must—
>

> (a) within 2 months of commencement of this plan, submit a statement of programs currently in existence, to the chief executive for approval; and

>
> (b) within 6 months of commencement of this plan, submit a program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

>
>
>
> (4) The resource operations licence holder may, where an emergency or operational incident results in an inability to comply with any rules or requirements of this plan, submit an interim program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

>
>
>
> (5) Where the submitted program relates to the Water Monitoring Data Collection Standards, the program must include the accuracy of methods currently used.

>
>
>
> (6) The chief executive, in considering any submitted program, may request additional information.
>
> Section 6A
>
> Despite anything in subsections (2), (3) or (4), a resource operations licence holder with an approved interim program may submit to the chief executive a revised program for consideration under subsection (7).

>
> (7) The chief executive, in considering any submitted program, may either—
>
> (a) approve the program with or without conditions;
>
> (b) amend and approve the amended program; or
>
> (c) require the resource operations licence holder to submit a revised program.
>
>
>
> (8) Within 10 business days of making a decision on a program submitted under this section, the chief executive must notify the resource operations licence holder of the decision.

>
>
>
> (9) Following approval of the program by the chief executive, the resource operations licence holder must—
>
> (a) implement and operate in accordance with the approved program; and
>
> (b) make public details of the approved program on their internet site.
>
>
>
>
>
> +---+
> Think B4U Print
> 1 ream of paper = 6% of a tree and 5.4kg CO2 in the atmosphere
> 3 sheets of A4 paper = 1 litre of water

> +--+
>

[redacted]

From: Reilly Bob [redacted]
Sent: Monday, 14 February 2011 9:00 AM
To: Dan Spiller
Subject: FW: Draft Deed of Indemnity
Attachments: 2D-KEEPER-918307-Deed_of_Indemnity.doc

Importance: High
Sensitivity: Confidential

Categories: T14: Continuation

Hi Dan

As discussed--you may also wish to consider whether the water releases to get Wivenhoe initially down to 75% (such releases will commence early this week, I understand)would be covered by the draft communication protocol for floodwater releases from Wivenhoe/Somerset.

Regards

Bob

-----O[redacted]----
From:[redacted]
Sent: Monday, 14 February 2011 5:45 AM
To: Reilly Bob; Allen Peter
Subject: Fw: Draft Deed of Indemnity
Importance: High
Sensitivity: Confidential

Fyi

----- Original Message -----
From:[redacted]
To: Bradley John
Cc: [redacted]Best Debbie; [redacted]
[redacted]
Sent: Mon Feb 14 00:39:20 2011
Subject: Draft Deed of Indemnity

Dear John

I attach:
- the revised draft Deed of Indemnity with amendments shown in track changes; and
- a clean version.

Please note that there are a few typographical or referencing errors corrected in the clean version that are not shown in the track change version because I spotted them after I had accepted the changes.

I have sent the documents to:
- Allens Arthur Robinson (solicitors for Seqwater);
- General Counsel, Seqwater;
- Commercial Counsel, Treasury; and
- Assistant Crown Solicitor, Crown Law; and I have requested comments by 10am Monday 14 February 2011.

N152

Naturally when I sent the documents to Allens and Seqwater I sent the documents on the basis that they were a draft and that I had not yet received instructions on the content.

If you (or any departmental officers in the cc of this email) have any comments or concerns please let me know.

Otherwise I will collate the comments I receive and provide an update after 10am tomorrow.

Please contact me (details below) if you have any questions or if I may be of further assistance.

Regards,

[redacted]

Principal Lawyer & Team Leader, Commercial Law Team, Legal Services

Telephone [redacted]

Email: [redacted]
www.derm.qld.gov.au <http://www.derm.qld.gov.au/>

Department of Environment and Resource Management

41 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

N153

Department of Environment
and Resource Management

DEED OF INDEMNITY

between

the **State of Queensland**
as represented by the **Department of Environment and Resource Management**

and

Queensland Bulk Water Supply Authority trading as **Seqwater**

Legal Services
Department of Environment and Resource Management
GPO Box 2454
Brisbane Qld 4001
Australia

Agreement Version Number: Non-Standard
Document Reference: KEEPER 918307 2D

THIS DEED is made:

BETWEEN: **The State of Queensland** as represented by the Department of Environment and Resource Management ("the State")

AND: **Queensland Bulk Water Supply Authority trading as Seqwater** ("Seqwater")

BACKGROUND

A. Seqwater is the operator of Wivenhoe Dam and Somerset Dam ("the Dam").

B. Seqwater is also an owner under section 374 of the *Water Supply (Safety and Reliability) Act 2008* ("the Act") which provides that:

374 Protection from liability for complying with flood mitigation manual

(1) The chief executive or a member of the council does not incur civil liability for an act done, or omission made, honestly and without negligence under this part.

(2) An owner of a dam who observes the operational procedures in a flood mitigation manual, approved by the chief executive, for the dam does not incur civil liability for an act done, or omission made, honestly and without negligence in observing the procedures.

(3) If subsection (1) or (2) prevents civil liability attaching to a person, the liability attaches instead to the State.

(4) In this section—

***owner**, of a dam, includes—*

(a) the operator of the dam; or

(b) a director of the owner or operator of the dam; or

(c) an employee of the owner or operator of the dam; or

(d) an agent of the owner or operator of the dam.

C. Seqwater seeks an indemnity from the State in relation to potential liability arising from proposed changes to existing operations under the regulatory requirements applicable to Seqwater in its operation of the Dam. The proposed operations will be authorised under a Revised Interim Program (including the Relevant Part of the Revised Interim Program which forms Annexure 1 to this Deed) approved by the Chief Executive of the Department of the Environment and Resource Management pursuant to section 13 of the Moreton Resource Operations Plan 2009 (as amended).

D. The proposed operations in accordance with the Relevant Part of the Revised Interim Program will involve Seqwater releasing waters from Wivenhoe Dam (additional to usual requirements for downstream demand or minimum flows) on a temporary basis (from the week commencing 14 February 2011 until 31 March 2011) to achieve a storage level of 75% of the Full Supply Level. Furthermore, as necessary during the term of the Relevant Part of the Revised Interim Program, Seqwater will recommence the release of waters as soon as safely practicable to regain a storage level of 75% of Full Supply Level.

E. Seqwater holds commercial insurance cover under various policies which cover its current operations. Seqwater has advised the State that it will take time to update its commercial insurance cover to take into account operations under the Relevant Part of the Revised Interim Program (the process to seeking insurers' approval is likely to require their review of the proposed indemnity and the involvement of underwriters in London, with a turnaround of 72 hours during the normal working week).

F. Seqwater seeks an indemnity from the State on the basis that the proposed operations in accordance with the Relevant Part of the Revised Interim Program have the potential to:

- give rise to liability in respect of Seqwater, its officers, employees and agents; and
- compromise rights of indemnity under existing policies of insurance.

G. Seqwater seeks an indemnity from the State which addresses the following:

- Seqwater, Seqwater's officers, and Seqwater's employees and agents ("the Indemnified") be indemnified fully and effectively in relation to risks arising from, or connected with, or related to, the proposed operations in accordance with the Relevant Part of the Revised Interim Program (directly or indirectly), to the extent any insurance held by or for the benefit of the Indemnified does not respond to cover the whole of that liability.

- the indemnity would not require the Indemnified to challenge insurers on denial of cover. Rather, the State would indemnify the Indemnified and, at the State's election, take an assignment of any right against insurers;
- the indemnity would not affect any other indemnity or immunity available to an Indemnified. Rather, it would stand alone;
- liabilities covered are intended to reflect the widest sense possible, including civil and criminal, or in respect of an inquiry proceeding, and costs on an indemnity basis;
- an Indemnified will not lose the benefit of the indemnity merely due to negligence, inadvertence, or error of judgment, provided that the Indemnified has not acted in bad faith, or engaged in wilful disregard or misconduct. For clarity, avoidance of the indemnity due to this range of matters will be available only in respect of the relevant Indemnified, but will affect no other Indemnified;
- Cessation of holding office or employment will not affect the continuing operation of the indemnities.
- the indemnity will be irrevocable though subject to expiry.

H. The State has agreed to:
- provide Seqwater with an indemnity for its operations under the Relevant Part of the Revised Interim Program to the same level as Seqwater would ordinarily have under its commercial insurance cover in accordance with the terms of this Deed; and
- provide a similar protection to section 374 of the Act to Seqwater;

to allow Seqwater time to obtain updated commercial insurance cover.

IT IS AGREED

1. INTERPRETATIO N

1.1 In this Deed, where commencing with a capital letter and unless the context otherwise requires:

(a) **Business Day** means between 9:00am and 5:00pm on a weekday other than a Saturday, Sunday or public holiday in Queensland.

(b) **Commencement Date** means either:

(i) the date specified in 1 of the Schedule; or

(ii) if no date is specified in 1 of the Schedule, the date on which this Deed is executed by the Parties (and if not executed by the Parties on the same day, the date on which the last Party executes this Deed).

(c) **Commercial Insurance Cover** means the insurance policies held by Seqwater including but not limited to Public Liability Insurance, Professional Indemnity Insurance, Product Liability Insurance, Infrastructure Insurance and Directors & Officers Indemnity Insurance.

(d) **Deed** means this document and any schedules and annexures attached to it.

(e) **Parties** means the State and Seqwater, and **Party** means either of the Parties as the context requires.

(f) **Relevant Part of the Revised Interim Program** means the operational procedures set out in Annexure 1 to this Deed.

(g) **Schedule** means the schedule attached to this Deed.

1.2 In this Deed, unless a contrary intention appears:

(a) words importing a gender include any other gender;

(b) words in the singular include the plural and vice versa;

(c) all dollar amounts refer to Australian currency;

(d) a reference to any legislation includes any subordinate legislation made under it and any legislation amending, consolidating or replacing it;

(e) a reference to an entity or person includes an individual, corporation, partnership or other legal entity;

(f) a Party includes its executors, administrators, liquidators, successors and permitted assigns;

(g) a reference to a clause, schedule, attachment or annexure is a reference to a clause, schedule, attachment or annexure of this Deed;

(h) clause headings in this Deed are for convenience of reference only and are not intended to affect the meaning or interpretation of this Deed;

(i) if an expression is defined, other grammatical forms of that expression will have corresponding meanings;

(j) if an entity ceases to exist, is replaced, reconstituted or renamed, or its powers or functions are transferred to another entity, the reference is to the other entity; and

(k) if the day on or by which any act is to be done is a Saturday, Sunday or public holiday in Queensland, the act may be done on the next Business Day.

1.3 If a Party to this Deed consists of more than one person, those persons are jointly and severally bound under this Deed.

2. INDEMNITY

2.1 In this clause 2:

(a) **Seqwater** includes Seqwater and its directors, officers, employees and agents (the Indemnified). Cessation of holding office or employment will not affect the continuing operation of the indemnity for acts or omissions which occurred prior to the cessation; and

(b) **Claim** includes any action, claim, suit, proceeding, demand, liability and obligation (including a claim for negligence) including civil and criminal, or in respect of an inquiry proceeding, for any damage, liability, loss, injury, death, economic loss and legal costs or expenses arising on a solicitor/own client basis.

2.2 Subject to clause 2.3 of this Deed, the State indemnifies the Indemnified fully and effectively in relation to risks and Claims arising from, or connected with, or related to, the proposed operations in accordance with the Relevant Part of the Revised Interim Program (directly or indirectly), to the extent any insurance held by or for the benefit of the Indemnified does not respond to cover the whole of that liability.

2.3 The indemnity provided in clause 2.2 of this Deed:

(a) is irrevocable;

(b) will cease upon expiry of this Deed;

(c) is limited to a total amount of $300,000,000.00 ($300million);

(d) only applies to operations in compliance with the Relevant Part of the Revised Interim Program;

(e) is not related to and does not apply to the Queensland Floods Commission of Inquiry established by the *Commissions of Inquiry Order (No. 1) 2011* on 17 January 2011;

(f) does not require the Indemnified to challenge insurers on denial of cover. Rather, the State must indemnify the Indemnified and, at the State's election, take an assignment of any right against insurers;

(g) stands alone and does not affect any other indemnity or immunity available to an Indemnified.

(h) will not be denied to an Indemnified merely due to negligence, inadvertence, or error of judgment, provided that the Indemnified has not acted in bad faith, or engaged in wilful disregard or misconduct. Loss of the benefit of the indemnity due to bad faith, wilful disregard or misconduct will apply only in respect of the relevant Indemnified, but will affect no other Indemnified;

3. PROTECTION

3.1 In this clause 3 **Seqwater** includes Seqwater and its directors, officers, employees and agents (the Indemnified). Cessation of holding office or employment will not affect the continuing operation of the indemnity for acts or omissions which occurred prior to the cessation.

3.2 Subject to clause 3.3 of this Deed, if Seqwater observes the operational procedures in the Relevant Part of the Revised Interim Program, the State will indemnify Seqwater for civil liability for an act done, or omission made, honestly and without negligence in observing the procedures.

3.3 The protection provided under clause 3.1 of this Deed:

(a) will cease upon expiry of this Deed;

(b) is irrevocable;

(c) is unlimited in amount;

(d) is intended to provide similar protection to Seqwater as is provided to an owner or operator under section 374 of the *Water Supply (Safety and Reliability) Act 2008*; and

(e) only applies to operations in compliance with the Relevant Part of the Revised Interim Program.

4. TERM

4.1 This Deed commences on the Commencement Date and expires on the earlier of the following two dates:

(a) When Seqwater obtains updated Commercial Insurance Cover for its operations including the Relevant Part of Revised Interim Program.

(b) 31 March 2011.

5. OBLIGATIONS TO SEEK COVER AND TO NOTIFY

5.1 Seqwater agrees that it will use its best endeavours to obtain updated Commercial Insurance Cover which includes operations under the Relevant Part of the Revised Interim Program on reasonable terms as soon as possible.

5.2 Seqwater will immediately give notice to the State when it obtains updated Commercial Insurance Cover which includes operations under the Relevant Part of the Revised Interim Program.

6. GENERAL

6.1.1 **Waiver** - No provision of this Deed will be deemed waived unless that waiver is in writing signed by the waiving Party. A waiver by a Party of a breach of any provision of this Deed will not operate as a waiver of any subsequent breach of this Deed. Any failure by a Party at any time to enforce a clause of this Deed, or any forbearance, delay or indulgence granted by a Party to the other Party will not constitute a waiver of that Party's rights.

6.2 **Governing law** - This Deed is governed by the laws of Queensland and the Parties submit to the jurisdiction of the courts of Queensland.

6.3 **Variation** - No agreement or understanding that varies or amends this Deed binds either Party unless it is in writing and signed by both Parties.

6.4 **Severability** - Any provision in this Deed, which is invalid or unenforceable, is to be read down if possible, so as to be valid and enforceable, and if that is not possible the provision must, to the extent that it is capable, be severed to the extent of the invalidity or unenforceability, without affecting the remaining provisions.

6.5 **Further assistance** – Each Party must do all things reasonably required by the other Party to give effect to this Deed.

6.6 **No adverse inference** – No adverse inference may be drawn in the interpretation of this Deed against the Party who was responsible for its preparation.

6.7 **Costs** - Each Party will bear their own legal costs in relation to the preparation and execution of this Deed. Seqwater must pay any stamp duty payable on this Deed.

6.8 **Notices** – Notices under this Deed must be delivered in accordance with the terms of the Deed. Notices under this Deed must be in writing and may be delivered by prepaid postage or certified mail, by hand, by electronic mail ("email") or by facsimile transmission to the Parties at the address specified in Item 2 of the Schedule or other address subsequently notified by a Party to the other. Notices will be deemed to be given –

(a) two (2) days after deposit in the mail with postage prepaid; or

(b) immediately upon delivery by hand; or

(c) if sent by facsimile transmission, upon completion of transmission evidenced by a transmission record.

(d) If sent by email, upon completion of transmission evidenced by an electronic delivery receipt.

The Parties agree that where notice by hand, by email or by facsimile transmission is not given during a Business Day, it will be deemed to by given on the next Business Day.

The Parties agree that where notice is given by email or by facsimile the sender must use its best endeavours to ensure that the original document is sent by post on the same day as the email or facsimile transmission is sent.

6.9 **Counterparts** – this Deed may be signed by the Parties in counterpart and will become operational upon the exchange of signed counterparts. Each counterpart forms part of the original Deed.

6.10 **Electronic exchange** – the Parties may exchange signed counterparts by email or facsimile and agree that this is valid for the purposes of the *Electronic Transactions Act 1999* (Cth).

SCHEDULE 1

Item 1 : **Commencement Date**	14 February 2011
Item 2 : **Address for Notices**	**State** Department of Environment and Resource Management GPO Box 2454 BRISBANE QLD 4000 Facsimile: 3224 2432 Attention: Director, Legal Services **Seqwater** [Address or solicitor's address] Facsimile: [fax number] Attention: [name/position]

ANNEXURE 1 - Relevant Part of Revised Interim Program

Seqwater will, between 14 February and 31 March 2011 ("**2011 Summer Season**") and subject to the operational constraints specified below, make the following releases from infrastructure –

(a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and

(b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level.

The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable.

If, after releases specified in (a) or (b) have commenced, the level in Wivenhoe Dam exceeds 67.25 m AHD and a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) would be recommenced.

For the purpose of the above, "**Interim Supply Security Level**" means 64 m AHD.

EXECUTED AS A DEED

STATE

SIGNED SEALED & DELIVERED for and on behalf of the **STATE OF QUEENSLAND** as represented by the **Department of Environment and Resource Management**	)
this 14th day of February 2011	)
by John Neville Bradley, Director-General	) .... (signature)
who is a duly authorised officer	)
in the presence of:	)
.... (full name of witness)	) .... (signature of witness)

SEQWATER

I

SIGNED SEALED & DELIVERED for and on behalf of **Queensland Bulk Water Supply Authority trading as Seqwater**	)
this 14th day of February 2011	)
by .... (full name and position)	)
who is a duly authorised officer	) .... (signature)
in the presence of:	)
by .... (full name of witness)	) .... (signature of witness)

[redacted]

From: [redacted]
Sent: Monday, 14 February 2011 10:24 AM
To: Barry Dennien; Dan Spiller
Subject: FW:

Categories: T14: Continuation

FYI - response from Seqwater

-----Original Message-----
From: Mike Foster [redacted]
Sent: Monday, 14 February 2011 10:20 AM
To: [redacted]
Subject: RE:

Thanks [redacted]

Changes will be made via ROP and not manual. Might be worth double-checking with John B on the 'ording he may prefer us to use.

If we do get a major rain event which takes levels over 100% the Manual as it stands will be used to manage the event.

Cheers Mike

-----Original Message-----
From: [redacted]
Sent: Monday, 14 February 2011 9:42 AM
To: Mike Foster
Subject:

Mike, Seeking a clarification on the process of the release to ensure we are all on the same page. Is it correct that the Manual is not being changed to conduct the release and that it is being done through a change to the ROP?

[redacted]
Senior Media Advisor
Office of the Hon Stephen Robertson MP
Minister for Natural Resources, Mines and Energy and Trade
P: [redacted]
M:
E:

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Unless stated otherwise, this email represents only the views of the sender and not the views of the Queensland Government.

Please consider the environment before printing this email.

N164

From: Barry Dennien [redacted]
Sent: Monday, February 14, 2011 10:51 AM
To: [redacted] Dan Spiller [redacted]
Subject: FW:
Attach: LtrChairtoMinister4February 2011.pdf; LtrtoJohnBradley10February2011 (2).pdf

---

From: [redacted]
Sent: Monday, 14 February 2011 9:33 AM
To: Barry Dennien
Subject: FW:

Barry, here's the letters. I'll call now. G

From: Mike Foster [redacted]
Sent: Sunday, 13 February 2011 12:16 PM
To: [redacted]
Subject:

[redacted]

Please find attached letter to the Minister from our chair on 4 Feb foreshadowing our impending recommendation.

Also attached is the recommendation letter to John Bradley on 10 Feb.

Cheers Mike

Mike Foster
Manager Strategic Relations & Communication
Queensland Bulk Water Supply Authority *trading* as Seqwater

seqwater
WATER FOR LIFE

Ph [redacted]
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

4 February 2011

seqwater
WATER FOR LIFE

The Honourable Stephen Robertson MP
Minister for Natural Resources, Mines and Energy
and Minister for Trade
PO Box 15216
CITY EAST QLD 4002

Dear Minister,

I refer to my 27 January 2011 letter and I am pleased to be able to relay to you the following further update, which has been provided to me by Seqwater's officers.

Work is continuing on the full Seqwater report on the recent flood event at Wivenhoe Dam, as required under the Flood Mitigation Manual for Wivenhoe and Somerset Dams. That report will address the requirements of sections 2.9 and 7.4 of the Manual and will be completed within the stipulated six week timeframe.

On Tuesday, 1 February 2011, Seqwater held a further meeting involving the Director-General of the Department of Environment and Resource Management (DERM), senior Board and Chief Executive representatives from the Water Grid Manager (WGM), Queensland Water Commission (QWC) and senior officers from DERM, including the Dam Safety Regulator and representatives from the Water Supply Regulator, to discuss the progress of works tasked to Seqwater on 25 January to address the issues raised in your letter of 20 January.

In your letter of 20 January 2011, you requested that Seqwater assist DERM in the consideration of the appropriate Full Supply Levels (***FSLs***) for Wivenhoe and Somerset Dams. Given that:

(a) Wivenhoe and Somerset Dams fulfil dual water supply and flood mitigation functions;
(b) the dams are the primary urban water supply for South East Queensland and their current FSLs are enshrined within the Moreton Resource Operations Plan and underpin the system yields adopted for the South East Queensland Water Strategy;
(c) Seqwater is obliged under its Flood Mitigation Manual to ensure that all opportunities to fill the dams are taken and therefore there should be no reason why the dams are not at their respective FSLs following a flood event,

it is noted that DERM is considering, from a policy perspective, whether the FSLs for the dams should be changed.

To assist DERM in formulating that policy position, Seqwater is continuing further modelling to provide an indicative assessment of the benefits or otherwise of undertaking a pre-release strategy to pre-emptively reduce the FSL of Wivenhoe Dam and the mechanisms by which any change to the FSL might best be implemented. However, given that this technical information will be of critical importance to:

(a) DERM in the formulation of its long term water supply and flood mitigation policies; and
(b) the Commission of Inquiry investigating the January 2011 flood events,

great care must be taken to ensure that the technical information is both accurate and comprehensive. Seqwater also notes that DERM will want to take into account the Inquiry's findings.

Compiling this technical information entails the following tasks:

(a) modelling the water outflows from Wivenhoe Dam for design flood events;
(b) calculating Brisbane River levels resulting from these various water outflow events; and
(c) determining the extent of inundation based on those Brisbane River levels.

In respect of task (a), Seqwater has completed modelling of approximately 90 permutations in respect of 3 previous flood events (including January 2011) and 6 design flood events (ranging between a 1 in 200 and a 1 in 5000 flood event) and our modelling has been peer reviewed by independent external experts.

Task (b) requires Seqwater to work with the Bureau of Meteorology (BOM) or Brisbane City Council (BCC), both of which have developed models for determining Brisbane River levels for various flow events. Seqwater is anxious to progress this task as a matter of priority but you should be aware that –

(i) BOM is unable to assist Seqwater at this point; and
(ii) BCC does not wish to assist until its model has been updated to take into account the January 2011 flood event.

If BCC is unable to assist promptly, Seqwater will need to utilise other modelling alternatives.

BCC has also developed the models which will need to be utilised to complete task (c). Task (c) can only be completed accurately when Seqwater and BCC have finalised task (b). Furthermore, Seqwater will need to have independently validated the input provided by BCC.

All of these tasks should be completed by 31 March 2011.

However, DERM may be satisfied, based on advice from QWC and the WGM from a water supply security perspective, that Wivenhoe Dam 's FSL could be reduced in the short term to, say, 75% of its current FSL. If that is the case, Seqwater can confirm (from its modelling undertaken in respect of task (a) to date) that, in respect of a flood event beyond Wivenhoe Dam's current flood mitigation design capability, such a reduced FSL will provide flood mitigation benefits for such an extreme rainfall event occurring in the Wivenhoe and Somerset catchments. For example, for a 1 in 500 probability flood event, the water outflows under Wivenhoe Dam's existing FSL are approximately 5,000 cubic metres of water per second (cumecs), whereas those water outflows would be approximately 3,400 cumecs in the case of a 75% FSL (assuming releases under the flood mitigation manual are triggered only at the reduced 75% FSL; by contrast, the water outflows would be approximately 3,700 cumecs if releases under the manual are triggered at the current FSL).
For your information, Wivenhoe Dam's current flood mitigation design enables it to contain a 1 in 100 probability flood event and substantially reduce the impacts of up to a 1 in 500 probability flood event.

Should a decision to reduce the FSL be made:

(a) Seqwater will need to work urgently with the Dam Safety Regulator to finalise any necessary changes to the flood mitigation manual;
(b) If requested, Seqwater can provide assistance to DERM following DERM's determinations regarding the Moreton Resource Operations Plan and the appropriate mechanism by which such a pre-release strategy would be implemented.

Seqwater has also developed a draft contingency protocol, should further rainfall result in the need for floodgate releases from Wivenhoe Dam in the next few weeks, and is currently finalising it with DERM.

Seqwater has sought input from the Office of the Water Supply Regulator to enable Seqwater to finalise improvements to the Technical Situation Report format identified by Mr Brian Cooper to enhance communication between government agencies and local governments during future flood events. Seqwater is currently finalising those improvements with DERM.

Seqwater remains committed to providing the State Government with timely and considered advice on the operation of the region's dams and co-operating fully with the Commission of Inquiry.

Yours sincerely,

[redacted]

Chairman

10 February 2011

Mr John Bradley
Director-General
Department of Environment and Resource Management
Level 13, 400 George Street
BRISBANE QLD 4000

Dear John,

Further to our Chairman's letter to the Honourable Stephen Robertson MP, Minister for Natural Resources, Mines and Energy, and Minister for Trade, of 4 February 2011, I advise that the SEQ Water Grid Manager informed Seqwater by the attached letter, received yesterday, 9 February 2011, that it has no objection, from a water security perspective, to Wivenhoe Dam being drawn down to 75% of its Full Supply Level (***FSL***) and that such a draw down, if temporary, would be unlikely to impact its obligations.

You will recall that, pursuant to Minister Robertson's earlier request, Seqwater undertook modelling of various potential flood events (which included approximately 90 permutations in respect of 3 previous flood events and 6 design flood events) and confirmed to you that a reduction in Wivenhoe Dam's storage level to 75% of its FSL will provide appreciable flood mitigation benefits. Reducing storage to this level will effectively increase the capability of the dam to further mitigate flood events (depending on rainfall conditions downstream of the dam).

By way of example, the simulation modelling undertaken by Seqwater, which was peer reviewed by independent experts and submitted to you with Seqwater's letter dated 7 February 2011, demonstrated, subject to the qualifications referred to in that letter, that the reduction in storage level of the Wivenhoe Dam to 75% of its FSL achieved (approximately):

(a) a flow reduction from 3900 cumecs to 2400 cumecs (being a 39% reduction) in the case of a 36 hour 1 in 200 design flood event; and

(b) a flow reduction from 5100 cumecs to 3700 cumecs (being a 28% reduction) in the case of a 36 hour 1 in 500 design flood event.

Seqwater notes the extreme January 2011 flood event resulted in 2,650,000 ML of flood water passing through Somerset and Wivenhoe Dams, which was 1,240,000 ML more than the 1974 floods.

In light of the SEQ Water Grid Manager's abovementioned advice to Seqwater, the extreme nature of the January 2011 event and the abovementioned modelling results, Seqwater recommends that Wivenhoe Dam's storage level be temporarily reduced to 75% of its FSL in order to temporarily increase its flood mitigation capacity. Should the State agree with this recommendation, Seqwater will then confer with your Departmental officers to explore the various options by which this outcome can most promptly be achieved.

I look forward to receiving your response.

Yours sincerely,

[redacted]

Peter Borrows
Chief Executive Officer

Attach.

SEQ Water Grid manager

Secure and efficient water
through partnership and innovation

TRIM ref: D/11/502

9 February 2010

Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Peter

Dear ~~Mr Borrows~~

I refer to Seqwater's Chair's letter to Minister Robertson dated 4 February 2011, regarding Seqwater's consideration of the appropriate Full Supply Levels (FSL) for Wivenhoe and Somerset dams. We acknowledge having recently received a copy of this letter from you.

I write regarding the water security impacts of lowering the FSL of Wivenhoe Dam, in light of the SEQ Water Grid Manager's obligation to manage water supplied from its water entitlements in accordance with Sections 6 and 7 (Desired Levels of Service Objectives and Risk Criteria) in the *South East Queensland System Operating Plan*. We understand that this is being considered as an interim measure for the current wet season.

I confirm previous verbal advice that, from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75 per cent of its FSL. The water security implications of a temporary draw down are unlikely to impact our ability to comply with the *South East Queensland System Operating Plan* or our Grid Contract obligations.

If a permanent reduction of Wivenhoe Dam's FSL is later considered, this may have an impact on the *South East Queensland System Operating Plan's* desired levels of service objectives and we would suggest that you also engage with the Queensland Water Commission on this matter.

I trust that this advice is sufficient. If you have any questions, please do not hesitate to contact me by telephone on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Chief Executive Officer

CC: Karen Waldman, Chief Executive Officer, Queensland Water Commission.

N169

[redacted]

From: Barry Dennien
Sent: Monday, 14 February 2011 10:54 AM
To: Dan Spiller
Subject: FW:

Categories: T14: Continuation

!

-----Original Message-----
From: [redacted]
Sent: Monday, 14 February 2011 10:24 AM
To: Barry Dennien; Dan Spiller
Subject: FW:

FYI - response from Seqwater

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From: Mike Foster [redacted]
Sent: Monday, 14 February 2011 10:20 AM
To: [redacted]
Subject: RE:

Thanks [redacted]

Changes will be made via ROP and not manual. Might be worth double-checking with John B on the wording he may prefer us to use.

If we do get a major rain event which takes levels over 100% the Manual as it stands will be used to manage the event.

Cheers Mike

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From: [redacted]
Sent: Monday, 14 February 2011 9:42 AM
To: Mike Foster
Subject:

Mike, Seeking a clarification on the process of the release to ensure we are all on the same page. Is it correct that the Manual is not being changed to conduct the release and that it is being done through a change to the ROP?

[redacted]
Senior Media Advisor
Office of the Hon Stephen Robertson MP
Minister for Natural Resources, Mines and Energy and Trade
P: [redacted]
M:
E:

N170

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QLD Bulk Water Supply Authority ABN75450239876 (Trading as Seqwater).

This email, together with any attachments, is intended for the named recipient(s) only; and may contain privileged and confidential information. If received in error, you are asked to inform the sender as quickly as possible and delete this email and any copies of this from your computer system network.

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Please consider the environment before printing this email.

From: Reilly Bob [redacted]
Sent: Monday, 14 February 2011 12:16 PM
To: Bradley John
Cc: Best Debbie; [redacted] Allen Peter; [redacted]
Subject: RE: Update on Governor in Council Process - and Draft ROP amendment.

Hi everyone

I discussed the matter with Peter Borrows at 7.15 am this morning.

Peter undertook to reconsider whether a variable, rather than uniform, approach should be taken to discharges under the Interim Program, for flood events. He also agreed to consider how possible inconsistencies between the size of releases under the Interim program and initial releases under the Flood Manual would be handled--one approach would be to seek a variation to the Flood Manual procedures in specific cases, where warranted. Peter would advise us once Seqwater has considered its position on these matters.

I have also asked the Grid Manager (Dan Spiller) to consider whether the releases to lower the level to75% should be treated as an event under the draft Communication Protocol covering Wivenhoe/Somerset floodwater releases. Dan will discuss this matter with Seqwater.

Regards

Bob

-----Original Message-----
From: Bradley John
Sent: Sunday, 13 February 2011 5:24 PM
To: [redacted]
Cc: Best Debbie; Reilly Bob; [redacted] Allen Peter
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

Debbie/[redacted]

Can your team pls check these issues directly with seqwater asap, so the Interim Program is right when lodged.

Thanks
JB

----- Original Message -----
From: [redacted]
Sent: Sunday, February 13, 2011 04:13 PM
To: Bradley John
Cc: Best Debbie; Reilly Bob; [redacted] Allen Peter
Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.

Hi John

Please see Bob and Lyalls comments below. Suggest if we intend to follow the outlined draft amendment to the interim program we need to prepare responses to the issues raised by Bob

[redacted]

N172

[redacted]

----- Original Message -----
From: [redacted]
To: Douglas Penny; [redacted]
Cc: Allen Peter; Reilly Bob; Best Debbie
Sent: Sun Feb 13 15:07:56 2011
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

[redacted]

Not an issue that needs to be resolved today, but I didn't think there was any room for further negotiation on this. If Bob and Peter have concerns about SEQwater's proposal, I suggest that you talk to the Dg with a view to arranging further discussions with SEQwater on Monday.

[redacted]

----- Original Message -----
From: [redacted]
To: [redacted]
Cc: Allen Peter; Reilly Bob; Best Debbie
Sent: Sun Feb 13 12:29:01 2011
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

[redacted]

Please see Bob's comments below. I am not sure of the timing but is this an issue that needs to be sorted today or do we have a bit more time.

[redacted]

-----Original Message-----
From: Reilly Bob
Sent: Sunday, 13 February 2011 12:10 PM
To: [redacted] Allen Peter
Cc: Best Debbie
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

Hi everyone

It could be desirable if the proposed interim program is adjusted to allow for the equivalents of w1c to w1e, but with an "initiation level"
of 64 rather than 67 m e.g. Once the lake level reaches 65 m have a maximum release of 1,900 cumecs.

Also the proposed interim program would, on my understanding--and I could be wrong, potentially result in a reduction of releases once 67.25m (but below 67.5.)is reached--if I am correct, this may appear a bit odd to some people.

Regards

Bob

----- Original Message -----
From: [redacted]
To: Reilly Bob; Allen Peter
Sent: Sun Feb 13 09:05:15 2011
Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.

Fyi

----- Original Message -----
From: Bradley John
To: Bradley John; [redacted]
Cc: Best Debbie; [redacted]
Sent: Sun Feb 13 08:49:22 2011
Subject: RE: Update on Governor in Council Process - and Draft ROP amendment.

Further to last - as provided to Min Robertson for info

From: Bradley John
Sent: Sunday, 13 February 2011 8:48 AM
To: 'stephen.robertson[redacted]
Cc: [redacted] Best Debbie
Subject: FW: Draft interim program wording

FYI

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]
<mailto[redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

DRAFT AMENDMENT TO THE INTERIM PROGRAM - APPROVED BY DG DERM AFTER ROP IS AMENDED.

Seqwater will, between 14 February and 31 March 2011 ("2011 Summer Season") and subject to the operational constraints specified below, make the following releases from infrastructure -

(a) the volume necessary to initially reduce Wivenhoe Dam to the Interim Supply Security Level; and

(b) volumes necessary to reduce back to the Interim Supply Security Level, where inflows occur during the 2011 Summer Season that take the Wivenhoe Dam level to between the Interim Supply Security Level and the Full Supply Level.

The releases specified in (a) and (b) will only be made where releases can be undertaken at a rate such that Burtons Bridge remains trafficable.

If, after releases specified in (a) or (b) have commenced, the level in Wivenhoe Dam exceeds 67.25 m AHD and a flood event is declared, the dam will be operated in accordance with the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam. Once the flood event has ended and the dam level is brought back to the Full Supply Level, the releases specified in (a) and (b) would be recommenced.

For the purpose of the above, "Interim Supply Security Level" means 64 m AHD.

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]
<mailt[redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sent: Sunday, 13 February 2011 8:47 AM
To: [redacted]
Cc: Best Debbie; [redacted]
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

[redacted]et al,

Pls note below, let me know if any problem with delivering execution copy at 8.30 AM tomorrow to Min R's office (needs to be through me by then - but that should be a formality.

Thanks for your efforts this weekend

John Bradley

Director-General

Department of Environment and Resource Management

'elephone:[redacted]

Email: [redacted]
<mailt[redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sent[redacted]uary 2011 8:44 AM
'o:[redacted]'stephen.robertson[redacted]
Cc: Best Debbie
Subject: Update on Governor in Council Process - and Draft ROP amendment.

Ministe[redacted]

Just for information -

1. I am liaising with [redacted] about the Governor In Council process.

N176

*   It will be you attending plus one other Minister.

*   We are currently planning on having the ECM to your office by 8.30 AM Monday - does this timeframe suit Min Robertson to get an early signature to allow to go to Governor early in the day in advance.

2.   The current draft of the ROP amendment is attached below. Please note that:

*   The ROP amendment itself won't specify the 75 pc level. It will allow the DERM DG to approve an amendment to the current "Interim Program" which Seqwater already has in place under the ROP specifying how dam will be managed.

*   Only the ROP amendment (not the Interim Program) needs to be approved by Governor-I-C. It is just one sentence (see below) inserting a new subsection 6(A) into section 13 of the ROP.

3.   I will send through a copy of the interim program in a separate email now.

Thanks

John B

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]
<mailt[redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sent: Sunday, 13 February 2011 8:22 AM
To: Ken Smith
Subject: FW: draft ROP amendment wording

Ken

As promised - the proposed amendment to the ROP inserts a new subsection (6A) to section 13 of the ROP.

See below -

13 Interim program

(1) The chief executive and the resource operations licence holder must implement requirements of this plan as soon as is practical within the timeframes stated below.

(2) Subsections 3 to 11 apply where a resource operations licence holder is unable to meet the requirements of this plan on the day this plan commences.

(3) The resource operations licence holder must-

(a) within 2 months of commencement of this plan, submit a statement of programs currently in existence, to the chief executive for approval; and

(b) within 6 months of commencement of this plan, submit a program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

(4) The resource operations licence holder may, where an emergency or operational incident results in an inability to comply with any rules or requirements of this plan, submit an interim program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

(5) Where the submitted program relates to the Water Monitoring Data Collection Standards, the program must include the accuracy of methods currently used.

(6) The chief executive, in considering any submitted program, may request additional information.

Section 6A

Despite anything in subsections (2), (3) or (4), a resource operations licence holder with an approved interim program may submit to the chief executive a revised program for consideration under subsection (7).

(7) The chief executive, in considering any submitted program, may either-

(a) approve the program with or without conditions;

(b) amend and approve the amended program; or

(c) require the resource operations licence holder to submit a revised program.

(8) Within 10 business days of making a decision on a program submitted under this section, the chief executive must notify the resource operations licence holder of the decision.

(9) Following approval of the program by the chief executive, the resource operations licence holder must-

(a) implement and operate in accordance with the approved program; and

(b) make public details of the approved program on their internet site.

+---+
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3 sheets of A4 paper = 1 litre of water
+---+

Litsupport Brisbane

From: Dan Spiller
Sent: Monday, 14 February 2011 1:03 PM
To: Best Debbie
Subject: Fwd: Update on Governor in Council Process - and Draft ROP amendment.

This is worth a 30 sec conversation if and when you have the time.

Dan

Begin forwarded message:

> **From:** Reilly Bob [redacted]
> **Date:** 14 February [redacted]
> **To:** Bradley Joh[redacted] Allen
> Peter [redacted] Spille[redacted]
> Dean [redacted]
> **Subject: RE: Update on Governor in Council Process - and Draft ROP amendment.**
>
> Hi everyone
>
> I discussed the matter with Peter Borrows at 7.15 am this morning.
>
> Peter undertook to reconsider whether a variable, rather than uniform, approach should be taken to discharges under the Interim Program, for flood events. He also agreed to consider how possible inconsistencies between the size of releases under the Interim program and initial releases under the Flood Manual would be handled--one approach would be to seek a variation to the Flood Manual procedures in specific cases, where warranted. Peter would advise us once Seqwater has considered its position on these matters.
>
> I have also asked the Grid Manager (Dan Spiller) to consider whether the releases to lower the level to75% should be treated as an event under the draft Communication Protocol covering Wivenhoe/Somerset floodwater releases. Dan will discuss this matter with Seqwater.
>
> Regards
>
> Bob
>
> -----Original Message-----
> From: Bradley John
> Sent: Sunday, 13 February 2011 5:24 PM
> To: [redacted]

Cc: Best Debbie; Reilly Bob[redacted]Allen Peter
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

Debbie[redacted]

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Thanks
JB

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Hi John

Please see Bob and[redacted]comments below. Suggest if we intend to follow the outlined draft amendment to the interim program we need to prepare responses to the issues raised by Bob

[redacted]

----- Original Message -----
From:[redacted]
To:[redacted]
Cc: Allen Peter; Reilly Bob; Best Debbie
Sent: Sun Feb 13 15:07:56 2011
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

[redacted]

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[redacted]

----- Original Message -----
From:[redacted]
To:[redacted]

N181

Cc: Allen Peter; Reilly Bob; Best Debbie
Sent: Sun Feb 13 12:29:01 2011
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

[redacted]

Please see Bob's comments below. I am not sure of the timing but is this an issue that needs to be sorted today or do we have a bit more time.

[redacted]

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From: Reilly Bob
Sent: [redacted]ruary 2011 12:10 PM
To: [redacted] Allen Peter
Cc: Best Debbie
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

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Also the proposed interim program would, on my understanding--and I could be wrong, potentially result in a reduction of releases once 67.25m (but below 67.5.)is reached--if I am correct, this may appear a bit odd to some people.

Regards

Bob

----- [redacted] -----
From: [redacted]
To: Reilly Bob; Allen Peter
Sent: Sun Feb 13 09:05:15 2011
Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.

Fyi

----- Original Message -----
From: Bradley John
To: Bradley John; [redacted]
Cc: Best Debbie; [redacted]

N182

Sent: Sun Feb 13 08:49:22 2011
Subject: RE: Update on Governor in Council Process - and Draft ROP amendment.

Further to last - as provided to Min Robertson for info

From: Bradley John
Sent: Sunday, 13 February 2011 8:48 AM
To: 'stephen.robertson[redacted]
Cc: [redacted]
Subject: FW: Draft interim program wording

FYI

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

Email: [redacted]
<mailt[redacted]

www.derm.qld.gov.au <http://www.derm.qld.gov.au>

Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

DRAFT AMENDMENT TO THE INTERIM PROGRAM - APPROVED BY DG DERM AFTER ROP
IS AMENDED.

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For the purpose of the above, "Interim Supply Security Level" means 64 m AHD.

John Bradley

Director-General

Department of Environment and Resource Management

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400 George Street, Brisbane Q 4000

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From: Bradley John
Sent: Sunday, 13 February 2011 8:47 AM
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Cc: Best Debbie; [redacted]
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

[redacted] et al,

Pls note below, let me know if any problem with delivering execution copy at 8.30 AM tomorrow to Min R's office (needs to be through me by then - but that should be a formality.

Thanks for your efforts this weekend

John Bradley

Director-General

Department of Environment and Resource Management

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Department of Environment and Resource Management

400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sent: Sunday, 13 February 2011 8:44 AM
To: [redacted] stephen.robertson[redacted]

N185

Cc: Best Debbie
Subject: Update on Governor in Council Process - and Draft ROP amendment.

Minister, [redacted]

Just for information -

1. I am liaising with [redacted] about the Governor In Council process.

* It will be you attending plus one other Minister.

* We are currently planning on having the ECM to your office by 8.30 AM Monday - does this timeframe suit Min Robertson to get an early signature to allow to go to Governor early in the day in advance.

2. The current draft of the ROP amendment is attached below. Please note that:

* The ROP amendment itself won't specify the 75 pc level. It will allow the DERM DG to approve an amendment to the current "Interim Program" which Seqwater already has in place under the ROP specifying how dam will be managed.

* Only the ROP amendment (not the Interim Program) needs to be approved by Governor-I-C. It is just one sentence (see below) inserting a new subsection 6(A) into section 13 of the ROP.

3. I will send through a copy of the interim program in a separate email now.

Thanks

John B

John Bradley

Director-General

Department of Environment and Resource Management

Telephone: [redacted]

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400 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sent: Sunday, 13 February 2011 8:22 AM
To: Ken Smith
Subject: FW: draft ROP amendment wording

Ken

As promised - the proposed amendment to the ROP inserts a new subsection (6A) to section 13 of the ROP.

See below -

N187

13 Interim program

(1) The chief executive and the resource operations licence holder must implement requirements of this plan as soon as is practical within the timeframes stated below.

(2) Subsections 3 to 11 apply where a resource operations licence holder is unable to meet the requirements of this plan on the day this plan commences.

(3) The resource operations licence holder must-

(a) within 2 months of commencement of this plan, submit a statement of programs currently in existence, to the chief executive for approval; and

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(4) The resource operations licence holder may, where an emergency or operational incident results in an inability to comply with any rules or requirements of this plan, submit an interim program for meeting the requirements of this plan to the chief executive for approval, including a timetable and interim methods to be used.

(5) Where the submitted program relates to the Water Monitoring Data Collection Standards, the program must include the accuracy of methods currently used.

(6) The chief executive, in considering any submitted program, may request additional information.

Section 6A

Despite anything in subsections (2), (3) or (4), a resource operations licence holder with an approved interim program may submit to the chief executive a revised program for consideration under subsection (7).

(7) The chief executive, in considering any submitted program, may either-

(a) approve the program with or without conditions;

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(c) require the resource operations licence holder to submit a revised program.

(8) Within 10 business days of making a decision on a program submitted under this section, the chief executive must notify the resource operations licence holder of the decision.

(9) Following approval of the program by the chief executive, the resource operations licence holder must-

(a) implement and operate in accordance with the approved program; and

(b) make public details of the approved program on their internet site.

Litsupport Brisbane

From: Reilly Bob [redacted]
Sent: Monday, 14 February 2011 3:37 PM
To: Best Debbie; [redacted]
Cc: [redacted] Allen Peter; Dan Spiller
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

Hi Debbie, [redacted]

Further to my email below, I have checked with Seqwater on progress.
Peter Borrows is unavailable, but may get back to me some time after 5pm today.

As I am unclear on your time constraints, you may wish to contact Seqwater direct, if this appears desirable, given that it a ROP-related regulatory decision. (Also, if time is pressing, another strategy may be to proceed with the current proposal for the initial reduction to 75%, and deal with what will be done in an actual flood event over the next week)

Regards

Bob

-----Original Message-----
From: Reilly Bob
Sent: Monday, 14 February 2011 12:16 PM
To: Bradley John
Cc: Best Debbie; [redacted] Allen Peter; spiller daniel @ SEQWGM; [redacted]
Subject: RE: Update on Governor in Council Process - and Draft ROP amendment.

Hi everyone

I discussed the matter with Peter Borrows at 7.15 am this morning.

Peter undertook to reconsider whether a variable, rather than uniform, approach should be taken to discharges under the Interim Program, for flood events. He also agreed to consider how possible inconsistencies between the size of releases under the Interim program and initial releases under the Flood Manual would be handled--one approach would be to seek a variation to the Flood Manual procedures in specific cases, where warranted. Peter would advise us once Seqwater has considered its position on these matters.

I have also asked the Grid Manager (Dan Spiller) to consider whether the releases to lower the level to75% should be treated as an event under the draft Communication Protocol covering Wivenhoe/Somerset floodwater releases. Dan will discuss this matter with Seqwater.

Regards

Bob

-----Original Message-----
From: Bradley John
Sent: Sunday, 13 February 2011 5:24 PM
To: [redacted]

N190

Cc: Best Debbie; Reilly Bob; [redacted] Allen Peter
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

Debbie[redacted]

Can your team pls check these issues directly with seqwater asap, so the Interim Program is right when lodged.

Thanks
JB

----- [redacted]ge -----
From: [redacted]
Sent: Sunday, February 13, 2011 04:13 PM
To: Bradley John
Cc: Best Debbie; Reilly Bob; [redacted] Allen Peter
Subject: Fw: Update on Governor in Council Process - and Draft ROP amendment.

Hi John

Please see Bob and [redacted] comments below. Suggest if we intend to follow the outlined draft amendment to the interim program we need to prepare responses to the issues raised by Bob

[redacted]

----- Original Message -----
From: [redacted]
To: [redacted]
Cc: Allen Peter; Reilly Bob; Best Debbie
Sent: Sun Feb 13 15:07:56 2011
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

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Sent: Sun Feb 13 12:29:01 2011
Subject: FW: Update on Governor in Council Process - and Draft ROP amendment.

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[redacted]

N191

[redacted]

-----Original Message-----
From: Reilly Bob
Sent: Sunday, 13 February 2011 12:10 PM
To: [redacted] Allen Peter
Cc: Best Debbie
Subject: Re: Update on Governor in Council Process - and Draft ROP amendment.

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Also the proposed interim program would, on my understanding--and I could be wrong, potentially result in a reduction of releases once 67.25m (but below 67.5.)is reached--if I am correct, this may appear a bit odd to some people.

Regards

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Cc: Best Debbie
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N195

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John B

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Subject: FW: draft ROP amendment wording

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[redacted]

From: Reilly Bob [redacted]
Sent: Monday, 14 February 2011 5:32 PM
To: Peter Borrows
Cc: [redacted] Jim Pruss; [redacted] Allen Peter; Best Debbie; Dan Spiller
Subject: RE: Draft interim program wording
Attachments: image003.jpg; image004.jpg

Categories: T14: Continuation

Hi Peter

Thanks

Bob

From: Peter Borrows [redacted]
Sent: Monday, 14 February 2011 4:52 PM
To: Reilly Bob
Cc: [redacted] Jim Pruss
Subject: FW: Draft interim program wording

Bob.

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Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

Ph[redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: [redacted]
Sent: Monday, 14 February 2011 4:37 PM
To: Peter Borrows
Subject: FW: Draft interim program wording

Peter – in case Bob needs to know who we have been dealing with over the weekend
[redacted]

From: [redacted]
Sent: Saturday, 12 February 2011 4:43 PM
To: [redacted]
Subject: Draft interim program wording

[redacted]

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I note this draft text is subject to further review and instructions.

Regards

[redacted]
Partner
Allens Arthur Robinson
[redacted]

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[redacted]

From: Dan Spiller
Sent: Monday, 14 February 2011 7:45 PM
To: 'Reilly Bob'
Subject: RE: Draft interim program wording
Attachments: image001.jpg; image002.jpg

Categories: T14: Continuation

Thanks Bob. Was there an attachment or is [redacted] referring to the email chain?

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Sent: Monday, February 14, 2011 5:32 PM
To: Peter Borrows
Cc: [redacted] Jim Pruss; [redacted] Allen Peter; Best Debbie; Dan Spiller
Subject: RE: Draft interim program wording

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Thanks

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Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

N202

seqwater

Ph[redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: [redacted]
Sent: Monday, 14 February 2011 4:37 PM
To: Peter Borrows
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N203

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Litsupport Brisbane

From: Reilly Bob [redacted]
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To: Dan Spiller
Subject: Re: Draft interim program wording

Hi dan

I think peter was referring to the email that was below his.

Regards

Bob

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From: Dan Spiller [redacted]
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Sent: Mon Feb 14 19:45:20 2011
Subject: RE: Draft interim program wording

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N205

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For the purpose of the above, "Interim Supply Security Level" means 64 m AHD.

While all care has been taken, the SEQ Water Grid Manager disclaims all liability for loss or damage to person or property arising from this message being infected by a computer virus or other contamination. Unless stated otherwise, this email represents only the views of the sender and not the views of the SEQ Water Grid Manager and/or the Queensland Government.

[redacted]

From: [redacted]
Sent: Tuesday, 15 February 2011 8:07 AM
To: Dan Spiller
Subject: Timing and flood levels

Categories: T14: Continuation

Hello Dan,

Can you please advise on the 9 “flood levels” modelled for Wivenhoe and the additional flood capacity to be provided during 7-12 March if the probability of the next major event is confirmed at that time?

Kind regards,

[redacted]
Principal Project Officer - Regional Water Supplies, DERM | Level 11, 400 George St | GPO Box 2454 | Brisbane, QLD 4001 | [redacted]

[redacted]

From: [redacted]
Sent: Tuesday, 15 February 2011 9:07 AM
To: Dan Spiller
Subject: RE: Timing and flood levels

Thanks Dan.

Cheers,

[redacted]
Principal Project Officer - Regional Water Supplies, DERM | Level 11, 400 George St | GPO Box 2454 | Brisbane, QLD 4001 [redacted]

From: Dan Spille [redacted]
Sent: Tuesday, 15 February 2011 8:48 AM
To: [redacted]
Cc:
Subject: RE: Timing and flood levels

[redacted]

The modelling was done by Seqwater, which provided recommendations to the Minister.

[redacted] may be able to assist.

Regards,
Dan

From: [redacted]
Sent: Tuesday, 15 February 2011 8:07 AM
To: Dan Spiller
Subject: Timing and flood levels

Hello Dan,

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Kind regards,

[redacted]

Principal Project Officer - Regional Water Supplies, DERM | Level 11, 400 George St | GPO Box 2454 | Brisbane, QLD 4001 | T: [redacted]

N211

+--+

[redacted]

From: [redacted]
Sent: Tuesday, 15 February 2011 9:07 AM
To: Dan Spiller
Subject: RE: Timing and flood levels

Categories: T14: Continuation

Thanks Dan.

Cheers,

[redacted]

Princip[redacted]r Supplies, DERM | Level 11, 400 George St | GPO Box 2454 | Brisbane, QLD 4001 | [redacted]

From: Dan Spiller [redacted]
Sent: Tuesday, 15 February 2011 8:48 AM
To: [redacted]
Cc: [redacted]
Subject: RE: Timing and flood levels

[redacted]

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[redacted] may be able to assist.

Regards,
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Subject: Timing and flood levels

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Kind regards,

[redacted]

Principal Project Officer - Regional Water Supplies, DERM | Level 11, 400 George St | GPO Box 2454 | Brisbane, QLD 4001 [redacted]

+--+

N213

Think B4U Print

1 ream of paper = 6% of a tree and 5.4kg CO2 in the atmosphere

3 sheets of A4 paper = 1 litre of water

+--+

[redacted]

From: Barry Dennien
Sent: Wednesday, 16 February 2011 4:08 PM
To: Dan Spiller
Subject: FW: Re North Pine Dam
Attachments: image001.jpg; image002.png; image003.jpg

Categories: T14: Continuation

From: Peter Borrows [redacted]
Sent: Wednesday, 16 February 2011 3:49 PM
To: Barry Dennien
Cc: Peter Borrows
Subject: RE: Re North Pine Dam

Barry, to confirm, I had asked how low can you go from a water supply security perspective in NPD. I had not nominated a percentage.

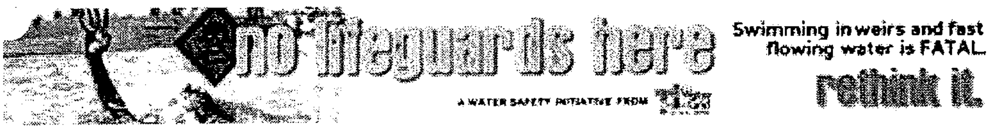
I'm still interested in your advice as to how low would be satisfactory from a Water Supply security perspective.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

Ph[redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au



From: Barry Dennien [redacted]
Sent: Wednesday, 16 February 2011 3:36 PM
To: Peter Borrows
Subject: RE: Re North Pine Dam

Peter

Thats OK I can recall the email, it is not in the post as yet.

I will wait your response.

N215

Barry

From: Peter Borrows [redacted]
Sent: Wednesday, 16 February 2011 3:32 PM
To: Barry Dennien
Cc: karen.waldman[redacted]Peter Borrows; Jim Pruss
Subject: RE: Re North Pine Dam

Hello Barry.

I just referred to my notes of our conversation last Friday in relation to North Pine. I had indicated that we had not been asked anything in particular at this stage, however, in case we were, the question I asked was how low could NPD be lowered from a Water Supply Security perspective, noting that it currently does not have any flood mitigation capacity and was not designed with flood mitigation capability.

At that stage, and this is still the case, we have not completed modelling – we are only in initial stages.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater

Ph [redacted]
Le[redacted]
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: [redacted] **On Behalf Of** Barry Dennien
Sent: Wednesday, 16 February 2011 3:21 PM
To: Peter Borrows
Cc: 'karen.waldman[redacted]
Subject: Re North Pine Dam

Peter

As per your request, please find attached our letter of response. A copy has been forwarded to the Queensland Water Commission.

Regards

Barry Dennien
Chief Executive Officer

N216

SEQ W[redacted]
Phone[redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

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From: Barry Dennien [redacted]
Sent: Wednesday, February 16, 2011 4:08 PM
To: Dan Spiller [redacted]
Subject: FW: Re North Pine Dam

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To: Barry Dennien
Cc: Peter Borrows
Subject: RE: Re North Pine Dam

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Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

Ph[redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: Barry Dennien[redacted]
Sent: Wednesday, 16 February 2011 3:36 PM
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Barry

From: Peter Borrows[redacted]
Sent: Wednesday, 16 February 2011 3:32 PM
To: Barry Dennien
Cc: karen.waldma[redacted]Peter Borrows; Jim Pruss

Subject: RE: Re North Pine Dam

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At that stage, and this is still the case, we have not completed modelling – we are only in initial stages.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

Ph [redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: [redacted] **On Behalf Of** Barry Dennien
Sent: Wednesday, 16 February 2011 3:21 PM
To: Peter Borrows
Cc: 'karen.waldma[redacted]
Subject: Re North Pine Dam

Peter

As per your request, please find attached our letter of response. A copy has been forwarded to the Queensland Water Commission.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
Phone: [redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

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From: Barry Dennien [redacted]
Sent: Thursday, February 17, 2011 8:52 AM
To: [redacted]
Cc: Dan Spiller [redacted]
Subject: FW: Re North Pine Dam
Attach: ATT00001.htm; cidimage003.png@01CB0654.C3081F20; ATT00002.htm; cidimage008.png@01CB8736.F84905B0; ATT00003.htm; cidimage003.png@01CB0654.C3081F20; ATT00004.htm; cidimage008.png@01CB8736.F84905B0; ATT00005.htm

---

[redacted]

Please TRIM and file

From: Barry Dennien
Sent: Thursday, 17 February 2011 7:39 AM
To: Peter Borrows
Subject: Re: Re North Pine Dam

Peter

We have modeled 25% and security is within our compliance limits.

If you require any further supply volume for flood storage please let us know.

Regards
Barry Dennien

On 16/02/2011, at 3:49 PM, Peter Borrows [redacted] wrote:

Barry, to confirm, I had asked how low can you go from a water supply security perspective in NPD. I had not nominated a percentage.

Iâ€™m still interested in your advice as to how low would be satisfactory from a Water Supply security perspective.

Regards, Peter.

Peter Borrows

Chief Executive Officer

Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

N223

Ph [redacted]

Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002

Website | www.seqwater.com.au

no lifeguards here

A WATER SAFETY INITIATIVE FROM

Swimming in weirs and fast flowing water is FATAL.

rethink it.

From: Barry Dennien[redacted]
Sent: Wednesday, 16[redacted]
To: Peter Borrows
Subject: RE: Re North Pine Dam

Peter

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I will wait your response.

Barry

From: Peter Borrows[redacted]
Sent: Wednesday, 16 February 2011 3:32 PM
To: Barry Dennien
Cc: karen.waldman[redacted] Peter Borrows; Jim Pruss
Subject: RE: Re North Pine Dam

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no lifeguards here
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Swimming in weirs and fast flowing water is FATAL.
rethink it.

From: [redacted] **On Behalf Of** Barry Dennien
Sent: Wednesday, 16 February 2011 3:21 PM
To: Peter Borrows [redacted]
Cc: 'karen.waldman[redacted]
Subject: Re North Pine Dam

Peter

As per your request, please find attached our letter of response. A copy has been forwarded to the Queensland Water Commission.

Regards

Barry Dennien

Chief Executive Officer

SEQ Water Grid Manager

Phone: [redacted]

Email: [redacted]

Visit: Level 15, 53 Albert Street, Brisbane

Post: PO Box 16205, City East Qld 4002

ABN: 14783 317 630

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Litsupport Brisbane

From:	Rob Drury [redacted]
Sent:	Monday, 28 February 2011 2:23 PM
To:	Rob Drury; Dan Spiller; SEQWGM Emergency
Cc:	Peter Borrows; Jim Pruss; [redacted] Mike Foster
Subject:	RE: Technical Report W74
Attachments:	Technical_Situation_Report_W74.docx

Attached is Technical Report W74 advising of extension of releases strategy to Wednesday afternoon.

Rob

TECHNICAL SITUATION REPORT

TSR Number	W74	Date of TSR release	28.2.11	Time of TSR release	2.00pm

Seqwater status of inflows and dam operations

Current status but could change based on inflows or rainfall.

Current objectives	• Reduce level in Wivenhoe dam to 75%
Strategy	• Initiate low level releases at around 350 to 400cumecs. • This will inundate Twin Bridges, Savages and Colleges Crossings. • Maintain access to Burtons bridge • **Extend releases until the afternoon of Wednesday 2nd March 2011**
Key considerations	Storage levels:
	Inflows:
	Rainfall:
	Lockyer/Bremer:
	Brisbane River:

Wivenhoe Dam

- Water releases to reduce Wivenhoe Dam to 75 per cent of Full Supply Level (FSL) commenced Sunday 20 February 2011 at 6.00 am and was scheduled to continue for nine days.
- The 9 day release period to reduce Wivenhoe Dam to 75 per cent of FSL was always dependent on further rainfall across the dam and catchment as well as rainfall downstream.
- Storm activity across the Wivenhoe Dam catchment and Brisbane River catchment below the dam on Monday, 21 February 2011 impacted on the release strategy. Wivenhoe Dam release rates were reduced to allow flows down the Lockyer to sufficiently pass.
- As a result of this storm as of 9.00am Monday 28 February 2011, Wivenhoe Dam had received inflows of up to 40,000 megalitres (or the equivalent of about four per cent capacity) from the surrounding catchment, with minor inflows continuing.
- As of 9.00 am, Monday 28 February 2011, Wivenhoe Dam is 82.2 per cent of full supply level. Wivenhoe Dam FSL has been reduced by total of about 208,000 megalitres.
- Releases have averaged between 350 cumecs to 400 cumecs.
- The current Bureau of Meteorology forecast is for 10-15 millimetres of rainfall until Thursday, 3 March 2011. Storm activity is forecast from Friday, 4 March 2011 with 50-100 millimetres of rainfall forecast over the following four days until Tuesday, 8 March 2011.

Current Strategy

- The nine day release strategy was scheduled to be completed in the morning of Tuesday, 1 March 2011. By this stage, Seqwater estimates Wivenhoe Dam levels will between 79-80 per cent of FSL (depending on further inflows).
- Seqwater estimates the impact of storm activity on Monday 21 February 2011 added at least 36 hours to the release strategy.

- Based on the current BoM forecasts, Seqwater will now be extending the current release strategy for Wivenhoe Dam until close of business, Wednesday, 2 March 2011 to get as close to 75% as possible and so that any ongoing releases do not coincide with potential rainfall events and increased river flows downstream of Wivenhoe Dam. After closure, minor releases only will be made of about 25 to 30 cumecs to get exactly 75% and allow water to be released from Somerset Dam through Wivenhoe.
- By continuing releases until close of business Wednesday, 2 March 2011, Seqwater estimates Wivenhoe Dam will be between 75-77 per cent of FSL.

Impacts

- Somerset Regional Council, Ipswich Regional Council and Brisbane City Council have been consulted and had raised no issues with the extended release strategy.
- Under the extended release strategy it is expected Twin Bridges and Savage's Crossing will no longer by inundated by Thursday, 3 March 2011 and College's Crossing no longer inundated by Friday, 4 March 2011. The extended release strategy has extended inundation time by around 36 hours.
- Local Councils are responsible for road closures as a result of spilling dams or controlled releases.

Seqwater Technical Officer name	Robert Drury
Seqwater Technical Officer position title	Dam Operations Manager
[redacted]	

BoM assessment

(consisting of references to latest Flood Warning for the BrisbaneRiver and other relevant Bureau forecasts and warnings (e.g. weather/rain forecasts, Tropical Cyclone Warning etc) and other updates/comments if needed)

BoM were advised.

BoM Technical Officer name	Peter Baddiley
BoM Technical Officer position title	
BoM Technical Officer contact details	[redacted]

Brisbane City Council(BCC) assessment

(to include predicted local inundation areas and depths of inundation based on the information)

Council has been advised of the current strategy

BCC Technical Officer name	[redacted]
BCC Technical Officer position title	Disaster Operations Manager
BCC Technical Officer contact details	[redacted]

Ipswich City Council (ICC) assessment (if required)

(to include predicted local inundation areas and depths of inundation based on the information)

Council has been advised of the current strategy.

ICC Technical Officer name	Tony Trace
ICC Technical Officer position title	Local Disaster Response Coordinator
ICC Technical Officer contact details	[redacted]

Somerset Regional Council (SRC) assessment (if required)

(to include predicted local inundation areas and depths of inundation based on the information)

Council has been advised of the current strategy.

SRC Technical Officer name	Tony Jacobs
SRC Technical Officer position title	Local Disaster Response Coordinator
SRC Technical Officer contact details	[redacted]

Collated and distributed by (Agency)

Contact Officer signature	
Contact Officer name	Rob Drury
Contact Officer position title	Dam Operations Manager

Next TSR due	Date		Time		or Event	Change

Litsupport Brisbane

From: [redacted]
Sent: Tuesday, 22 March 2011 3:23 PM
To: Dan Spiller
Subject: FW: Letter from [redacted]ater Grid Manager
Attachments: Level3Scanner[redacted]_20110322_151630.pdf

Importance: High

[redacted]
Executive Assistant to Barry Dennien, Chief Executive Officer
SEQ W[redacted]
Phone[redacted]
Email:[redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

Please consider the environment before printing this email. It takes 10 litres of water to make one sheet of A4 paper.

From: [redacted]
Sent: Tuesday, 22 March 2011 3:20 PM
To:[redacted]
Cc:[redacted] Peter Borrows
Sub[redacted]m Seqwater to SEQ Water Grid Manager
Importance: High

Dear Barry,

I refer to the attached letter.

Peter Borrows has asked that I forward this letter to you for your attention – thank you.

Regards,[redacted]

[redacted]
Executive Assistant to the CEO
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

P[redacted]
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

N237

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22 March 2011

Barry Dennien
Chief Executive Officer
South East Queensland Water Grid Manager
PO Box 16205
City East QLD 4002

By email

Dear Mr Dennien,

Request for water security advice - Proposed extension of Interim Program to maintain 75% full supply level at Wivenhoe Dam to 30 June 2011

I refer to your letter dated 9 February 2011 regarding the water security impacts of temporarily lowering the Full Supply Level (***FSL***) of Wivenhoe Dam.

I acknowledge your advice that "from a water security perspective, the SEQ Water Grid Manager has no objection to Wivenhoe Dam being drawn down to 75 per cent of its FSL. The water security implications of a temporary drawdown are unlikely to impact our ability to comply with the *South East Queensland System Operating Plan* or our Grid Contract obligations".

In light of the above advice, Seqwater sought and obtained approval from the Chief Executive of the Department of Environment and Resource Management for an Interim Program to override the operational procedures contained in the Moreton Resource Operations Plan, in order that Seqwater be authorised to undertake releases, on specified terms:

- to reduce the water storage level in Wivenhoe Dam to an "Interim Security Supply Level" being 75% of its FSL from 20 February 2011; and
- to return the dam to the Interim Security Supply Level where inflows occur after the initial reduction, until 31 March 2011.

The relevant authorisation under the approved Interim Program is accordingly due to expire on 31 March 2011.

Seqwater is considering whether to commence discussions with the State regarding an extension to the period that Wivenhoe Dam be kept at the Interim Security Supply Level. The extension of time, if proposed, would be for the period **1 April 2011 to 30 June 2011**.

In view of the dual functionality of the Wivenhoe Dam storage, as both water supply storage and providing capacity for flood mitigation, Seqwater would only progress discussions with the State regarding a further extension of time to the current requirements under the Interim Program on receiving advice from the SEQ Water Grid Manager in relation to short term security, and the Queensland Water Commission in relation to long term security, that such an extension in time would not impact unfavourably on water supply security in SEQ.

Accordingly, Seqwater requests advice from the SEQ Water Grid Manager whether it would object to an extension of time to the temporary draw down to 75% of FSL in Wivenhoe Dam until 30 June 2011. We request that your advice by provided by midday on Monday, 28 March 2011.

Subject to receiving confirmation of supply security in this further advice sought from the SEQ Water Grid Manager and similar advice to be sought from the Queensland Water Commission, Seqwater would consult the Chief Executive of the Department of Environment and Resource Management to ascertain whether he would be likely to approve an extension to the present arrangements under the Interim Program for the Interim Security Supply Level at Wivenhoe Dam to be continued to 30 June 2011. Such an approach to DERM would only be made in circumstances where both the SEQ Water Grid Manager and the Queensland Water Commission have no objection to such a proposal from a water supply security perspective.

Yours sincerely

[redacted]

Peter Borrows
Chief Executive Officer

From:	[redacted]
Sent:	[redacted]2011 4:33 PM
To:	Peter Borrows
Cc:	Barry Dennien; Dan Spille[redacted]
Subject:	Correspondence
Attachments:	Ltr to Seqwater re Wivenhoe Dam at 75% FSL to 30 June 2011.pdf

Good afternoon Mr Borrows

Please find attached letter from Mr Barry Dennien regarding Maintenance of Wivenhoe Dam at 75% full supply level up to 30 June 2011.

The original letter has been mailed out today.

Regards

[redacted]

Executive Assistant to Daniel Spiller
Director Operations
SEQ Water Grid Manager
Phone: [redacted]
Email:
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/11/2127

25 March 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear Mr ~~Borrows~~ Peter

Maintenance of Wivenhoe Dam at 75% full supply level up to 30 June 2011

I refer to your letter dated 22 March 2011 regarding Seqwater's consideration of extending the period in which Wivenhoe Dam is maintained at 75%, from 31 March 2011 to 30 June 2011.

As requested in your letter, to assist Seqwater in deciding whether it makes a recommendation to the Chief Executive of the Department of Environment and Resource Management, we confirm that temporarily maintaining Wivenhoe Dam at 75% up to 30 June 2011, is unlikely to impact on our ability to manage the Water Grid to achieve the desired levels of service and the System Operating Plan's risk criteria. Please note that this is based on information currently available and may be subject to change.

If you have any questions, please contact me on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

PO Box 16205, City East QLD 4002 Tel: +61 7 3247 3012 Fax: +61 7 3405 0373 www.seqwgm.qld.gov.au
ABN: 14 783 317 630

N242

Litsupport Brisbane

From: Dan Spiller
Sent: Monday, 28 March 2011 8:49 AM
To: [redacted]
Subject: FW: Correspondence
Attachments: Ltr to Seqwater re Wivenhoe Dam at 75% FSL to 30 June 2011.pdf

---

From [redacted]
Sent: Friday, 25 March 2011 4:33 PM
To: Peter Borrows
Cc: Barry Dennien; Dan Spiller; [redacted]
Subject: Correspondence

Good afternoon Mr Borrows

Please find attached letter from Mr Barry Dennien regarding Maintenance of Wivenhoe Dam at 75% full supply level up to 30 June 2011.

The original letter has been mailed out today.

Regards

[redacted]
Executive Assistant to Daniel Spiller
Director Operations
SEQ Water Grid Manager
Phone: [redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/11/2127

25 March 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear Mr ~~Borrows~~ Peter

Maintenance of Wivenhoe Dam at 75% full supply level up to 30 June 2011

I refer to your letter dated 22 March 2011 regarding Seqwater's consideration of extending the period in which Wivenhoe Dam is maintained at 75%, from 31 March 2011 to 30 June 2011.

As requested in your letter, to assist Seqwater in deciding whether it makes a recommendation to the Chief Executive of the Department of Environment and Resource Management, we confirm that temporarily maintaining Wivenhoe Dam at 75% up to 30 June 2011, is unlikely to impact on our ability to manage the Water Grid to achieve the desired levels of service and the System Operating Plan's risk criteria. Please note that this is based on information currently available and may be subject to change.

If you have any questions, please contact me on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

N244

[redacted]

From: [redacted]
Sent: Tuesday, 29 March 2011 10:31 AM
To: [redacted] Dan Spiller
Cc: [redacted]
Subject: Re: Modelling assessments

Categories: T14: Continuation

Hi Dan,

[redacted] and I had a discussion this morning about your modelling query - it all makes sense but just wanted to clarify one point for the North Pine scenarios mentioned in section 1 of your email. Are they assuming Wivenhoe is maintained at 75% of its current FSL over the five years from June 2011, or just until end June 2011?

We will be able to send through results by monday at the latest and costs will be of the order of $5,000.

Let us know if this suits,

[redacted]

> On 28/03/2011, at 4:48 PM, Dan Spiller [redacted] wrote:
>
> [redacted]
>
> Our modelling requests are outlined below, further to our discussion.
>
> Base case for comparison is the recently completed modelling of the impact of maintaining Wivenhoe Dam at 75% of its current FSL until end June 2011 (North Pine Dam initially at 95%). At least initially, the high demand forecast should be used. Grant will provide this file.
>
> Changes should be assumed to be operational, unless you advise otherwise. That is, the LOS system yield and drought response triggers should remain unchanged. Permanent changes resulting in changes to LOS would need to be assessed by the QWC. For simplicity, report dam levels as a proportion of the current capacity of the Grid 12 (for example, having draw down Wivenhoe Dam we are currently at 86% of combined capacity).
>
> Infrastructure should be delivered as per the Operating Strategy assumptions (Hinze Dam by mid 2011, NPI Stage 2 by end 2011, Wyaralong Dam WTP and connecting pipelines commissioning in 2015-16).

1. North Pine Dam

Modelling is required of the impact of drawing North Pine Dam down and maintaining it at that level for five years from end June 2011. Modelling should be undertaken for:

- 75% of its current FSL
- 50%
- 25%.

Wivenhoe Dam should be 75% of its FSL at end June 2011.

2. Impact of PRW

Modelling is required of the extent to which earlier use of PRW will offset the impacts of storages continuing to be held at below FSL. PRW should be assumed to be introduced when Grid 12 storages are at:

- 40% of the combined current capacity of Grid 12 storages
- 50%
- 60%.

Over the five years from end June 2011 assume:

- Wivenhoe Dam is held to no more than 75% of its current FSL
- North Pine Dam is held to no more than 50% of its current FSL.

These options should be plotted against the base case and the North Pine at 50% scenario above.

3. Timing

Results are required by the end of the week, if possible. Please advise of the cost involved and confirm the timeframe within which the modelling can be undertaken.

Costs will be from the existing purchase order.

Please call me if you require any further information.

Regards,

Dan

Daniel Spiller

Director, Operations

SEQ Water Grid Manager

Phone: [redacted]

Email: [redacted]

Visit: Level 15, 53 Albert Street Brisbane

Post: PO Box 16205, City East QLD 4002

ABN: 14783 317 630

a computer virus or other contamination. Unless stated otherwise, this email represents only the views of the sender and not the views of the SEQ Water Grid Manager and/or the Queensland Government.

+GILBERT SUTHERLAND

28 March 2011

SEQ Water Grid Manager
PO Box 16205
City East, Qld 4002

Attention: Mr Dan Spiller

Dear Dan,

Re: Permanent reduction of Wivenhoe Dam's Full Supply Level (FSL)

As requested, the following summary presents final outcomes from assessment undertaken looking at permanently reducing the full supply level of Wivenhoe Dam to levels ranging from 90% to 50%. These outcomes have been updated from previous advice sent in February 2011 to include evaporative adjustments to Wivenhoe Dam.

Key assumptions

- Throughout this report, all references to SEQ key storage percent capacity are based on its **current FSL**. This is reflecting the assumption that all operational and contingency triggers are maintained volumetrically based on SEQ current FSL.

- All probabilistic assessments start from end June 2011 and assume initial key SEQ storages at 72% of current combined capacity, including Wivenhoe at 50% and other storages full following the wet season.

- Demands are based on the QWC Strategy baseline: medium series population growth, "rebound" from 2009 recorded consumption levels to 230 L/p/d (residential) by 2018.

Author [redacted]
Our Reference 10505_Wivenhoe permanent reduction assessment (Mar-2011).docx
By ☐ Courier ☑ Email ☐ Facsimile ☐ Post

CAIRNS
KAWANA
ROBINA
BRISBANE
20 /115 Wickham Street
PO Box 694
Fortitude Valley Q4006
Phone 07 3852 3999
Fax 07 3852 3933
brisbane@access.gs

Gilbert and Sutherland Pty Ltd
ABN 56 077 310 840

- Tugun desalination plant is assumed to operate in "mothball" regime with full capacity when key SEQ storages are below 60%, and 4% capacity above 60%.

- PRW is supplied to power stations (assumed constant 80 ML/d), industries (assumed constant 20 ML/d) and irrigators when key SEQ storages are above 40% of capacity. Below 40%, supply to irrigators is cutoff and PRW is supplied to power stations and industries only with remaining PRW added to Wivenhoe Dam.

- Wyaralong Dam constructed without WTP (i.e. no additional supply to grid) in mid 2012

- No Hinze raise

- NPI transfer capacity: 65 ML/d Sunshine Coast to Central when Northern key storages are above 70% of capacity, 65 ML/d Central to Sunshine Coast when Northern key storages are below 40%.

- SRWP transfer capacity: 25 ML/d Gold Coast to Central when Southern key storages are above 40% of capacity, 55 ML/d Central to Gold Coast when Southern key storages are below 40%.

- Wivenhoe to Toowoomba: 10,000 ML/a constant supply

Please note that assumptions regarding the Logan (Wyaralong) and the Gold Coast (Hinze and SRWP) area are based on operating strategy conditions which have been modified since the time the modelling was undertaken. They will be updated in accordance with latest operating strategy in all future modelling, however for this exercise we do not anticipate these differences to significantly affect the outcomes presented below.

Key outcomes

Final results are in line with preliminary results suggesting that permanent FSL reduction of Wivenhoe would have a greater impact on the security of the grid than temporary reduction, with effects persisting in the medium to long term (beyond initial memory of the system). Probability of SEQ falling to T1 is simulated to increase from 3.6% for 100% FSL scenario, to 10.7% for 70% FSL scenario and 23.8% for 50% FSL scenario. The following table and figures summarise these outcomes.

+GILBERT SUTHERLAND

Wivenhoe FSL	Esimated probability of SEQ key storages falling to trigger within 10 years	
	T1	T2
100%	3.6%	0.6%
90%	5.0%	0.8%
80%	7.2%	1.2%
70%	10.7%	1.8%
50%	23.8%	4.5%

Table 1 Estimated impact of Wivenhoe permanent FSL reduction on probability of SEQ key storages falling to T1 and T2 trigger levels within 10 years from June 2011

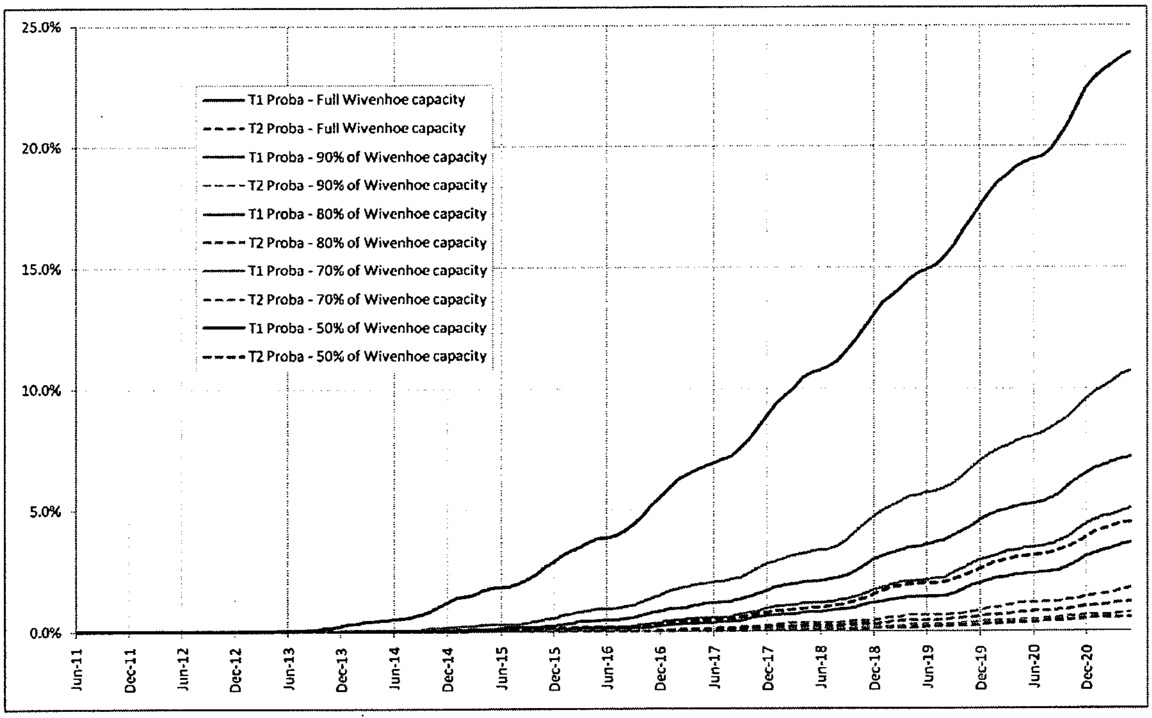

Figure 1 Estimated probability of SEQ key storages falling to T1 and T2 trigger levels, Jul-2011 to Jun-2021

These results suggest that maintaining Wivenhoe at 70% of its current FSL would increase the likelihood of having to construct contingency infrastructure within 10 years by a factor of 3 (i.e. .from 0.6% to 1.8%). An important point to note is that within the context of the economic and social consequences of this event, this increase in risk is potentially highly significant.

GILBERT SUTHERLAND

We trust this is acceptable, however please feel free to contact us should you require any clarifications.

Yours sincerely,

[redacted]
Director/Principal Water Resource Engineer
B.E.(Civil)(Hons)/B.Nat.Res. RPEQ, MIEAust

[redacted]
Water Resource Engineer
BEng MSc(EnvEng)

SEQ Water Grid manager

Memorandum

TRIM reference: D/11/2083	Date: 26 March 2011
To: Daniel Spiller, Director, Operations	
From: [redacted] Water Engineer	
Subject: Modelling security implications of continuing to operate Wivenhoe Dam at 75% until 30 June 2011.	

Purpose

To provide advice on the water security implications of drawing down Wivenhoe Dam to 75% and continuing to maintain this level for the period up to 30 June 2010.

Background

Seqwater have previously received approval from the Department of Environment and Resource Management to maintain the operational level of Wivenhoe at 75% of Full Supply Level. This applies to the period up to 31 March 2011. Seqwater have released water to reach close to 75% and will continue to release water as needed to maintain this level up to 31 March 2011.

Prior to this occurring the WGM provided advice as to the water security implications of releasing this water and the impact on our ability to meet the risk criteria in the SOP. WGM advice was that the water security objectives outlined in the SOP could be met under the proposed lowering of Wivenhoe Dam.

On 22 March 2011 Seqwater wrote to the WGM seeking further advice on the implications on water security should this mode of operation continue until 30 June 2011.

When Seqwater first asked for advice in February 2011 for releases to maintain a level of 75% until 31 March 2011, the potential flood mitigation benefits were raised. The advice in this memorandum is provided in the context that Seqwater's position continues to be that there are ongoing flood mitigation benefits from maintaining Wivenhoe Dam at 75% until 31 June 2011.

Current status

WathNet modelling undertaken for the March 2011 Draft Operating Strategy shows that the proposed operational philosophy for the Water Grid met the risk criteria including maintaining Wivenhoe Dam at 75% of its full supply level. For the Operating Strategy further runs were undertaken based on the same runs starting in June simulating the effect of reaching winter without receiving inflows required to refill Wivenhoe Dam. The probability of reaching T1 and T2 under all of these runs met the SOP risk criteria.

To assess the security implications of the latest proposal from Seqwater two additional cases were undertaken to determine the implications of continuing to maintain Wivenhoe at 75%

N253

until the end of June 2011. These were based on the runs undertaken for the recently submitted Operating Strategy to ensure consistency in results for comparison purposes.

Cases are described below:

Case 1:
Operating Strategy compliance run based on **low demand scenario**, initial storage volumes based on current storage levels as listed on Seqwater's website (as at Feb 2011) except for Wivenhoe at 75% and North Pine at 95%. Start date was **March 2011**.

Case 2:
Operating Strategy compliance run based on **high demand scenario**, initial storage volumes based on current storage levels as listed on Seqwater's website (as at Feb 2011) except for Wivenhoe at 75% and North Pine at 95%. Start date was **March 2011**.

Case 3:
Based on case 1 except the start date was **July 2011**.

Case 4:
Based on case 2 except the start date was **July 2011**.

Regional risk statistics

Table 1: System Operating Plan Rules

Trigger	1 year	3 years	5 years
T1	<0.2%	Not specified	<5%
T2	Not specified	<0.5%	<1%

Table 2: Case 1 - Low Demand Operating Strategy Run Wivenhoe at 75% - March 2011 start

Trigger	1 year	3 years	5 years
T1	0	0.01%	0.03%
T2	0	0	0

Table 3: Case 2 - High Demand Operating Strategy Run Wivenhoe at 75% - March 2011

Trigger	1 year	3 years	5 years
T1	0	0.03	0.40%
T2	0	0	0.01%

Table 4: Case 3 - Low Demand Scenario Start Wivenhoe at 75% - 1 July start

Trigger	1 year	3 years	5 years
T1	0	0	0.02%
T2	0	0	0

Table 5: Case 4 - High Demand Scenario 1 July Start Wivenhoe at 75% - 1 July start

Trigger	1 year	3 years	5 years
T1	0	0.04%	0.46%
T2	0	0	0.02%

Preliminary results show that the probability of reaching 40% and 30% in regional storages is slightly increased by continuing to operate Wivenhoe Dam at 75% until 31 June 2011. The resulting probabilities are still within the requirements of the risk criteria outlined in the System Operating Plan.

The Level of Service Assessment is not conducive to undertaking a temporary reduction of starting level in Wivenhoe Dam. The agreed initial levels for all storages when running the SEQ Regional Water Balance Model to test long term security objectives is 75% to ensure the results aren't skewed by the starting levels. The long term runs are intended to assess the performance of the system over time scales longer than should be affected by the initial "system memory" associated with starting levels such as those discussed as part of this paper.

The long term model runs undertaken for the Operating Strategy submitted to QWC in March 2011 showed the levels of service objectives are met.

Specific long term runs for the continued, temporary maintenance of the operation of Wivenhoe Dam at 75% have not been undertaken.

Other Issues not covered as part of this assessment

Real inflow

While the probabilities of reaching specified levels where restrictions are implemented and new infrastructure is triggered are within stated values as per the SOP, the issues not contemplated by this assessment are one of consequence and timing of the inflows.

Should there be a similar drought event to the event from which we have just recovered (the Millennium Drought), the drawdown of Wivenhoe Dam will have significant impacts on the needs and timing of future sources to supply SEQ.

The longer this mode of operation persists the greater the likelihood that we collectively will be exposed to this risk of bringing forward supply options. It is assumed that the Queensland Water Commission would provide advice on the acceptability of a permanent change to the operating level of Wivenhoe Dam should it be considered in the future.

Water Resource Plan Compliance

As part of demonstrating that this operation can be implemented, Seqwater will need to demonstrate whether the proposed release of water enables the performance requirements of the WGM water allocations outlined in the Moreton Basin Water Resource Plan to be met. This may require a modelling assessment utilising the DERM WRP/ROP model that Seqwater utilise under licence from DERM.

Conclusion

1) Results show that continuing to keep Wivenhoe Dam at 75% until 30 June 2011 will result in a small increase in the probability of reaching 40% in regional storages when compared with the current operating philosophy.
2) Probabilities of reaching 40% and 30% in the regional storages are within the required risk criteria set in the SOP.
3) The proposed operation does not itself breach any of the specific rules contained in Section 8 of the SOP and the modelling undertaken embeds these rules into the results presented above.
4) A request will be drafted to Seqwater to confirm that the performance of the WGM water allocations from the Brisbane system is not adversely affected by the proposed action should it be pursued.

Contact Officer: [redacted] Water Engineer 25 March 2011	Authorised: Daniel Spiller Director, Operations March 2011

[redacted]

From: Reilly Bob [redacted]
Sent: Friday, 1 April 2011 2:30 PM
To: Dan Spiller
Subject: FW: Wivenhoe Dam - Interim Supply Security Level
Attachments: Level3Scanner[redacted]_20110330_123548.pdf

Hi Dan

As discussed

Regards

Bob

From: Best Debbie
Sent: Wednesday, 30 March 2011 2:00 PM
To: Reilly Bob; [redacted]
Subject: FW: Wivenhoe Dam - Interim Supply Security Level

Debbie Best
Deputy Director-General, Water and Ecosystem Outcomes Division
Telephone [redacted]
Emai[redacted]
www.derm.qld.gov.au

Department of Environment and Resource Management
Level 13, 400 George Street, Brisbane Q 4000
GPO Box 2454, Brisbane Q 4001

From: Bradley John
Sent: Wednesday, 30 March 2011 1:20 PM
To: Best Debbie
Subject: Fw: Wivenhoe Dam - Interim Supply Security Level

Fyi

From: Bradley John
Sent: Wednesday, March 30, 2011 01:18 PM
To: 'ken.smith[redacted] 'kate.jones[redacted]
Subject: Fw: Wivenhoe Dam - Interim Supply Security Level

FYI

N257

From: Peter Borrows [redacted]
Sent: Wednesday, March 30, 2011 01:03 PM
To: Bradley John
Cc: Peter Borrows [redacted]
Subject: Wivenhoe Dam - Interim Supply Security Level

John, please find attached correspondence. The original will be posted today.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

seqwater
WATER FOR LIFE

Ph [redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
website | www.seqwater.com.au

seqwater
WATER FOR LIFE

30 March 2011

Mr John Bradley
Director-General
Department of Environment & Resource Management
Level 13
400 George Street
Brisbane QLD 4000

Dear John,

Wivenhoe Dam - Interim Supply Security Level

Seqwater's approved interim program under the Moreton Resource Operations Plan obliges Seqwater to maintain the water storage level in Wivenhoe Dam at the Interim Supply Security Level (which is 75% of Full Supply Level) until 31 March 2011.

In view of the impending expiry of this part of Seqwater's interim program, Seqwater has recently sought advice from the Queensland Water Commission and the Water Grid Manager as to whether either agency has any objection from a water supply security perspective to an extension of the above temporary arrangements to 30 June 2011.

The advice received from the Queensland Water Commission and the Water Grid Manager (copies attached) is qualified in this regard.

Accordingly, Seqwater does not propose to submit a revised interim program.

Yours sincerely,

[redacted]

Peter Borrows
Chief Executive Officer

Attach.

N259

Queensland
water
Commission

Securing our water, together.

Our ref: ME/11/0179

RECEIVED
29 MAR 2011

25 MAR 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

By email to: [redacted]

Dear ~~Mr Borrows~~ Peter

Thank you for your letter of 22 March 2011 including your request for advice on a proposed extension to the period that Wivenhoe Dam be kept at the Interim Security Supply Level from 1 April 2011 to 30 June 2011.

The Queensland Water Commission has no objection to this proposal as a temporary measure. Our analysis of the total grid capacity shows that the impact on water security by the extension of time is compliant with the South East Queensland System Operating Plan Risk Criteria.

It should be noted that operational and regulatory impacts such as potential increased pumping costs have not been assessed. Advice from the responsible agency or entity would need to also be considered.

If you would like to further discuss these matters or require any information, please contact [redacted] Acting General Manager, Regional Planning and Policy on [redacted]

Yours sincerely

[redacted]

Ms Karen Waldman
Chief Executive Officer

Queensland Water Commission
PO Box 15087 City East Qld 4002
Ph [illegible] Fax [illegible] 3227 8227
ABN [illegible] web www.qwc.qld.gov.au

N260

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/11/2127

25 March 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Peter

Dear Mr ~~Borrows~~

Maintenance of Wivenhoe Dam at 75% full supply level up to 30 June 2011

I refer to your letter dated 22 March 2011 regarding Seqwater's consideration of extending the period in which Wivenhoe Dam is maintained at 75%, from 31 March 2011 to 30 June 2011.

As requested in your letter, to assist Seqwater in deciding whether it makes a recommendation to the Chief Executive of the Department of Environment and Resource Management, we confirm that temporarily maintaining Wivenhoe Dam at 75% up to 30 June 2011, is unlikely to impact on our ability to manage the Water Grid to achieve the desired levels of service and the System Operating Plan's risk criteria. Please note that this is based on information currently available and may be subject to change.

If you have any questions, please contact me on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

N261

[redacted]

From: Barry Dennien [redacted]
Sent: Friday, 1 April 2011 4:45 PM
To: Peter Borrows
Cc: Dan Spiller; Debbie Best [redacted] Bradley John; [redacted] Waldman Karen
Subject: Wivenhoe Dam
Attachments: Letter to Seqwater 1 April 2011.pdf

Peter

Please find attached a letter with regards maintenance of Wivenhoe at 75%.

Regards

Barry Dennien
Chief Executive Officer
SEQ Water Grid Manager
.1one[redacted]
Email[redacted]
Visit: Level 15, 53 Albert Street, Brisbane
Post: PO Box 16205, City East Qld 4002
ABN: 14783 317 630

SEQ Water Grid manager

Secure and efficient water through partnership and innovation

TRIM ref: D/11/2398

01 April 2011

Mr Peter Borrows
Chief Executive Officer
Seqwater
PO Box 16146
City East QLD 4002

Dear ~~Mr Borrows~~ Peter

I refer to our letter of 25 March 2011, responding to Seqwater's letter about maintenance of Wivenhoe Dam at 75% of its full supply level until 30 June 2011 (Seqwater's Proposal).

I have become aware that Seqwater may have some concerns about qualifications to our response. I note that Seqwater has not contacted us directly regarding any concerns with our response, however, I take this opportunity to provide clarification.

I confirm that, from a water security perspective, the SEQ Water Grid Manager has no objection to Seqwater's Proposal. This is consistent with our letter to you dated 25 March 2011.

I also understand that the Queensland Water Commission advised Seqwater that:

- the Queensland Water Commission had no objection to Seqwater's Proposal
- operational and regulatory impacts such as potential increased pumping costs have not been assessed.

Upon considering any impacts on the cost of operating the Water Grid, I further confirm that we have no objection to Seqwater's Proposal.

Again, if you have any queries please contact me on [redacted] or via email at [redacted]

Yours sincerely

[redacted]

Barry Dennien
Chief Executive Officer

Litsupport Brisbane

From: Reilly Bob [redacted]
Sent: Friday, 21 [redacted]ry 2011 4:06 PM
To: [redacted]
Cc: [redacted] Best Debbie; Dan Spiller
Subject: Improving the amount of information provided by Seqwater in the Technical Situation Reports required under the Communication Protocol

Hi [redacted]

Peter Borrows rang me about this matter this afternoon. They have commenced working on it, and he will give me a ring to set up a meeting for next week to discuss the matter (I have asked him to involve the Grid Manager in that meeting)

Regards

Bob

Bob Reilly

General Manager, Office of the Water Supply Regulator

Telephone: [redacted]

Emai[redacted]

www.derm.qld.gov.au

Department of Environment and Resource Management

Lvl 3 41 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

Litsupport Brisbane

From: Best Debbie[redacted]
Sent: Friday, 4 February 2011 10:00 AM
To: Bradley John; Dan Spiller
Subject: Fw: Wivenhoe Dam gate operation

John
Dan will action. Just for your information.
Debbie

----- Original Message -----
From: Martin.Peter[redacted]
To: Best Debbie
Cc: spiller daniel @ SEQWGM; richard.c.johnson[redacted]
Sent: Fri Feb 04 09:35:05 2011
Subject: RE: Wivenhoe Dam gate operation

Dear Debbie,

You will recall that in December 2010 and prior to the January 2011 Brisbane Floods you kindly ensured that I, as DDC of Brisbane was placed on the SEQ Water notifications about Dam releases. I want to thank you for that and can say that the support of Dan Spiller and his colleagues in passing information in a timely fashion benefited me in terms of preparations for this event and in the recovery. I was grateful for your support of this initiative.

At the Brisbane DDMG meeting this morning, our Harbour Master for Brisbane, Captain Richard Johnson (Maritime Safety Queensland) raised the importance of him having access to this information given that even minor releases impact upon his safe management of large assets and operations downstream.

Would you kindly consider putting Captain Richard Johnson on the recipient list (emails) for such releases. I know that he would both appreciate it and that this would go towards ensuring public safety particularly relating to maritime assets.

Please feel free to contact me should I be able to clarify any issues concerning this. Naturally, this proposal has my full support.

Thanks again for your assistance,

Kind regards

Peter Martin

Assistant Commissioner

METROPOLITAN NORTH REGION and

DISTRICT DISASTER COORDINATOR, BRISBANE

(t) [redacted]

(f)

(m)

www.police.qld.gov.au

From: Dan Spiller [redacted]
Sent: Thursday, 3 February 2011 5:47 PM
To: Bradley John; Martin.PeterJ[MNR]; Best Debbie; [redacted]
Cc: Peter Borrows; Rob Drury; SEQWGM Media; Barry Dennien
Subject: Wivenhoe Dam gate operation

All,

For information, Seqwater intends to commence a small gate release tomorrow afternoon to bring Wivenhoe Dam back to FSL. The gate release is required because the cone valve cannot be used until a channel is reinstated downstream of Wivenhoe Dam.

Seqwater plans to increase releases to around a total of 3,000ML/day, including from the hydro scheme. Releases will continue for several day.

We do not intend to provide Technical Situation Reports for this minor release.

Regards,

Dan

Daniel Spiller

Director, Operations

SEQ Water Grid Manager

Phone: [redacted]

Email: [redacted]

Visit: Level 15, 53 Albert Street Brisbane

Post: PO Box 16205, City East QLD 4002

ABN: 14783 317 630

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****

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+---+
Think B4U Print
1 ream of paper = 6% of a tree and 5.4kg CO2 in the atmosphere
3 sheets of A4 paper = 1 litre of water
+---+

Litsupport Brisbane

From: Martin.Peter[redacted]
Sent: Thursday, 10 February 2011 1:57 PM
To: Dan Spiller
Subject: RE: Wivenhoe Dam gate operation

Hi Dan,

Appreciate you doing this. Hope all goes well with you.

Regards Peter

Peter Martin
Assistant Commissioner
METROPOLITAN NORTH REGION
(t)[redacted]
(f)[redacted]
www.police.qld.gov.au

From: Dan Spiller[redacted]
Sent: Thursday, 10 February 2011 1:48 PM
To: Martin.PeterJ[MNR]; Debbie.Best[redacted]
Cc: richard.c.johnson[redacted]
Subject: RE: Wivenhoe Dam gate operation

Peter,

We will certainly include Captain Johnson on the distribution list for future reports. Apologies for the delay in responding.

Dan

From: Martin.PeterJ[redacted]
Sent: Friday, 4 February 2011 9:35 AM
To: Debbie.Bes[redacted]
Cc: Dan Spiller; richard.c.johnson[redacted]
Subject: RE: Wivenhoe Dam gate operation

Dear Debbie,

You will recall that in December 2010 and prior to the January 2011 Brisbane Floods you kindly ensured that I, as DDC of Brisbane was placed on the SEQ Water notifications about Dam releases. I want to thank you for that and can say that the support of Dan Spiller and his colleagues in passing information in a timely fashion benefited me in terms of preparations for this event and in the recovery. I was grateful for your support of this initiative.

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Please feel free to contact me should I be able to clarify any issues concerning this. Naturally, this proposal has my full support.

Thanks again for your assistance,

Kind regards

Peter Martin
Assistant Commissioner
METROPOLITAN NORTH REGION and
[redacted]TOR, BRISBANE

From: Dan Spille[redacted]
Sent: Thursday, 3 February 2011 5:47 PM
To: Bradley John; Martin.PeterJ[MNR]; Best Debbie; [redacted]
Cc: Peter Borrows; Rob Drury; SEQWGM Media; Barry Dennien
Subject: Wivenhoe Dam gate operation

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We do not intend to provide Technical Situation Reports for this minor release.

Regards,
Dan

Daniel Spiller
Director, Operations
SEQ Water Grid Manager
Phone: [redacted]
Email: [redacted]
Visit: Level 15, 53 Albert Street Brisbane
Post: PO Box 16205, City East QLD 4002
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[redacted]

From:	Rob Drury [redacted]
Sent:	Tuesday, 22 February 2011 11:11 AM
To:	Dan Spiller
Cc:	Mike Foster
Subject:	TSR's
Attachments:	TSR_draft.pdf
Categories:	T16: Review

Dan,
Will send another TSR shortly based on last nights rain but here is a draft of one I had provided to DERM Peter Allen for comment that was considered to have more info and the same info in each one.

It will be a spreadsheet that produces the report (this is just a pdf) and may be a little too much info for what people really need.

Rob

CHNICAL SITUATION REPORT		date / time:	28-January-2011
		ID:	TSR20110128-1

SOMERSET DAM

FSL:		Operational trigger:		Spillway:	100.45	Dam Crest:	

Current Status — date / time: 27/01/11 09:00

Level (mAHD):	99.5	Actual 24hr rainfall (mm):	107

Release Settings

Gate:	I	J	K	L	M	N	O	P
Opening:	100%	100%	100%	100%	100%	100%	100%	100%
Sluice:	closed	closed	closed	closed	closed	closed	closed	closed

Regulator:	2	3	12	13
Opening:	50%	50%	50%	50%

Total discharge (m3/s): 1,500 Estimated inflow (m3/s): 1,200

Forecast status

24hr rainfall (QPF): Rain to fill (5mm/hr): Rain to operate (5mm/hr):

Comments incl. future discharge: All regulators were closed at 20:00 Tuesday 18 January 2011. The dam level was 99.09 m AHD at 15:00 on Thursday and rising slowly. Further regulator releases may take place over the next few days to maintain the dam at Full Supply Level (FSL).

WIVENHOE DAM

FSL:		Operational trigger:		Fuse Plug 1:	75.70	Dam Crest:	

Current Status — date / time: 27/01/11 09:00

Level (mAHD):	67.95	Actual 24hr rainfall (mm):	201

Release Settings

Gate:	1	2	3	4	5
Opening:	2.0	3.5	4.0	3.5	2.0

Regulator: Hydro:

Total discharge (m3/s): 2,400 Estimated inflow (m3/s): 3,000

Bridges Inundated

Fernvale:	N	Colleges Xing:	Y	Savages Xing:	N	Twin Bridges:	Y
Kholo Bridge:	N	Burtons Bridge:	N	Mt Crosby Weir:	N		

Lockyer & Bremer Flows

Lockyer (m3/s):	800	Bremer (m3/s):	200

Forecast status

24hr rainfall (QPF): Rain to fill (5mm/hr): Rain to operate (5mm/hr):

Comments incl. future discharge: All gates were closed at Wivenhoe at 12:00 on Wednesday 19 January 2011. The current lake level is just below FSL and rising slowly due to the overnight storm inflows.

NORTH PINE DAM

FSL:		Operational trigger:		Winch floor:	41.12	Dam Crest:	

Current Status — date / time: 27/01/11 09:00

Level (mAHD):	39.58	Actual 24hr rainfall (mm):	50

Release Settings

Gate:	A	B	C	D	E
Opening:	2	2	2	2	2

Regulator: River Release Value:

Total discharge (m3/s): 1,200 Estimated inflow (m3/s): 1,000

Bridges Inundated

Youngs Crossing: Y

Forecast status

24hr rainfall (QPF): Rain to fill (5mm/hr): Rain to operate (5mm/hr):

Comments incl. future discharge: North Pine Dam commenced gate operations at 01:00 on Thursday 20 January 2011 due to the runoff generated from the overnight storm. These gate operations ceased at 14:00 on Thursday 20 January 2011 with the lake level at 39.44 mAHD.

QFP - Quantitative Precipitation Forecast, 24hr forecast rainfall issued by Bureau of Meteorology

Seqwater status of inflows and dam operations

Current status but could change based on inflows and rainfall.

Current Strategy: (eg. W2)	The Flood Operations Centre will monitor the situation in North Pine Dam overnight, but control of the Somerset and Wivenhoe dams has reverted to normal Seqwater operations. Remote monitoring will revert to the On Call Duty Engineer (Rob Ayre) from Friday 21 January 2011.
Future Directions: (eg. possible change to W3)	
Key Considerations:	

Seqwater Technical Officer Name	Robert Drury
Seqwater Technical Officer Position Title	Dam Operations Manager
Seqwater Technical Officer Contact Details	[redacted]

BoM Assessment

(Consisting of references to latest Flood Warning for Brisbane River and other relevant Bureau forecasts and warnings (e.g. Weather/rain forecasts, Tropical Cyclone Warning etc) and other updates/comments if needed).

BoM has been advised.

BoM Technical Officer Name	Peter Baddiley
BoM Technical Officer Position Title	Regional Hydrology Manager
BoM Technical Officer Contact Details	[redacted]

Brisbane City Council (BCC) assessment

(To include predicted local inundation areas and depths of inundation based on information).

Council has been advised of the current strategy.

BCC Technical Officer Name	Chris Lavin
BCC Technical Officer Position Title	Disaster Operations Manager
BCC Technical Officer Contact Details	[redacted]

Ipswich City Council (ICC) assessment (if required)

(To include predicted local inundation areas and depths of inundation based on information).

Council has been advised of the current strategy.

ICC Technical Officer Name	Tony Trace
ICC Technical Officer Position Title	Local Disaster Response Coordinator
ICC Technical Officer Contact Details	[redacted]

Somerset Regional Council (SRC) assessment (if required)

(To include predicted local inundation areas and depths of inundation based on information).

Council has been advised of the current strategy.

SRC Technical Officer Name	Tony Jacobs
SRC Technical Officer Position Title	Local Disaster Response Coordinator
SRC Technical Officer Contact Details	[redacted]

Collated and distributed by (Agency)

Contact Officer's Signature	
Contact Officer	Rob Drury
Contact Officer Position Title	Dam Operations Manager

Next TSR due	18.1.2011 09:00 hrs

[redacted]

From: Reilly Bob [redacted]
Sent: Tuesday, 22 February 2011 12:59 PM
To: Dan Spiller
Subject: FW: Improving Communications: Communication Protocol for Wivenhoe/Somerset flood releases.
Attachments: image003.jpg; image002.jpg

Categories: T16: Review

Hi Dan

Note the point under 1. (below) with respect to the Grid Manager.

Regards

Bob

From: Peter Borrows [redacted]
Sent: Tuesday, 22 February 2011 11:29 AM
To: Reilly Bob
Subject: RE: Improving Communications: Communication Protocol for Wivenhoe/Somerset flood releases.

Hello Bob.

The progress on Improving Communications: Communication Protocol for Wivenhoe/Somerset flood releases is as follows.

1. **Technical Situation Report (TSR):**

Seqwater has revised its TSR as per recommendations of Brian Cooper as part of his review of the Draft Communication Protocols between govt agencies and local govt.

This revised TSR template is currently with DERM (Peter Allen who advised he wants to run it by Debbie Best) and WGM. Seqwater is yet to get any feedback and is currently following up.

2. **Communication Protocols:**

The Draft protocols have yet to be signed off by councils, however, they have been used informally over the wet season. (Council Sign off was not being organised by Seqwater.)

WGM advised yesterday that the Emergency Management Qld was now chasing Councils for sign off.

Regards, Peter.

Peter Borrows
Chief Executive Officer
Queensland Bulk Water Supply Authority *trading as* Seqwater

Ph[redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

Swimming in weirs and fast
flowing water is FATAL.

From: Reilly Bob [redacted]
Sent: Monday, February 21, 2011 10:52 AM
To: Peter Borrows
Subject: Improving Communications: Communication Protocol for Wivenhoe/Somerset flood releases.

Ii Peter

This matter was raised in the Minister's letter of January 2011, and I think we discussed it as well. Would you be able to give me a ring about the matter early this week—I would just like to know progress.

Thanks

Bob

Bob Reilly

General Manager, Office of the Water Supply Regulator

Telephone[redacted]

Email[redacted]

www.derm.qld.gov.au

Department of Environment and Resource Management

Lvl 3 41 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

+---+

Think B4U Print

1 ream of paper = 6% of a tree and 5.4kg CO2 in the atmosphere

3 sheets of A4 paper = 1 litre of water

+--+

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[redacted]

From: Dan Spiller
Sent: Tuesday, 22 February 2011 1:09 PM
To: 'Reilly Bob'
Subject: RE: Improving Communications: Communication Protocol for Wivenhoe/Somerset flood releases.
Attachments: image001.jpg; image002.jpg

Categories: T16: Review

Bob,

Thanks for the

We received the revised TSR for comment at 11.11am this morning.

Dan

From: Reilly Bob [redacted]
Sent: Tuesday, February 22, 2011 12:59 PM
To: Dan Spiller
Subject: FW: Improving Communications: Communication Protocol for Wivenhoe/Somerset flood releases.

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Ph [redacted]
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PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

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Thanks

Bob

Bob Reilly

General Manager, Office of the Water Supply Regulator

Telephone: 0[redacted]

Email:[redacted]

www.derm.qld.gov.au

Department of Environment and Resource Management

Lvl 3 41 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

[redacted]

From:	Dan Spiller
Sent:	Tuesday, 22 February 2011 1:10 PM
To:	'Rob Drury'
Cc:	Mike Foster
Subject:	RE: TSR's
Categories:	T16: Review

Thanks Rob. We will review and provide comments back to you.

Regards,
Dan

From: Rob Drury [redacted]
Sent: Tuesday, February 22, 2011 11:11 AM
To: Dan Spiller
Cc: Mike Foster
Subject: TSR's

Dan,
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It will be a spreadsheet that produces the report (this is just a pdf) and may be a little too much info for what people really need.

Rob

[redacted]

From:	Dan Spiller
Sent:	Thursday, 24 February 2011 3:27 PM
To:	'Reilly Bob'
Subject:	FW: TSR's
Attachments:	TSR_draft.pdf
Categories:	T16: Review

From: Rob Drury [redacted]
Sent: Tuesday, 22 February 2011 11:11 AM
To: Dan Spiller
Cc: Mike Foster
Subject: TSR's

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Rob

TECHNICAL SITUATION REPORT

date / time: 28-January-2011
ID: TSR20110128-1

SOMERSET DAM

FSL: | Operational trigger: | Spillway: 100.45 | Dam Crest:

Current Status — date / time: 27/01/11 09:00

Level (mAHD): 99.5 | Actual 24hr rainfall (mm): 107

Release Settings

Gate:	I	J	K	L	M	N	O	P
Opening:	100%	100%	100%	100%	100%	100%	100%	100%
Sluice:	closed	closed	closed	closed	closed	closed	closed	closed

Regulator:	2	3	12	13
Opening:	50%	50%	50%	50%

Total discharge (m3/s): 1,500 | Estimated inflow (m3/s): 1,200

Forecast status

24hr rainfall (QPF): | Rain to fill (5mm/hr): | Rain to operate (5mm/hr):

Comments incl. future discharge: All regulators were closed at 20:00 Tuesday 18 January 2011. The dam level was 99.09 m AHD at 15:00 on Thursday and rising slowly. Further regulator releases may take place over the next few days to maintain the dam at Full Supply Level (FSL).

WIVENHOE DAM

FSL: | Operational trigger: | Fuse Plug 1: 75.70 | Dam Crest:

Current Status — date / time: 27/01/11 09:00

Level (mAHD): 67.95 | Actual 24hr rainfall (mm): 201

Release Settings

Gate:	1	2	3	4	5
Opening:	2.0	3.5	4.0	3.5	2.0

Regulator: | Hydro:

Total discharge (m3/s): 2,400 | Estimated inflow (m3/s): 3,000

Bridges Inundated

Fernvale:	N	Colleges Xing:	Y	Savages Xing:	N	Twin Bridges:	Y
Kholo Bridge:	N	Burtons Bridge:	N	Mt Crosby Weir:	N		

Lockyer & Bremer Flows

Lockyer (m3/s): 800 | Bremer (m3/s): 200

Forecast status

24hr rainfall (QPF): | Rain to fill (5mm/hr): | Rain to operate (5mm/hr):

Comments incl. future discharge: All gates were closed at Wivenhoe at 12:00 on Wednesday 19 January 2011. The current lake level is just below FSL and rising slowly due to the overnight storm inflows.

NORTH PINE DAM

FSL: | Operational trigger: 39.60 | Winch floor: 41.12 | Dam Crest:

Current Status — date / time: 27/01/11 09:00

Level (mAHD): 39.58 | Actual 24hr rainfall (mm): 50

Release Settings

Gate:	A	B	C	D	E
Opening:	2	2	2	2	2

Regulator: | River Release Value:

Total discharge (m3/s): 1,200 | Estimated inflow (m3/s): 1,000

Bridges Inundated

Youngs Crossing: Y

Forecast status

24hr rainfall (QPF): | Rain to fill (5mm/hr): | Rain to operate (5mm/hr):

Comments incl. future discharge: North Pine Dam commenced gate operations at 01:00 on Thursday 20 January 2011 due to the runoff generated from the overnight storm. These gate operations ceased at 14:00 on Thursday 20 January 2011 with the lake level at 39.44 mAHD.

QFP - Quantitative Precipitation Forecast, 24hr forecast rainfall issued by Bureau of Meteorology

Seqwater status of inflows and dam operations

Current status but could change based on inflows and rainfall.

Current Strategy: (eg. W2)	The Flood Operations Centre will monitor the situation in North Pine Dam overnight, but control of the Somerset and Wivenhoe dams has reverted to normal Seqwater operations. Remote monitoring will revert to the On Call Duty Engineer (Rob Ayre) from Friday 21 January 2011.
Future Directions: (eg. possible change to W3)	
Key Considerations:	

Seqwater Technical Officer Name	Robert Drury
Seqwater Technical Officer Position Title	Dam Operations Manager
Seqwater Technical Officer Contact Details	[redacted]

BoM Assessment

(Consisting of references to latest Flood Warning for Brisbane River and other relevant Bureau forecasts and warnings (e.g. Weather/rain forecasts, Tropical Cyclone Warning etc) and other updates/comments if needed).

BoM has been advised.

BoM Technical Officer Name	Peter Baddiley
BoM Technical Officer Position Title	Regional Hydrology Manager
BoM Technical Officer Contact Details	[redacted]

Brisbane City Council (BCC) assessment

(To include predicted local inundation areas and depths of inundation based on information).

Council has been advised of the current strategy.

BCC Technical Officer Name	Chris Lavin
BCC Technical Officer Position Title	Disaster Operations Manager
BCC Technical Officer Contact Details	[redacted]

Ipswich City Council (ICC) assessment (if required)

(To include predicted local inundation areas and depths of inundation based on information).

Council has been advised of the current strategy.

ICC Technical Officer Name	Tony Trace
ICC Technical Officer Position Title	Local Disaster Response Coordinator
ICC Technical Officer Contact Details	[redacted]

Somerset Regional Council (SRC) assessment (if required)

(To include predicted local inundation areas and depths of inundation based on information).

Council has been advised of the current strategy.

SRC Technical Officer Name	Tony Jacobs
SRC Technical Officer Position Title	Local Disaster Response Coordinator
SRC Technical Officer Contact Details	[redacted]

Collated and distributed by (Agency)

Contact Officer's Signature	
Contact Officer	Rob Drury
Contact Officer Position Title	Dam Operations Manager

Next TSR due	18.1.2011 09:00 hrs

[redacted]

From:	Dan Spiller
Sent:	Friday, 25 February 2011 12:01 PM
To:	Rob Drury
Cc:	Mike Foster; 'Reilly Bob'; [redacted]
Subject:	RE: TSR's
Attachments:	Technical Stuation Report_WGM comments.docx
Categories:	T16: Review

Rob,

Thanks for the opportunity to comment.

In our view, it is important that the TSR provide a clear overview of the end-to-end plan for the flood event, based on what is known and the forecast at the time that it is prepared. This plan needs to be detailed enough to inform planning and pro-active communication by affected entities, including councils and emergency management agencies. To perform this role, the TSR should also provide a succinct summary of the information and forecasts that underpin the plan and the current release Strategy.

I have amended the table that we previously provided to draw out these issues, as attached. I suggest that this type of information be provided at the front of the TSR, before the information from other entities. The more detailed information sheet could follow.

In terms of the detailed information sheet, my comments are:

- Dam levels should be included as % as well as AHD
- The current release Strategy should be stated (e.g. W2)
- I am unclear as to the significance of "Rain to fill (5mm/hr)". Perhaps it needs a note. Similarly, would "Rain to operate (5mm/hr)" refer to the next trigger to change release Strategy?
- Would "Operational trigger" change during an event to be the next trigger level?
- It needs to be clear whether the information is pre or post any changes to releases proposed as part of TSR (i.e. is it a list of the bridges that are already inundated or is it the bridges that will be once releases are changed)
- It would be useful to include combined flows at the Moggill gauge.

hope these suggestions are useful. I am happy to meet with you and Bob Reilly to discuss options in more detail.

Regards,
Dan

From: Rob Drury [redacted]
Sent: Tuesday, 22 February 2011 11:11 AM
To: Dan Spiller
Cc: Mike Foster
Subject: TSR's

Dan,
Will send another TSR shortly based on last nights rain but here is a draft of one I had provided to DERM Peter Allen for comment that was considered to have more info and the same info in each one.

It will be a spreadsheet that produces the report (this is just a pdf) and may be a little too much info for what people really need.

Rob

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TECHNICAL SITUATION REPORT

TSR Number	W16	Date of TSR release	23.12.2010	Time of TSR release	8.00am

Seqwater status of inflows and dam operations

Somerset/Wivenhoe Dams

<table>
<tr><td>Current Strategy and Plan (previous TSR)</td><td colspan="2">Overview of current strategy, plan and status, with a focus on changes that have occurred since the last TSR was provided

• Release Strategy (e.g. W1)
• Release Plan (e.g. 350 cumecs over 9 days to the 24th March)
• Release rate and total releases over event to date
• Wivenhoe and Somerset dam levels (AHD and %)
• Actual rainfall (total and since previous TSR) and inflow rate
• Known impacts of releases, including bridges currently inundated (as per proposed table)</td></tr>
<tr><td>Revised Strategy and Plan (this TSR)</td><td colspan="2">Overview of what is proposed to be implemented, based on current information and forecasts. Should address both the current changes and the plan for the completion of the event. Should be sufficient to inform any necessary management actions by Councils and emergency services

• No change <u>OR</u>

• Revised release strategy (e.g. W2)
• Revised Plan (e.g. 11 days release to 26th March)
• Likely impacts of revised strategy, including bridges inundated and impacts on peak river levels at Brisbane</td></tr>
<tr><td rowspan="4">Strategy key considerations</td><td colspan="2">Overview of considerations that informed the current strategy, making key assumptions and the source of that information clear</td></tr>
<tr><td>Forecast rainfall:</td><td>BoM advice used. Current and to the end of the event</td></tr>
<tr><td>Forecast inflows:</td><td>Seqwater assessment of implications</td></tr>
<tr><td>Downstream flows:</td><td>Current and forecast flows from the Lockyer and Bremer and at the Moggill gauge</td></tr>
<tr><td></td><td>Tides:</td><td>BoM advice used</td></tr>
<tr><td>Future risk analysis</td><td colspan="2">Overview of potential risks and potential worse case scenarios, as an input to emergency management contingency planning and actions</td></tr>
</table>

	Rainfall scenarios:	BoM advice (e.g. storms possible in three days)
	Inflow sensitivity:	Seqwater assessment of inflow scenarios
	Trigger for change:	Likelihood of reaching trigger to change release Strategy (e.g. W2 to W3)

Somerset Dam

Wivenhoe Dam

Impacts of Wivenhoe Dam Releases

Seqwater Technical Officer name	Robert Drury
Seqwater Technical Officer position title	Dam Operations Manager
[redacted]	

BoM assessment

(consisting of references to latest Flood Warning for the Brisbane River and other relevant Bureau forecasts and warnings (e.g. weather/rain forecasts, Tropical Cyclone Warning etc) and other updates/comments if needed)

BoM has been advised.

BoM Technical Officer name	Peter Baddiley
BoM Technical Officer position title	
BoM Technical Officer contact details	[redacted]

Brisbane City Council (BCC) assessment

(to include predicted local inundation areas and depths of inundation based on the information)

Council has been advised and is in line with previous strategy.

BCC Technical Officer name	Chris Lavin
BCC Technical Officer position title	Disaster Operations Manager
BCC Technical Officer contact details	[redacted]

Ipswich City Council (ICC) assessment (if required)

(to include predicted local inundation areas and depths of inundation based on the information)

Council has been advised and is in line with previous strategy.

ICC Technical Officer name	Tony Trace
ICC Technical Officer position title	Local Disaster Response Coordinator
ICC Technical Officer contact details	[redacted]

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(to include predicted local inundation areas and depths of inundation based on the information)

Council has been advised and is in line with previous strategy.

SRC Technical Officer name	Tony Jacobs
SRC Technical Officer position title	Local Disaster Response Coordinator
SRC Technical Officer contact details	[redacted]

Collated and distributed by (Agency)

Contact Officer signature	
Contact Officer name	Rob Drury
Contact Officer position title	Dam Operations Manager

Next TSR due	**Date**		**Time**		**or Event**	Closure

[redacted]

From: Reilly Bob [redacted]
Sent: [redacted]
To: [redacted]
Cc: Allen Peter; Dan Spiller; [redacted]
Subject: Update of draft communication protocol for Wivenhoe releases.

Categories: T16: Review

Hi Mike, [redacted]

The Seqwater Report on the operation of Wivenhoe/Somerset during the January 2011 flood event is now available on the DERM website.

In the first volume Seqwater makes a number of observations about possible improvements to the Protocol. The SEQ Grid Manager also has some ideas for improvement.

As EMQ is the lead agency for the Protocol, would one of you be able to give me a ring today to discuss the best way to advance this matter?—(I would like to progress the matter over the next week).

Thanks

Bob

Bob Reilly

General Manager, Office of the Water Supply Regulator

Telephone: [redacted]

Email: [redacted]

www.derm.qld.gov.au

Department of Environment and Resource Management

Lvl 3 41 George Street, Brisbane Q 4000

GPO Box 2454, Brisbane Q 4001

[redacted]

From: Rob Drury[redacted]
Sent: Tuesday, 15 March 2011 3:26 PM
To: Dan Spiller
Subject: TSR
Attachments: Technical Stuation Report_WGM comments 3.docx

Categories: T16: Review

Dan,
Attached is an update based on your comments but more in line with the headings and format of the status reports flood centre so they align as close as possible but still covering most of what you added.

Rob

TECHNICAL SITUATION REPORT

TSR Number	W16	Date of TSR release	23.12.2010	Time of TSR release	8.00am

Seqwater status of inflows and dam operations

Somerset/Wivenhoe/North Pine Dams

Current Strategy and Plan	Overview of current strategy, plan and status, with changes that have occurred since last update Rainfall Current strategy (e.g. W2) Wivenhoe/Somerset (releases, levels, inflows) North Pine (releases, levels, inflows) Impacts (e.g. bridges inundated)
Proposed Strategy and Plan	• No change OR • Revised release strategy (e.g. W2) and impacts, e.g. closing sequence, etc.
Strategy key considerations	Overview of considerations that informed the current strategy, making key assumptions and the source of that information clear e.g. Forecast rainfall (BoM advice used), Forecast inflows, and Downstream flows and tides (e.g. Lockyer, Bremer, Moggill, Brisbane River)
Future risk analysis	Overview of potential risks and worse case scenarios, , rainfall predictions, possible inflows, releases, etc.

Seqwater Technical Officer name	Robert Drury
Seqwater Technical Officer position title	Dam Operations Manager
[redacted]	

BoM assessment

(consisting of references to latest Flood Warning for the Brisbane River and other relevant Bureau forecasts and warnings (e.g. weather/rain forecasts, Tropical Cyclone Warning etc) and other updates/comments if needed)

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Council has been advised and is in line with previous strategy.

ICC Technical Officer name	Tony Trace
ICC Technical Officer position title	Local Disaster Response Coordinator
ICC Technical Officer contact details	[redacted]

Somerset Regional Council (SRC) assessment (if required)

(to include predicted local inundation areas and depths of inundation based on the information)

Council has been advised and is in line with previous strategy.

SRC Technical Officer name	Tony Jacobs
SRC Technical Officer position title	Local Disaster Response Coordinator
SRC Technical Officer contact details	[redacted]

Collated and distributed by (Agency)

Contact Officer signature	
Contact Officer name	Rob Drury
Contact Officer position title	Dam Operations Manager

Next TSR due	Date		Time		or Event	Closure

[redacted]

From: [redacted]
Sent: Thursday, 24 March 2011 4:09 PM
To: [redacted] p.baddiley [redacted]; bob.reilly [redacted] rdrury [redacted] peter.allen [redacted] mfoster [redacted] Dan Spiller; jpruss [redacted] martin.peteri [redacted]
Cc: [redacted]
Subject: Wivenhoe Protocol - Revised discussion draft
Attachments: 110323_Protocol_Communication of Flooding Information.doc

Categories: T16: Review

Greetings

Please see attached the revised flood release protocol that attempts to capture the discussion last week. The revised document (with track changes) aligns more closely with the Queensland Disaster Management Arrangements, provides for technical liaison officers (Seqwater etc) in the disaster management groups, establishes technical contact lists and a mechanism for communicating and puts rigour around the coordination of the TSR for timely information sharing.

pologies for the late release of this draft and I look forward to your comments in the morning.

Regards, [redacted]

[redacted] Principal Program Officer | Operations Policy
Emergency Management Queensland | Department of Community Safety

GPO Box 1425 Brisbane : Emergency Services Complex 125 Kedron Park Rd, Kedron
P: (07) 3635 3481 | M: 0488 410 089 | F: (07) 3247 8010 | E: Michael.Peach@dcs.qld.gov.au

Protocol for the Communication of Flooding Information for the Brisbane River Catchment - including Floodwater Releases from Wivenhoe and Somerset Dams

OBJECTIVE

The purpose of this protocol is to outline the arrangements to be followed by the Brisbane, Ipswich and Somerset Councils, relevant Queensland Government agencies and the Bureau of Meteorology (BoM), which will ensure the provision of consistent and robust information to the community, create an understanding in the minds of decision makers of the context and detail of releases of floodwater from Wivenhoe and Somerset Dams concerningand potential flooding impacts for the Brisbane River catchment, ~~including release of floodwater from Wivenhoe and Somerset Dams~~.

The intent is to ensure that consistent, harmonised information, based on an agreed single point of truth, is communicated to the public in a way that contributes to resilient communities.

BACKGROUND

Queensland's disaster management arrangements, based on disaster management groups at local, district and state level, ensure the collaborative and effective coordination of information for all hazards.

Existing local, district and state disaster management and hazard-specific plans outline arrangements and structures for disaster management, or the hazard, and amongst other things, identify the need for coordination of public communications.

This protocol adds to such plans by outlining specific arrangements to provide for Water Grid/Seqwater liaison officers in the disaster management system at local, district and state level as appropriate, and ~~necessary~~ when advice to the community needs to be based on technical assessments from hazard-specific primary agencies and other complementary stakeholders across federal, state and local governments.

~~Factors such as storm surges, tides, creek flooding, flooding from the lower Brisbane River, including Lockyer Creek and the Bremer River, will influence inundation levels in Brisbane.~~

Wivenhoe Dam controls approximately half of the Brisbane River catchment above Brisbane City. The operational strategy for water release from Wivenhoe and Somerset Dams is governed by the *Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam*, henceforth referred to as the Flood Mitigation Manual.

This protocol also covers the possibility that, during an above-average wet season, the water supply level of the dams may be marginally reduced, on a temporary basis, by small water releases. The water supply level would be returned to normal prior to the conclusion of the wet season, to avoid affecting water supply security. These changes, if they proceed, will ultimately be incorporated into the Flood Mitigation Manual.

GENERAL DECISION MAKING - GUIDING PRINCIPLES

- Protection of public safety is paramount throughout both this Protocol and the Flood Mitigation Manual;
- Impact on the community upstream or downstream is a legitimate consideration of any risk assessment;
- Regular and consistent communications within government and to the public, in relation to flooding impacts, are essential;
- Decision-making chains regarding the communications strategy and disaster management should remain flexible;
- The Flood Mitigation Manual is used to determine how Wivenhoe and Somerset Dams will be operated during flood events.
- This Protocol does not infringe the right of any party to issue information in line with their responsibilities.

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PROCESS OF COMMUNICATION

There are three stages in the process of communication:

- Monitoring and Assessment
- Briefing and Activation
- Public Communications

Monitoring and Assessment

Agency / Council Core Business:
**See Appendix B for further information regarding Roles and Responsibilities*

Bureau of Meteorology
- Provide weather forecasts and warnings

Seqwater
- Routine monitoring of weather events and dam levels

Councils
- Monitor creek levels, local runoff and flash flooding

Protocol Initiation
Communications with the public on flooding information, including floodwater releases, are based on a continuous process of monitoring and technical assessment. The process is dynamic and evolves according to the event, during which, it may become apparent to either BoM, Councils or Seqwater that the situation is likely to result in public safety issues. These public safety issues may arise from a decision to release floodwater, a significant change in the severity and scope of the event, or a pre-agreed trigger-point being reached.

~~but will normally contain the following steps:~~ Any of the agencies may initiate the public communications process and engage with the disaster management arrangements as appropriate, however, the initiating agency should notify the State Disaster Coordination Centre (SDCC) as soon as practicable to outline the communication strategy. Where public communication is not time-critical the initiating agency should notify the (SDCC) to activate the protocol. The SDCC will notify key stakeholders and instigate teleconferences, record minutes, drive timeframes for initial and regular technical reporting and ensure senior decision makers, senior management and media representatives of each agency receive timely briefs.

Agency / Council Collaboration:

Bureau of Meteorology
- In the event of heavy rain and runoff in the Wivenhoe and/or Somerset Dam catchments, BoM will discuss modelled inflows and downstream flood levels with Seqwater.
- Undertake modelling of the Brisbane River catchment and its river systems using Seqwater advice of actual and projected Wivenhoe Dam and/or Somerset Dam releases when these are, or are expected, to occur.
- Participate in technical discussions with Seqwater, Brisbane City Council, Ipswich City Council and Somerset Regional Council as necessary, to share modelling results. The discussions aim to establish technical agreement on the flood situation, on which public communications should be based.

Seqwater
- Discuss and model implications of the inflows on the necessary floodwater release from Wivenhoe Dam and/or Somerset Dam. The floodwater release strategy is a balance between releasing the water quickly enough so that the flood storage capacity is available if another major rain event occurs, versus minimising downstream flooding impacts (human

safety and property damage) from the releases.

- Calculate the releases according to dam levels and predicted weather events in accordance with the Flood Mitigation Manual. A fundamental principle is that all floodwater should be released from the dams within seven days of the flood event peaking in Wivenhoe or Somerset Dam. This ensures the dams can cope with closely spaced major rain events.
- Share predicted floodwater releases with BoM and with the Councils.

Councils

- Consult with BoM and Seqwater on other potential events upstream that may contribute to and aggravate the situation.
- Share information on the status of the Brisbane River catchment and its river systems with BoM and Seqwater.
- Undertake modelling, form predictions, identify flood inundation areas and assess impacts for their communities, and regularly share this information with all relevant parties.
- Provide for more involvement (and feedback) from a wider range of Council business units i.e. road transport potentially impacted by flood waters, particularly to inform flood water release levels where appropriate.

State Disaster Coordination Centre

- The 3-person Watch Desk Office provides 24/7 all-hazards monitoring of Queensland and can offer timely activation of the centre for Whole of Government response, notification of key stakeholders and decision makers and adequate resources to support Liaison Officers deployed to the SDCC.
- Provide a venue for agency interaction and centralised information sharing.

Technical Information

- ~~Routine monitoring of weather events and dam levels by relevant agencies via established systems and procedures;~~

- ~~The Bureau of Meteorology (BoM) provides weather forecasts and warnings (e.g. Tropical Cyclone, Severe Weather, Severe Thunderstorm, Flood). In the event of heavy rain and runoff in the Wivenhoe and/or Somerset Dam catchments, BoM and the Queensland Bulk Water Supply Authority (Seqwater) discuss modelled inflows to Wivenhoe and/or Somerset Dam, and downstream flood levels.~~

- ~~Councils monitor creek levels, local runoff and flash flooding, consult with BoM and Seqwater on other potential events upstream that may contribute to and aggravate the situation.~~

- ~~Seqwater discusses and models implications of the inflows on the necessary floodwater release from Wivenhoe Dam and/or Somerset Dam. The floodwater release strategy is a balance between releasing the water quickly enough so that the flood storage capacity is available if another major rain event occurs, versus minimising downstream flooding impacts (human safety and property damage) from the releases.~~

- ~~Seqwater calculates the releases according to dam levels and predicted weather events in accordance with the Flood Mitigation Manual. A fundamental principle is that all floodwater should be released from the dams within seven days of the flood event peaking in Wivenhoe or Somerset Dam. This ensures the dams can cope with closely spaced major rain events.~~

- ~~Seqwater shares predicted floodwater releases with BoM and with the Councils.~~

- ~~Councils share information on the status of the Brisbane River catchment and its river systems with BoM and Seqwater.~~

- ~~BoM undertakes modelling of the Brisbane River catchment and its river systems using Seqwater advice of actual and projected Wivenhoe Dam and/or Somerset Dam releases when these are, or are expected, to occur.~~

- BoM participates in technical discussions with Seqwater, Brisbane City Council, Ipswich City Council and Somerset Regional Council as necessary, to share modelling results. The discussions aim to establish technical agreement on the flood situation, on which public communications should be based.

- Councils undertake modelling, form predictions, identify flood inundation areas and assess impacts for their communities, and regularly share this information with all relevant parties.

During this continuous process, it may become apparent to either BoM, local governments or Seqwater that the situation is likely to result in public safety issues.

These public safety issues may arise from a decision to release floodwater, a significant change in the severity and scope of the event, or a pre-agreed trigger-point being reached.

Any of the agencies may initiate the public communications process and engage with the disaster management arrangements as appropriate.

The initiating agency will instigate a technical staff teleconference. Decisions from the teleconference will be distributed to senior management and media representatives of each agency.

In these circumstances all agencies agree that technical advice in the form of a Technical Situation Report (TSR) (*see Appendix C*) will form the basis of public communications messages. The SDCC will provide a robust framework for the TSR within the disaster management system by:

- Ensuring equitable input and feedback from all stakeholders;
- Ensuring regular reporting timeframes are maintained;
- Amplifying the report with information for key decision makers

The SDCC will coordinate the collation of stakeholder information and distribution of the TSR. Authority for the TSR is as follows:

- Seqwater: Significant In the case of floodwater releases it considers significant, Seqwater coordinates the completion of the Technical Situation Report – TSR (Appendix C) and provides the Report to the SEQ Water Grid Manager (according to their Emergency Response Plan), and to relevant local governments.
-
- Local or State agency: In other circumstances Wwhere a formal technical statement would enhance clarity, the initiating local or state agency may coordinate the completion of a TSR. If initiated, the TSR should be circulated to all parties of potential flooding impacts for the Brisbane River catchment.

Briefing and Activation

Consideration will be given to the activation of the Queensland disaster management arrangements, if not already activated.

1. Councils will consider activating their Local Disaster Management Groups (LDMGs);

2. LDMGs will inform the relevant District Disaster Coordinators (DDCs);

3. The Queensland Police Service (QPS) will consider initiating disaster management actions as provided for under the *Disaster Management Act 2003;*

4. The SDCC will activate to support Agency / Council collaboration and information sharing;

5. Water Grid / Seqwater will deploy Liaison Officers to relevant disaster management groups as required.

~~3.~~6. ~~The Queensland Police Service (QPS) will consider initiating disaster management actions as provided for under the *Disaster Management Act 2003*;~~ DG DCS will inform the DG of the Department of Premier and Cabinet (DPC) - the Chair of the State Disaster Management Group (SDMG) of the SDCC activation. DG DCS will also inform the Minister for Police, Corrective Services and Emergency Services;

~~4.~~In the case of floodwater release, the SEQ Water Grid Manager will alert the Director-General (DG) of the Department of Community Safety (DCS), DG Department of Environment and Resource Management (DERM), and the local governments;

4.7.

~~5. DG DCS will inform the DG of the Department of Premier and Cabinet (DPC) - the Chair of the State Disaster Management Group (SDMG) and will activate the State Disaster Coordination Centre (SDCC). DG DCS will also inform the Minister for Police, Corrective Services and Emergency Services;~~

~~6.~~8. DG DERM will inform the Minister for Natural Resources, Mines and Energy;

~~7.~~9. DG DPC will inform the Premier;

~~8.~~10. In the case of an extreme event, the Crisis Communications Network, chaired by DPC, may be activated at the direction of the SDMG Chair to coordinate public messaging from BoM, Seqwater, SEQ Water Grid Manager, QPS, relevant Councils and DCS as per this protocol;

~~9.~~11. In the case of a non-disaster, public communications will be in accordance with existing arrangements, supported where appropriate by this protocol.

Public Communications Issues

Each agency has its own responsibilities to issue information commensurate with their role without prior approvals. The obligation under this protocol is to share that information with the SDCC and other agencies, and operate in a fully consultative process to ensure consistent public information.

The BoM, Local Governments and relevant State Government agencies are to maintain continual discussions, to ensure that conflicting information is not released to the public at any time. Genuine efforts should be made to ensure consistency by basing public communications on technical reports. Inter-agency consultation should not cause delays in the issuance of public warnings. All agencies must exchange public communications at time of release. No power of veto is implied under this protocol.

Harmonised public communications messages will be released from the following agencies:

- **Bureau of Meteorology -** concentrating on Flood Warnings which are widely disseminated to the BoM website, agencies and the media. BoM also participates in media (radio, television, newspaper) interviews to provide factual information regarding observed and forecast weather conditions, rainfalls and water levels;

- **Local Governments /Local Disaster Management Groups -** concentrating on the effects of weather related events and safety for their local communities and residents. Local governments have primacy of public communications within their community. Pre-agreed community service announcements from local governments will be shared with the relevant agencies prior to public release;

- **SEQ Water Grid Manager -** if significant floodwater releases from Wivenhoe and Somerset dams are involved, the SEQ Water Grid Manager concentrates on the communication aspects of release timings and duration of effects as the State's lead communication agency on floodwater release. Seqwater operational staff are to ensure that technical information is communicated to the SEQ Water Grid Emergency Response Team (if activated), the SEQ Water Grid Communications Unit and relevant local governments.

If necessary these will be augmented by:

- **Queensland Police Service** - concentrating on specific community safety messaging during operations;

- **Department of Community Safety** - concentrating on general safety matters regarding flooding;

- **Department of Premier and Cabinet (extreme events only)** - concentrating on consistent messages to media and agencies concerned.

Event-specific information will be released to the public as frequently as required by the severity and scope of the event. Timings of media releases will be dependent on the event, guided by the frequency of technical reports and may range from once a day to once an hour.

In the case of floodwater release considered significant, SEQ Water Grid Communications Unit will centrally track all communications and ensure they are shared. The unit will liaise with the following or their representatives over pubic safety messages:

- BoM;
- Seqwater;
- Councils' Media Directors;
- QPS Media Director; and
- DCS Media Director.

Questions from the Public

All questions from the public should be directed to the relevant local government in the first instance. Questions expressly relating to the event should be directed to the hazard-specific primary agency. Any questions relating to the release of water should be directed to the SEQ Water Grid Communications Unit. Any queries about disaster management should be addressed by the relevant local and district disaster management groups.

Warnings and Consequence Management

Brisbane City Council Brisbane has partnered with the Early Warning Network (EWN) to provide households with free severe weather alerts. This opt-in system provides location-based alerts to residential addresses potentially impacted by severe weather or other hazards as appropriate. Seqwater have discussed assisting Somerset Regional Council with the costs of establishing and maintaining a similar system for flood water releases affecting the local government area.

Emergency Management Queensland, on behalf of the Queensland Disaster Management Arrangements is responsible for issuing public warnings via Emergency Alert (EA). EA is a telephone warning system that Queensland government can use to send alerts to communities via landline telephones based on the location of the handset, and to mobile phones, based on the service address of the phone. EA is operated and activated by authorised personnel from emergency services organisations. It is not an opt-in system, rather a broadcast initiative that allows for localised, community based warnings to be issued by area or geographic region.

State government might provide more support to Somerset Regional Council in both the preparation and communication of public warnings and the consequences to the public i.e. local flood level mapping, evacuation plans and contact details for further information.

State government will work with the Queensland Reconstruction Authority (QldRA) to identify funding opportunities to assist Somerset Regional Council with flood modelling and mapping, either through the Natural Disaster Resilience Program (NDRP) or other identified assistance programs.

Quality and Reliance upon shared information

The parties to this protocol recognise that every effort will be made to ensure that information share with each other is true and correct. However, the parties acknowledge that errors or omissions in the shared information are highly likely given the variability of future flooding events.

For the avoidance of doubt, each parties agrees and acknowledges that a party providing shared information("**the Provider**") makes no statement, representation, or warranty about the accuracy or completeness of the information shared, and that the party receiving the information ("**the Receiver**") should not rely on it.

To the maximum extent permitted by law, the Provider of the shared information excludes all responsibility and all liability (including, without limitation, liability in negligence) for all expenses, health effects, injuries, losses, damages and costs the Receiver might incur as a result of the information being inaccurate or incomplete in any way, and for any reason. Where any applicable law implies a warranty into these terms which may not be lawfully excluded, then to the maximum extent permitted by law, the Provider's liability for breach of such implied warranty will be limited to re-supply of the services.

Protocol Maintenance

This protocol will be reviewed annually by agencies involved and exercised, during non-operational season, under DDMG arrangements.

The protocol should provide for a review after each event of what worked and could be improved for management of future events, to be led by DCS.

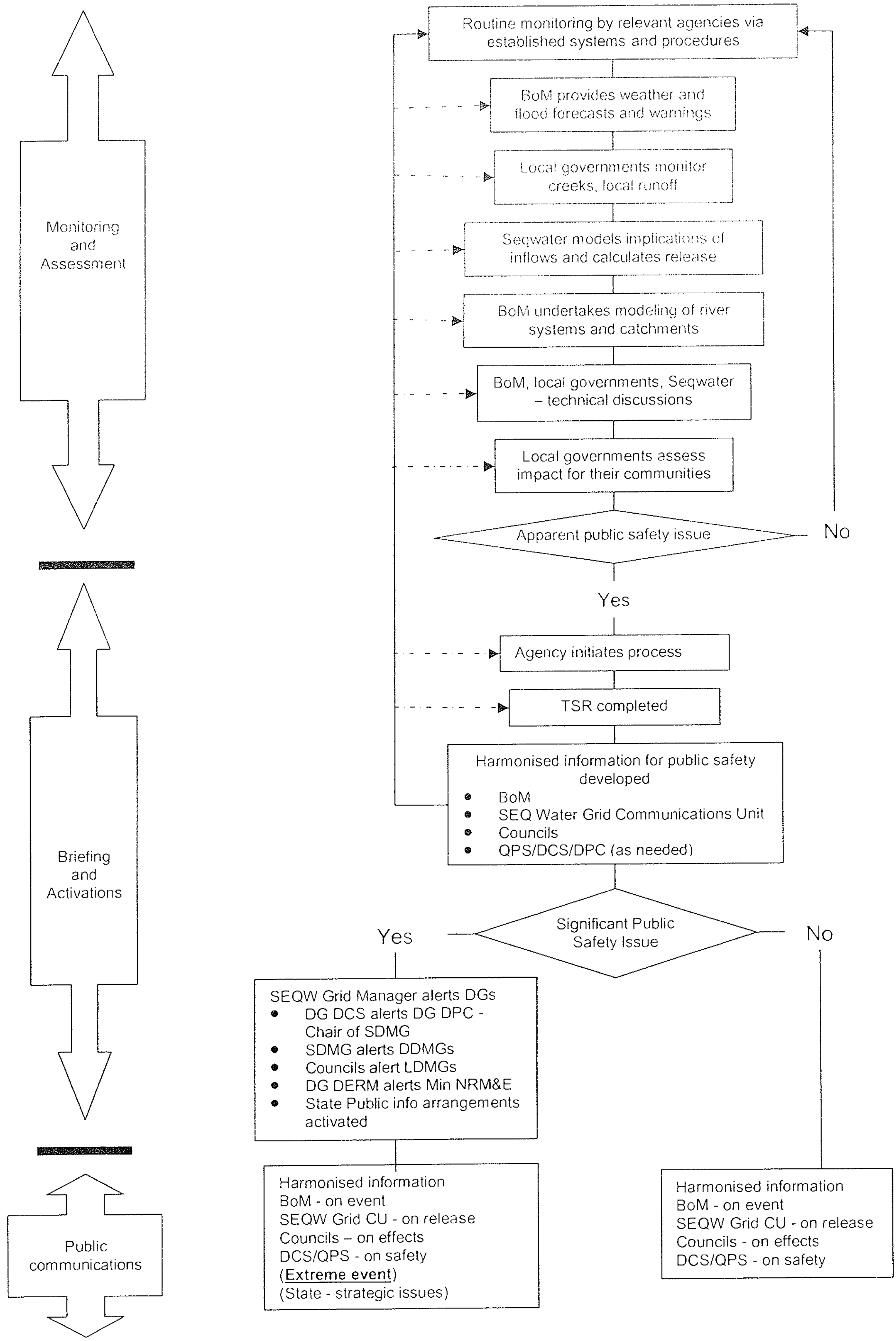
Contact Arrangements / Contact Lists

The SDCC will maintain a dynamic list of key stakeholders of this protocol, including a notification matrix for agreed trigger points related to significant flood water releases affecting Brisbane, Ipswich and Somerset Councils.

Agreed mechanism for establishing contact between technical agencies and Councils may be through the SDCC, whereby the initiating agency notifies the SDCC and then requests the SDCC to activate the protocol and notification process. For less significant events, agencies would be encouraged to establish contact at officer level?

See Appendix D for Contact List

Communications process for the release of floodwater from Wivenhoe and Somerset Dams



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Appendix B

ROLES AND RESPONSIBILITIES

- The Bureau of Meteorology (BoM) is the agency responsible for issuing flood warnings for the Brisbane River and its major tributaries. These, when required, include rainfall forecasts for the Brisbane catchment and predicted river heights for Brisbane City, Ipswich, Jindalee and Moggill according to established procedures.

  River height predictions are agreed in consultation with Seqwater, Brisbane City Council (BCC), Ipswich City Council (ICC) and Somerset Regional Council (SRC), as required.

- Queensland Bulk Water Supply Authority (Seqwater) operates Wivenhoe and Somerset Dams in accordance with the Flood Mitigation Manual. It provides dam outflow information to BoM, to allow the development of Flood Warnings and to local authorities, to assist them in quantifying likely impacts within their areas.

  It informs BoM and other agencies on the status of dams, and actual and projected releases from Wivenhoe and Somerset dams. It consults BoM regarding inflows to Wivenhoe and Somerset dams and expected flood heights along the Brisbane River downstream of Wivenhoe Dam.

  Seqwater initiates proposed reviews or updates to the Flood Mitigation Manual, undertaking consultation with Councils and other stakeholders. Seqwater coordinates the production of the TSRs relating to floodwater releases from the Wivenhoe and Somerset dams.

- Brisbane City Council (BCC), Ipswich City Council (ICC) and Somerset Regional Council (SRC) distribute consistent, detailed local flood level information, both to their respective operational units, their senior management and their broader communities. This should include the interpretation of BoM flood warnings and river height forecasts into expected areas and depths of inundation. Councils are responsible for activating their respective Local Disaster Management Groups (LDMGs), which then undertake the disaster management responsibility for response in the community.

- Department of Environment and Resource Management (DERM) consults with the stakeholders prior to the approval of any updates to the Flood Mitigation Manual. DERM also approves any necessary variations to the strategies in the manual if required during the course of a flood event.

- Queensland Police Service (QPS) assumes a legislative role, as per the disaster management system, to provide disaster management at a district level during an event, including provision of necessary community advice for public safety.

- Emergency Management Queensland (EMQ) provides support and general community safety advice on flooding issues, during non-operational times. It also maintains the State Disaster Coordination Centre, a 24/7 whole of government resource to support inter-agency coordination during events and ensure formal reporting to senior decision makers.

- SEQ Water Grid Communications Unit tracks the general harmonisation, but not specific detail of public messaging relating to floodwater releases, with BoM, SEQ Water Grid, Councils and DCS, as required. It does this by ensuring that each agency understands the extent of the release and that there is a general consensus as to the level of potential impacts.

Appendix C

TECHNICAL SITUATION REPORT

TSR Number		Date of TSR release		Time of TSR release	

This report is as at the time of assessment, and may quickly become out of date, depending on the current events. It relies on timely information provided by Seqwater, BoM and Councils. A reply will be required by a specified time and if not received by that time no information will be included.
If any information is not provided, the section will remain blank. There will be no follow up requests.

Each authority will provide an email and telephone contact for all communications. If an event escalates, there may be less time to respond or it may not be possible to respond to requests.

In floodwater releases Seqwater will email advices on releases to the organisations email address provided. Once a flood event is initiated, at any time a Council or agency can contact Seqwater to discuss if they have a serious concern regarding the information on releases provided. This would normally be by phone and followed by email. However, the ability to respond to any queries depends on the event. The frequency of advices will depend on the severity of the event and the needs of each agency.

Seqwater will also request at that time, a situation assessment from each agency as per details outlined in this document. Each agency will then email in return the requested information if possible or advice that it has not changed. If it is not received within the specified timeframe, it is assumed it is not being provided.

TRIGGERS	
These illustrative triggers provide guidance to initiation of this report	
BoM	
Seqwater	
Local Government	

Seqwater status of inflows and dam operations

(to include information on the current and/or predicted levels of Somerset and Wivenhoe Dams and the probable or planned release strategy with assessment as governed under the Manual of Operational Procedures for Flood Mitigation at Wivenhoe Dam and Somerset Dam)

This is Seqwater's status report on the dam levels, probable inflows and planned releases.

....

This has been supplied to
BCC on .....
ICC on .....
SRC on .....

Issues raised by Councils were .....

Actions taken were .....

Seqwater Technical Officer name	
Seqwater Technical Officer position title	
Seqwater Technical Officer contact details	

BoM assessment

(~~consisting~~Consisting of references to latest Flood Warning for the Brisbane River and other relevant Bureau forecasts and warnings (e.g. weather/rain forecasts, Tropical Cyclone Warning etc) and other updates/comments if needed)

BoM is to provide either a copy of, or links to, their current information and other updates or comments if needed. This will be their current set of warnings and may be updated or changed at any time.

BoM Technical Officer name	
BoM Technical Officer position title	
BoM Technical Officer contact details	

Brisbane City Council (BCC) assessment

(~~to~~To include predicted local inundation areas and depths of inundation based on the information)

This is an assessment as provided by BCC. A request for this information will be sent to the email address provided by BCC.

BCC Technical Officer name	
BCC Technical Officer position title	
BCC Technical Officer contact details	

Ipswich City Council (ICC) assessment (if required)

(~~to~~To include predicted local inundation areas and depths of inundation based on the information)

This is an assessment as provided by ICC. A request for this information will be sent to the email address provided by ICC.

ICC Technical Officer name	
ICC Technical Officer position title	
ICC Technical Officer contact details	

Somerset Regional Council (SRC) assessment (if required)

(~~to~~To include predicted local inundation areas and depths of inundation based on the information)

This is an assessment as provided by SRC. A request for this information will be sent to the email address provided by SRC.

SRC Technical Officer name	
SRC Technical Officer position title	
SRC Technical Officer contact details	

Collated and distributed by (Agency)

Contact Officer signature	
Contact Officer name	
Contact Officer position title	

Next TSR due	**Date**		**Tim e**		**or Event**	

Appendix D – Contact List

Technical Agency

Name	Title/Position	Agency	Mobile	Phone	Email

Council

Name	Title/Position	Council	Mobile	Phone	Email

[redacted]

From:	Mike Foster [redacted]
Sent:	Friday, 25 March 2011 3:56 PM
To:	[redacted]
Cc:	[redacted] Rob Drury; [redacted] Reilly Bob. Dan Spiller; [redacted]
Subject:	FW: Colleges Crossing
Attachments:	MOU TMR SEQ Water Colleges Crossing.pdf
Categories:	T16: Review

Hi Michael,

As discussed please find attached draft MOU from TMR covering off its information requirements in relation to flood gate releases from Wivenhoe.

[redacted], it's Seqwater's view that rather than a stand alone communication protocol, your requirements would be far better included in the overarching flood comms protocol document currently being finalised.

As such I have forwarded the draft MOU to [redacted] from EMQ who leading the finalisation of the flood protocol between the State and local Councils.

Cheers Mike

Mike Foster
Manager Strategic Relations & Communication
Queensland Bulk Water Supply Authority *trading as* Seqwater

Ph [redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au

From: [redacted]
Sent: Thursday, 24 March 2011 17:06
To: [redacted]
Cc: Rob Drury; [redacted]
Subject: Re: Colleges Crossing

[redacted]

Thankyou for attending the stakeholder meeting on Colleges Crossing on 11 March 2010.

To formalise the discussions and to ensure that all parties are aware of the arrangements, I have prepared the attached draft MOU between TMR and SEQ Water.

Could you please review or advise who in SEQ Water would review this.

Much appreciated.

(See attached file: MOU TMR SEQ Water Colleges Crossing.pdf)

Kind regards

[redacted]
District Director (Ipswich) | Metropolitan Region | Ipswich Office
Asset & Operations | Department of Transport and Main Roads

---

c/- Darra Office 23 Limestone Street | Darra Qld 4076
P
P [redacted]
W: www.tmr.qld.gov.au
Please consider the environment before printing this email

[redacted]

21/01/2011 10:43 AM	To	"Rob Drury" [redacted]
	cc	[redacted]
	Subject	Colleges Crossing

Hi Rob,

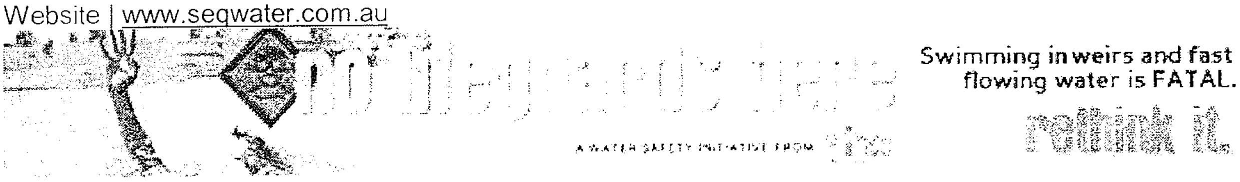
Have spoke with [redacted] who's the DTMR District Director covering Colleges Crossing. He is seeking an understanding of our release program so that they can start to get some timeframes around when Colleges can be repaired.

Would you please be able to call him on [redacted] to discuss,

Thanks

[redacted]
Senior Communications Advisor
Queensland Bulk Water Supply Authority *trading as* Seqwater

P [redacted]
Level 3, 240 Margaret St, Brisbane City QLD 4000
PO Box 16146, City East QLD 4002
Website | www.seqwater.com.au



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DRAFT

MEMORANDUM OF UNDERSTANDING (MOU)

Metropolitan Region
Department of
Transport and Main Roads (TMR)

and

SEQ Water

Flood Event Response

Mt Crosby Road – Colleges Crossing

Queensland Government

Department of Transport and Main Roads

seqwater

Contents

1 References

1.1. Queensland State Disaster Management Plan, State Disaster Management Group, 3020

2 Background

2.1. Weather events requiring water releases from the Wivenhoe Dam can adversely affect road network operations where roads cross the Brisbane River downstream of the dam.

2.2. Resultant increases to water levels in the Brisbane River have particular impacts on known low points on the road network affecting both state and local government authorities as well as affecting other river services such as ferry operations.

2.3. Known low road points crossing the Brisbane River are Twin Bridges on Wivenhoe Pocket Road, Savages Crossing on Banks Creek Road, Mt Crosby Weir on Allawah Road and Stumers Road, and Colleges Crossing on Mt Crosby Road.

2.4. Continuing growth within South East Queensland (SEQ) and in particular the Greater Brisbane Area presents ever increasing challenges for the road network. New and existing growth areas of Brisbane, Ipswich, Lockyer Valley and Somerset regions are impacted by road closures at these low points.

2.5. This agreement is about providing communication between the relevant state agencies to promote improve road network operations and community advice.

2.6. Separate arrangements relate to communication between SEQ Water and local governments.

2.7. In early 2003, an Alliance between the former Main Roads (MR), Queensland Transport (QT) and Brisbane City Council (BCC) agreed to develop a joint traffic and transport facility.

2.8. In December 2006, the Brisbane Metropolitan Transport Management Centre (BMTMC) commenced operation, in a purpose built facility, of a real time transport operation centre. This facility has provided an excellent platform through which interagency incident management coordination is already being undertaken.

3 Context

3.1.Strategic

3.1.1 The Government's desire for closer working relationships across agencies has been well embraced by TMR, SEQ Water, Queensland Police Service, Regional Councils and other stakeholders who are already working closely to address a number of whole of government priorities.

3.1.2 This is no better reflected than in the good working relationship developed around a joint desire for the best possible operational efficiency outcomes from the State's road network.

3.1.3 Underpinning this agreement is a commitment to work more closely to achieve improved network and community outcomes.

3.1.4 This MOU is a Partnering Arrangement between SEQ Water and TMR for the purpose demonstrating that commitment relating to relevant water crossings on State-controlled roads.

3.2.Operational Arrangements for Brisbane River Crossings on State Controlled Roads

3.2.1. TMR, through the BMTMC works closely with many external agencies in providing coordinated real time incident management services to Brisbane's road network, the focus of which is to improve road network safety and efficiency.

3.2.2. TMR has two main branches relating to this agreement: Metropolitan Region and SEQ South Transport Services Division. Metropolitan Region builds and operates the state-controlled road network. Transport Services Division provides the front line services to the community, including driver licensing, vehicle registrations, transport inspectorate, school crossing services and a first point of call service for customer enquiries.

3.2.3. A good working relationship exists between SEQ Water, QPS, Councils and TMR developed through a stakeholder interaction in dealing with road network activities across Brisbane, Ipswich, Lockyer Valley and Somerset region's road network.

3.2.4. Traffic Management Centres are critical in responding to and coordinating incident response management and support from initial notification through to clearance and the return of the network to normal operations.

3.2.5. The QPS currently provides a physical presence in the BMTMC facility to assist in coordinating traffic/crowd activity around major event or incidents. This positively enhances operational capability resulting in greatly improved outcomes on the road network.

3.2.6. The value of QPS presence within the BMTMC facility has been well investigated and tested during the BMTMC's early development and operation resulting in the current MOU for QPS Presence in the BMTMC.

4 Communication Arrangements

4.1 This MOU outlines the agreed arrangements for communication between SEQ Water and TMR relating to the following river crossings on state-controlled roads.

4.2 Colleges Crossing on Mt Crosby Road

4.2.1 **Attachment 1** provides a map of Colleges Crossing and surrounding local road network.

4.2.2 During closures of Colleges Crossing TMR recommends travellers use detours via Mt Crosby Road, Warrego Highway and Ipswich Motorway as this provides an all weather fully signed and line marked route.

4.2.3 TMR provides permanent and temporary variable message signs on the Warrego Highway, Western Freeway, Mount Crosby Road and other activated and/or installed signs at appropriate locations. Other locations include (but not limited to):

- Ipswich Motorway westbound, within proximity of the Progress Road On-Ramp
- Ipswich Motorway westbound, within proximity of the Centenary Highway roundabout at Darra
- Cunningham Highway northbound
- Cunningham Highway eastbound
- Brisbane Road eastbound
- Logan Motorway westbound

4.2.4 TMR also utilises permanent fold-down metal signage on approach roads to Mt Crosby Road and Colleges Crossing. The department does not promote the Stumers Road, Allawah Road link as an alternative route because this is the responsibility of Ipswich City Council and Brisbane City Council who jointly manage this link.

4.2.5 TMR requires advance notice of SEQ Water of Wivenhoe Dam releases or adverse weather events that could impact on the closure of Colleges Crossing. Transport Services Division also need to work with stakeholders in this regard.

4.2.6 Regional Traffic Management Centres are a key interface for SEQ Water to provide this advance notice. **Attachment 2** provides the flood event response flow chart.

4.2.7 Transport and Main Roads is undertaking a planning study to determine possible upgrade options to Colleges Crossing to improve flood immunity.

5 Outcomes

5.1 This initiative contributes to the broader joint objective:

"A free flowing and open network: that when impacted by a traffic incident, results in a rapid, appropriately resourced and coordinated joint response that mitigates impact and returns the road network to normality as safely and efficiently as possible".

5.2 QPS presence in the BMTMC facility facilitates this through communications between QPS Communications Centres, TMR through the BMTMC and QPS field resources the outcome of which should result in:

5.2.1 Improved operational awareness and therefore, quicker/better focused responses.

5.2.2 Reduced incident duration and clearance times; traffic delays and congestion; and secondary incidents.

5.2.3 Mutually agreed effective and safe diversion coordination.

5.2.4 Better informed road users.

5.2.5 Efficient use of multi-agency resources.

6 Arrangement

6.1 Both parties agree to undertake arrangements in accordance with this agreement..

7 Operational Relationship Principles

7.1 Both parties agree to:

7.1.1 Mutually respect each other's role in road operations and more specifically incident management activities.

7.1.2 Agree to consult and, wherever appropriate, agree on, operational actions and decisions to be taken.

7.1.3 Support a joint operational approach to addressing real time incident and systems issues, particularly in response to network congestion and safety, through expeditious incident clearance and safety risk removal.

7.1.4 Promote the rapid, well organised and coordinated clearance of incidents both across and within respective agency responsibilities.

7.1.5 Jointly monitor, review and evaluate incident management performance.

8 Governance

8.1 This agreement is to be managed jointly by TMR Metropolitan Region and SEQ Water.

9 Dispute Resolution

9.1 In the first instance dispute resolution should be undertaken through regional consultation. In the event that it cannot be resolved at this level the issue should be escalated to SROCG for resolution.

10 Term and Review

10.1 This MOU remains in place for a period of three (3) years to coincide with the term of the project which has funding commitment until June 2013. Any review is to be undertaken on an as required basis, either by signatories jointly or independently.

11.2 Amendments may be made to this MOU at any time with the written agreement of the parties.

11 Definitions (within the context of this MOU)

11.1 **Alliance agreement** – An overarching "heads of agreement" that outline guiding principals and a framework to which participation agencies agree to commit.

11.2 **Congestion** – Reflected as increased travel time created when travel demand exceeds road capacity. It can be either recurrent or non-recurrent in nature:

11.2.1 Recurrent – Generally occurs as a result of existing infrastructure and/or systems deficiencies that regularly create traffic bottlenecks and choke points. The cause is addressed through medium to long term infrastructure, systems, modal change and/or policy amendment.

11.2.2 Non-recurrent – This can be caused through an incident or event that temporarily impedes/reduces road capacity, eg traffic incidents, systems faults, road works, events and weather. This would be addressed through appropriate real time responses to mitigate impediment impact.

11.3 **Incident management (IM)** – The planned, coordinated use of appropriate response resources designed to reduce the duration and impact of incidents on the road network.

11.4 **Road operation** - The overall management of the road network and the associated road systems. It includes the management of vehicles, road system access priority, compliance and enforcement activities as they relate to access and movement and the general management of the road user.

12 Agreement Endorsement

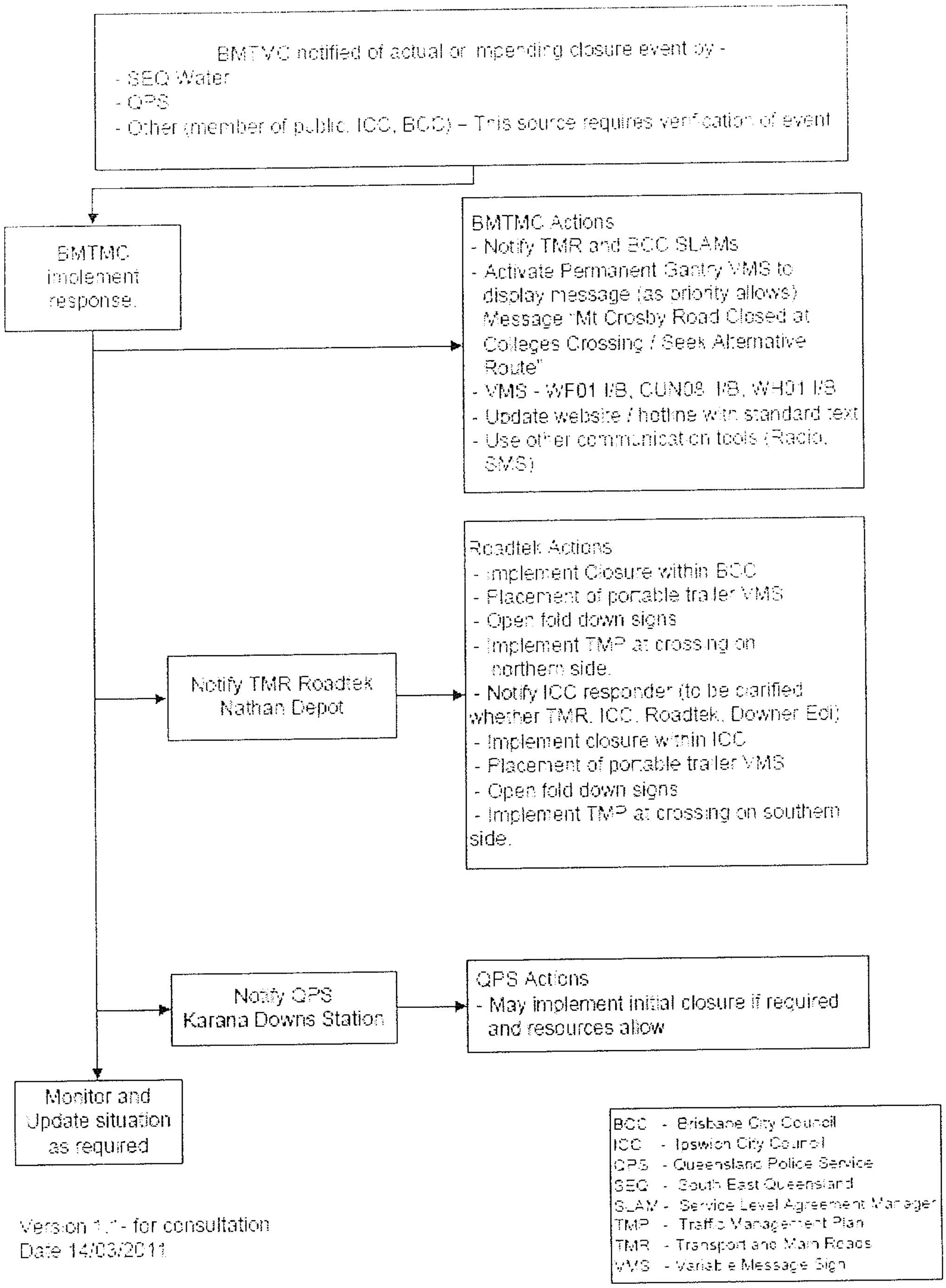
13.1 It is not intended that this MOU create any contractual relationship or that it be legally binding on the parties.

13.2 The below parties agree to work through close cooperation and commitment, in the spirit set out in this Memorandum of Understanding.

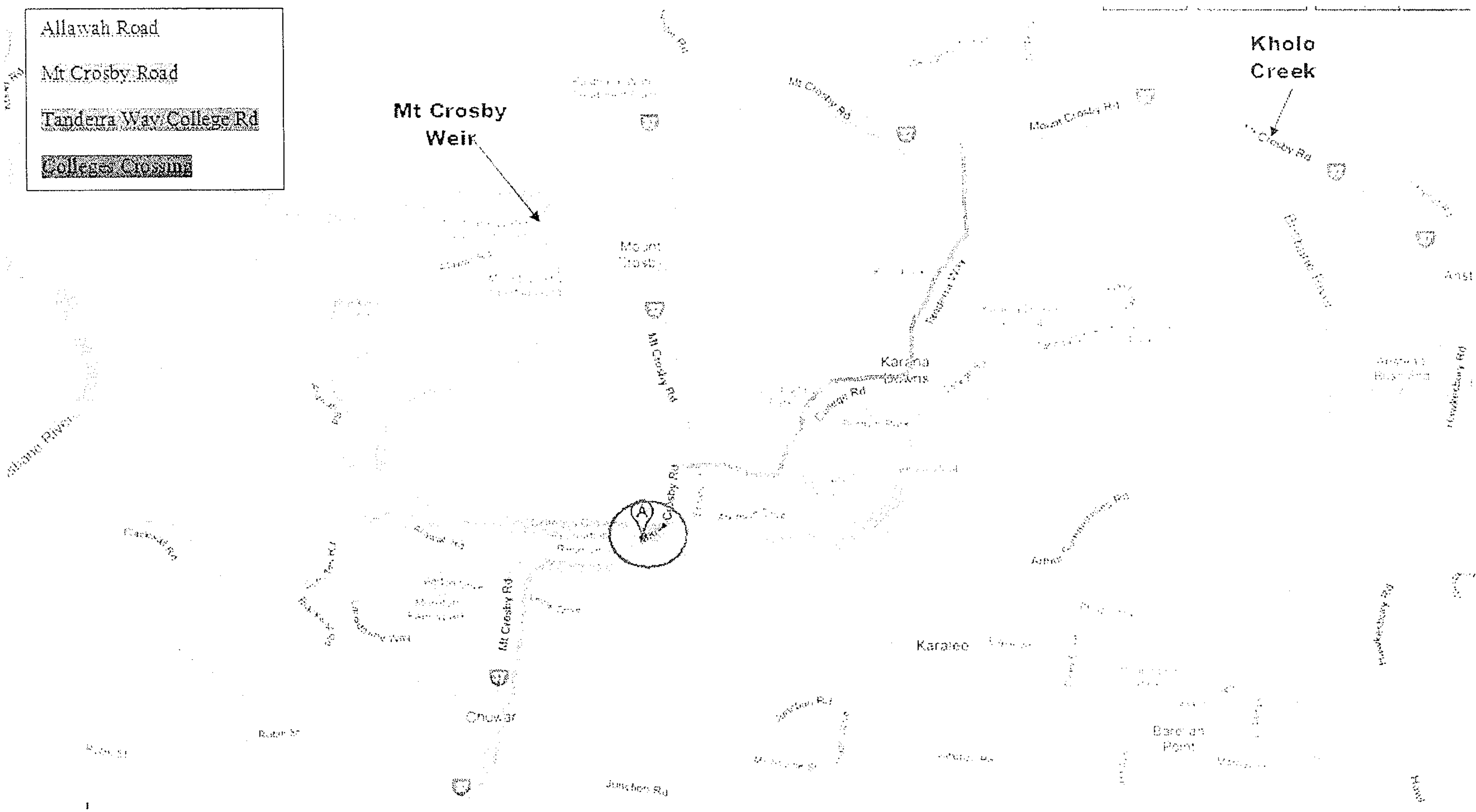
Department	Representative	Date
Department of Transport and Main Roads	[redacted] Regional Director (Metropolitan)	xx/04/11
South East Queensland Water		xx/04/11

Attachment 1 Flood Event Response Flow Chart for Mt Crosby Road – Colleges Crossing

EVENT RESPONSE FLOW CHART
ROAD CLOSURE
Mt Crosby Road – Colleges Crossing



Attachment 2 Map of Colleges Crossing on Mt Crosby Road



[redacted]

From: Reilly Bob [redacted]
Sent: Thursday, 31 March 2011 10:43 AM
To: [redacted] p.baddile[redacted] rdrury[redacted] Allen Peter; mfoster[redacted] Dan Spiller; jpruss[redacted] martin.peter[redacted]
Cc: [redacted]
Subject: Communication review: North Pine dam floodwater releases

Categories: T16: Review

Hi everyone

At our meeting on 25 March 2011 to discuss the review of the Communication Protocol for Wivenhoe/Somerset dams floodwater releases, I also raised the matter of a review of communications for floodwater releases for North Pine dam. (Seqwater stated the desirability of undertaking such a review in their report on the January 2011 event for North Pine dams titled: *January 2011 Flood Event: Report on the Operation of North Pine Dam*).

At our meeting I said that Seqwater would normally initiate, lead and manage such a review and that this process would be followed, unless anyone advised me of any objections to this approach by 29 March 2011. No one has advised me of any objections to this approach.

Accordingly, Seqwater will now initiate a review of the North Pine communications. If you wish to be involved, please contact Mike Foster—email details above.

Thanks

Bob

expressly, and with the authority, states them to be the opinions of the Department of Community Safety, Queensland.

All reasonable precautions will be taken to respect the privacy of individuals in accordance with the Information Privacy Act 2009 (Qld). Details on how personal Information may be used or disclosed by the Department of Community Safety, Queensland are available from www.communitysafety.qld.gov.au/info/privacy.htm