Total Water Cycle Management Planning Guideline for South East Queensland

Produced for the Department of Environment and Resource Management under the Queensland Environmental Protection (Water) Policy 2009

waterbydesign

Version 1, December 2010

Queensland Government

Water by Design is a program of the South East Queensland Healthy Waterways Partnership

HEALTHY WATERWAYS
Because we're all in the same boat

Version: Version 1, December 2010

This publication should be cited as: Water by Design (2010). *Total Water Cycle Management Planning Guideline for South East Queensland (Version 1, December 2010).* Department of Environment and Resource Management, Brisbane, Queensland.

This document is available for download from www.waterbydesign.com.au/twcm

DISCLAIMER

The material contained in this publication is produced for general information only. It is not intended as professional advice on specific applications. It is the responsibility of the user to determine the suitability and appropriateness of the material contained in this publication to specific applications. No person should act or fail to act on the basis of any material contained in this publication without first obtaining specific independent professional advice. Healthy Waterways Limited and the participants of the Healthy Waterways Network expressly disclaim any and all liability to any person in respect of anything done by any such person in reliance, whether in whole or in part, on this publication. The information contained in this publication does not necessarily represent the views of Healthy Waterways Limited or the participants of the Healthy Waterways Network.

This document has been prepared with all due diligence and care, based on the best available information at the time of publication. The Queensland Government, acting through the Department of Environmental and Resource Management, holds no responsibility for any errors or omissions within this document. Any decisions made by other parties based on this document are solely the responsibility of those parties. Information contained in this document is from a number of sources and, as such, does not necessarily represent government or departmental policy.

Queensland Government

ACKNOWLEDGEMENTS

The *Total Water Cycle Management Planning Guideline for South East Queensland was* developed by the Water by Design program of the South East Queensland Healthy Waterways Partnership (SEQHWP), with financial assistance from the State of Queensland acting through the Department of Environment and Resource Management. In-kind contributions were provided by Moreton Bay Regional Council, Unity Water and the Queensland Water Commission.

Project Manager: Sarah Jones (Water by Design, SEQHWP)

Authoring Team: Sarah Jones (Water by Design, SEQHWP), Damian McGarry (McGarry & Eadie), Alan Hoban (Water by Design, SEQHWP), Andrew Sloan (Unitywater) and Malcolm Eadie (McGarry & Eadie).

Editor: Justine Gannon

A number of individuals have contributed to the development of this document through the stakeholder consultation and drafting process. This includes representatives from(in alphabetical order) Allconnex Water, Bligh Tanner, Brisbane City Council, Council of Mayors, Gold Coast City Council, Institute for Sustainable Futures (University of Technology, Sydney), Integrated Water Cycle Management Scientific Expert Panel Working Group, Ipswich City Council, Logan City Council, Moreton Bay Regional Council, Queensland Conservation Council, Queensland Urban Utilities, Queensland Water Commission, Queensland Water Directorate, Redland City Council, South East Queensland Catchments, Sunshine Coast Regional Council, Unitywater and Water Strategies. No endorsement by these organisations is implied.

Water by Design

Water by Design is a program of the South East Queensland Healthy Waterways Partnership. Water by Design builds the capacity of the water and urban development sectors to help successfully implement sustainable urban water management

South East Queensland Healthy Waterways Partnership

The South East Queensland Healthy Waterways Partnership is a collaboration between government, industry, researchers and the community. The Partnership was created in 2001. The partners work together to improve catchment management and waterway health in Moreton Bay and the rivers of South East Queensland between Noosa and the Queensland–New South Wales border. The South East Queensland Healthy Waterways Partnership developed and implemented the *South East Queensland Regional Water Quality Management Strategy* (2001) and its successor, the *South East Queensland Healthy Waterways Strategy 2007–2012* (2008). The Partnership also manages the Ecosystem Health Monitoring Program, which produces an annual report card on the health of the region's waterways, estuaries and bays.

Further information on the SEQ Healthy Waterways Partnership and the Water by Design Program is available from www.healthywaterways.org and www.waterbydesign.com.au.

EXECUTIVE SUMMARY

Total Water Cycle Management (TWCM) planning aims to consider all elements of the water cycle to deliver the community's needs and aspirations for water in a way that optimises social and environmental benefits and minimises costs.

There are a number of drivers for TWCM in South East Queensland (SEQ), including population growth, climate change, environmental decline, technology advances, and changing community values. At a national level, the National Water Initiative is Australia's blueprint for water reform. TWCM is central to the Initiative's objective of achieving a nationally compatible market, regulatory framework, and planning-based system of managing surface and groundwater resources for rural and urban use.

Local governments in SEQ are now required by the Environmental Protection (Water) Policy (2009) of the *Environmental Protection Act 1994* to develop and start implementing a TWCM Plan by the 30 June 2012. This requirement recognises local government's ongoing responsibilities for water management following the SEQ water reforms. TWCM planning will give local governments an opportunity, in collaboration with water service providers, to better manage and influence key water cycle services for their communities and environment. TWCM provides the forum for collaboration and understanding of water-related issues across all the relevant water sectors. Through these shared understandings, options for responding to significant issues can be tested among all stakeholders and the community aspirations in local government Community Plans can be translated into relevant actions and strategies.

This guideline *Total Water Cycle Management Planning Guideline* is published by the Department of Environment and Resource Management under Part 6 Division 2 of the EPP Water 2009. The guideline provides important contextual information, the statutory framework and roles and responsibilities of key stakeholders for TWCM, and the key linkages between other planning instruments that are relevant to the timing, detail and rigour of TWCM Plans. The recommended TWCM planning approach is also detailed, including requirements and recommendations for monitoring and review of the plans.

Following the approach detailed in this guideline will provide a robust and transparent process to inform planning instruments, management plans, and infrastructure agreements for local government areas across SEQ. The key components of the recommended approach are:

- developing a TWCM strategy
- undertaking detailed planning (where necessary)
- preparing an implementation plan
- publishing, monitoring and reviewing the plan
- obtaining certification and endorsement throughout the process.

The approach has been designed to accommodate a range of variances across SEQ. These include current planning, the complexity of water management issues, and the capacity of local governments.

This guideline has been structured to encourage local governments to begin preparing their TWCM Plans by building on existing knowledge and information. This approach will provide early recognition for those local governments who have previously undertaken work that may support total water cycle management planning. It should integrate, not duplicate existing work.

Detailed planning is the optioneering process that generates preferred water management solutions for planning areas through an inclusive and transparent process. Detailed planning is only required where it has been identified as necessary in the TWCM Strategy for identified planning areas with identified issues.

Preparing and implementing TWCM Plans involves a broad range of stakeholders. Model team and reference group structures are presented, and indicative milestones and resource requirements are provided to assist with planning the process.

In addition to this guideline, tools and resources to support the preparation and implementation of TWCM Plans will be provided via the Healthy Waterway's Partnerships Water by Design program at www.waterbydesign.com.au/twcm.

Contents

List of Acronyms and Abbreviations

CEO	Chief Executive Officer
DALY	Disability Adjusted Life Years
DERM	(Queensland) Department of Environment and Resource Management
DIP	Department of Infrastructure and Planning
D-R	Distributor-Retailers
EPP Water 2009	Environmental Protection (Water) Policy (2009)
GHG	Greenhouse Gas
MP	Mandatory Part
NRM	Natural Resource Management
NWC	National Water Commission
PIP	Priority Infrastructure Plan
PRG	Project Reference Group
QCA	Queensland Competition Authority
QDC	Queensland Development Code
QWC	Queensland Water Commission
S&R	Security and Reliability
S-R	Sub-Regional
SAMP	Strategic Asset Management Plan
SEQ	South East Queensland
SEQHWS	SEQ Healthy Waterways Strategy 2007–2012
SPP	State Planning Policy
STP	Sewage Treatment Plant
TWCM	Total Water Cycle Management
UDA	Urban Development Areas
ULDA	Urban Land Development Authority
WGM	Water Grid Manager
WSAA	Water Services Association of Australia
WSP	Water Service Provider

1 INTRODUCTION

1.1 CONTEXT

Managing the various components of the water cycle has been a both a statutory and non-statutory requirement for local governments since the 1990s. Under the new Environmental Protection (Water) Policy (2009)[1], local governments in South East Queensland are required to develop and start implementing a Total Water Cycle Management (TWCM) Plan by 30 June 2012.

The EPP Water 2009 is subordinate to the *Environmental Protection Act 1994*. The objectives of EPP Water 2009 are to enhance and protect the environmental values of Queensland waters, while allowing for ecologically sustainable development. Environmental values include the biological integrity of an aquatic ecosystem; the cultural and spiritual values of water; the suitability of water for producing food, aquaculture use; agricultural purposes; primary, secondary or visual recreational use; drinking water; and industrial use. Further information on the purpose and how the policy will protect Queensland waters is available via www.derm.qld.gov.au. A key way to achieve the objectives of the EPP Water 2009 is through local governments preparing and implementing TWCM Plans.

The EPP Water 2009 states that when local governments plan and implement their TWCM Plans, they 'must have regard to any guidelines published by the department about total water cycle management' (Section 19.3 (a)). This document is one of the 'guidelines' the policy refers to—it outlines a process to develop and implement a TWCM Plan, as well as containing essential contextual information including the links with other legislation and planning processes. If a TWCM Plan is satisfactorily prepared in accordance with this guideline, including being certified and endorsed as outlined in Section 9, it will comply with the requirements of the policy.

1.2 STRUCTURE

This guideline explains what a TWCM Plan is and the drivers for it, describes the statutory framework for TWCM planning, clarifies roles and responsibilities, and sets out the recommended process for TWCM planning in South East Queensland. The structure of the guideline is:

- Section 2 —an overview of TWCM
- Section 3—an outline of the drivers for TWCM
- Section 4—the statutory framework for TWCM planning in South East Queensland and the roles and responsibilities of stakeholders
- Sections 5–10—the process for developing, monitoring, and reviewing a TWCM Plan
- Appendices A–C—additional information to support TWCM planning processes.

This guideline does not provide detailed information on particular elements of the TWCM planning process, such as the use of decision support tools. Healthy Waterways is investigating developing a range of additional resources to assist the TWCM planning process. These additional resources include:

- online resource centre to bring together knowledge, experiences and expertise in TWCM
- a draft Terms of Reference and a generic consultant's brief
- a literature review on the costs and benefits of decentralised systems
- checklists
- example table of contents
- information on decision support tools and modelling software
- recommended criteria for undertaking multi-criteria analysis.

The resources that are developed will be available through the Water by Design website at www.waterbydesign.com.au/twcm.

[1] At the time of writing, the current version of the EPP Water 2009 was Reprint No. 1B, 16 July 2010.

1.3 WHO WILL BENEFIT FROM THIS GUIDE?

This guideline is primarily for **local governments** South East Queensland who are obliged to prepare and start implementing TWCM Plans.

The guideline will also be of use to **water service providers**[2] (i.e. Queensland Urban Utilities, Allconnex Water, Unitywater) who have a significant role in local government TWCM planning and implementation.

Other organisations with a role in TWCM (see Section 4) will also find this guideline useful, including:

- Seqwater, the SEQ Water Grid Manager, and WaterSecure
- State government agencies such as the Department of Environment and Resource Management (DERM); the Department of Infrastructure and Planning (DIP); and the Queensland Water Commission (QWC)
- Urban Land Development Authority (ULDA)
- non-government stakeholders
- consultants assisting to prepare TWCM Plans.

[2] 'Water service providers', rather than 'distributor-retailers', has been used throughout this document (except in the context of specific legislation) to refer to Queensland Urban Utilities, Allconnex Water and Unitywater. It is the most commonly used term, with the majority of the legislation relevant to water management (such as the *Water Supply Act*) using the term. "Distributor-retailers" is a term used to set up the three businesses under the *SEQ Water (Distribution and Retail Restructuring) Act 2009*.

2 TOTAL WATER CYCLE MANAGEMENT

2.1 WHAT IS TOTAL WATER CYCLE MANAGEMENT?

Every local government area in South East Queensland has a unique water cycle. Water cycles are influenced by a number of factors such as climate, geography and biogeography, population growth and settlement patterns, rural and industrial activities, interest groups, and governance arrangements. A conceptual diagram of an area's total water cycle is shown in Figure 1.

Figure 1 Conceptual diagram of an area's water cycle

Historically, specific elements of the water cycle have been managed by separate organisations and professional disciplines. Separation of management created a narrow focus on discrete parts of the water cycle—no-one had an overall picture of the total water cycle. The result was inefficiencies, market distortions, and unintended negative impacts. Such approaches emerged in an historical context with few perceived limitations on growth and the environment was assumed to have an almost infinite assimilative capacity.

TWCM recognises that all elements of the water cycle are interdependent—a decision made in one part of the water cycle impacts other parts of the cycle. **All** the elements of the water cycle should be considered— separately and in combination. TWCM also requires integration of infrastructure planning with land use planning. Section 11 of the *South East Queensland Regional Plan* (State of Queensland, 2009) sets out the principles of TWCM for SEQ (Box 1).

TWCM requires a systems thinking approach where decision makers understand how issues and decisions fit into the overall, interlinked system. This requires lateral, holistic and cyclic problem solving techniques rather than linear, reductionist techniques. The Kalkalo project, (see Box 1) demonstrates the benefits that can arise from such an approach.

The major barriers to uptake of TWCM are socio-institutional rather than technological (Brown and Farrelly, 2007). TWCM planning provides a vision, objectives and preferred solutions; however, achieving TWCM requires behavioural and institutional change with sufficient resources, communication and (political) commitment.

Box 1 South East Queensland Regional Plan's Regional Policy 11 on Water

Desired regional outcome 11 *Water in the region is managed on a sustainable and total water cycle basis to provide sufficient quantity and quality of water for human uses and to protect ecosystem health.*

11.1 Total water cycle management

Principle: *Plan and manage water as a valuable and finite regional resource on a total water cycle basis.*

11.2 Water supply planning

Principle: *Supply sufficient water to support a comfortable, sustainable and prosperous lifestyle, while meeting the needs of urban, industrial and rural growth, and the environment.*

11.3 Efficient water use

Principle: *Achieve targeted reductions in water consumption to decrease pressure on water supplies and the environment.*

11.4 Waterway Health

Principle: *Protect and enhance the ecological health, environmental values and water quality of surface and groundwater, including waterways, wetlands, estuaries and Moreton Bay.*

11.5 Drinking water catchment protection

Principle: *Manage risks in drinking water catchments to achieve acceptable water quality.*

11.6 Overland flow and flood management

Principle: *Provide necessary flood immunity for infrastructure and buildings, and resilience to potential climate change flooding, while seeking to maintain the natural flow regime.*

11.7 Rural Water

Principle: *Supply and use rural water in an efficient and sustainable way.*

Box 2 Kalkallo case study

Yarra Valley Water adopted a multi-criteria assessment framework to assess different infrastructure options for a greenfield development site 28km north of Melbounre. The study found that when a waterway manager (Melbourne Water), local government (Hume City Council), a health regulator (DHS), a land developer (MAB Corporation) and a water company work together and step outside their usual spheres of influence, significant benefits can be achieved.

The Kalkallo project will be a project of international significance. It will showcase alternatives in how urban water infrastructure can be designed differently to deliver a more resilient potable water supply solution that is invulnerable to dry climatic sequences, while proving it is possible to retain the natural characteristics of a stream following urbanisation.

When completed, the key project outcomes will show:

- that urban stormwater can be treated to a standard suitable for potable consumption using current technologies while following a risk management framework which includes appropriate governance, monitoring and control
- the use of treated stormwater for direct potable substitution will ultimately lead to a reduction in the net volume of imported potable water by up to 90%
- a decrease in the runoff volume discharged into the local stream following urbanisation by 50% (compared with a traditional stormwater system which may reduce the volume by 5–10%)
- a reduction in pollutant loads of: gross pollutants by 100%; total suspended solids by 94%; total phosphorus by 82%; and total nitrogen by 70%
- seventy-five per cent less energy consumption than desalination, which is presently the most common supply enhancer
- cost recovery of the upfront capital and ongoing operational costs within a 25-year period.

References: Pamminger (2008), Wilson et. al. (2005) and Sharma et. al (2005)

2.2 What is a Total Water Cycle Management Plan?

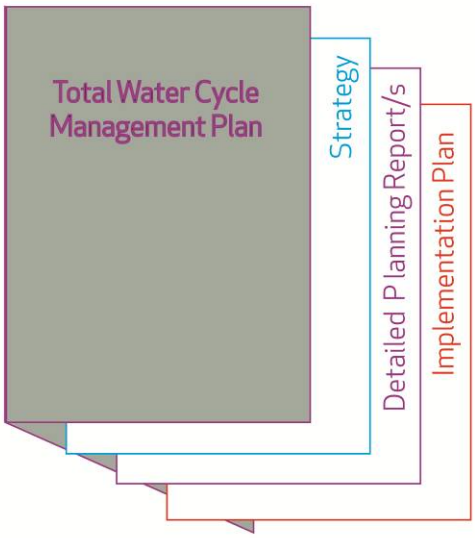
A TWCM Plan is a way to deliver balanced decisions for water management that met the community's needs and aspirations in a manner that optimises costs and social and environmental benefits.

A TWCM Plan will:

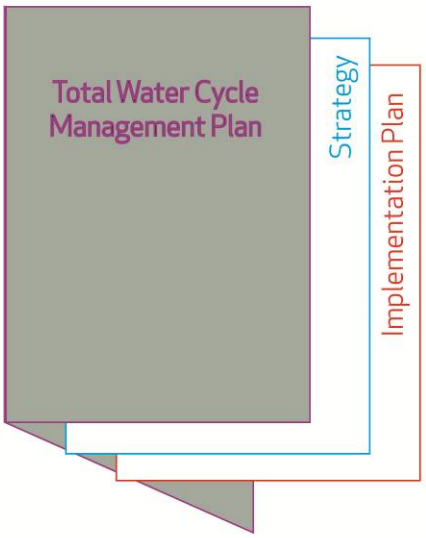
- be a key strategic document within local governments' corporate and operational framework
- influence decisions and actions across the organisation, as well as influencing decisions and actions by other stakeholders such as water service providers
- provide a central point of reference to integrate existing information about water management and planned activities
- be an endorsed, transparent, accountable, and publicly accessible basis for decisions by local governments and water service providers about all aspects of water management, including capital investment
- provide direction to Water Netserv Plans prepared by water service providers.

As shown in Figure 2, TWCM Plans will consist of:

- **TWCM Strategy:** A document covering the whole local government area outlining the vision and objectives for managing the water cycle. Each TWCM Strategy will document existing knowledge and identify and prioritise 'planning areas' where 'detailed planning' is required.
- **Detailed Planning Report:** Where needed, these reports document the results of the 'optioneering' process to generate preferred water management solutions through an inclusive and transparent process.
- **Implementation Plan:** A document that outlines strategies and actions to achieve the local government's vision for the water cycle.



Total Water Cycle Management Plan contents (typical)



Total Water Cycle Management Plan contents (if no detailed planning is needed)

Figure 2 Total Water Cycle Management Plan contents

Detailed planning may not form part of all TWCM Plans prepared by 1 July 2012. The need for, and extent of, detailed planning will be identified during development of a TWCM Strategy. It will vary depending on a range of factors (see Section 6.4), including the level of risk and the potential for synergies to improve overall system outcomes. This approach allows local governments to prioritise their investment to the most important areas in the detailed planning stage while allowing other areas to be addressed in the future. It also accommodates a range of variations across South East Queensland. For example, some local governments are already well progressed in the development of their TWCM Plans and some have not yet started. Some local governments will need to provide input to sub-regional TWCM plans (led by the QWC) or to development

schemes for Urban Land Development Areas (prepared by the ULDA). Some local governments have limited capacity to undertake detailed planning across their entire jurisdiction within the timeframe required by the EPP Water 2009.

A collaborative TWCM Plan can be prepared by adjoining local governments if water services and environmental resources are shared and common TWCM objectives can be agreed. A collaborative TWCM Plan may be preferred if local governments share a water service provider.

It is recommended that TWCM Plans cover a 20-year period to account for longer-term patterns and changes. This timeframe is consistent with the 20-year horizon of other key strategic documents such as the SEQ Regional Plan, SEQ Water Strategy, and Water Netserv Plans. Implementation Plans may limit detailed actions to a five-year period.

3 THE CASE FOR TOTAL WATER CYCLE MANAGEMENT

TWCM planning is universally recognised as the best way to develop and evaluate strategic water cycle options. This is evident in many key documents such as:

- COAG's *National Urban Water Planning Principles,* and Principles 2, 3, 4 ,and 5 in particular (see http://www.environment.gov.au/water/policy-programs/urban-reform/nuw-planning-principles.html).
- *Ozwater 2010 Cities of the Future Workshop Report* (see https://www.wsaa.asn.au/About/News/Pages/default.aspx).
- Infrastructure Australia's *Review of Urban Water Security Strategies*, May 2010, Recommendation 2. (see http://www.infrastructureaustralia.gov.au/public_submissions/uws/index.aspx).
- *SEQ Regional Plan 2009*, Chapter 11 (see http://www.dip.qld.gov.au/regional-planning/regional-plan-2009-2031.html).

There are a number of drivers for TWCM in South East Queensland. These are:

- national reform
- coordination and alignment
- planning is better than reacting
- planning for climate change
- planning for population growth
- managing waterway decline
- addressing increases in water supply costs
- demonstration of prudency and efficiency in water pricing
- improved knowledge about water management options.

3.1 NATIONAL REFORM

The National Water Initiative (NWI) is Australia's blueprint for water reform. The philosophy of TWCM is central to the NWI with the overall objective to achieve a nationally compatible market, regulatory and planning-based system of managing surface and groundwater resources for rural and urban use that optimises economic, social, and environmental outcomes.

The TWCM objectives for urban water reform outlined in the NWI are to:

- provide healthy, safe and reliable water supplies
- increase water use efficiency in domestic and commercial settings
- encourage re-use and recycling of wastewater where cost effective
- facilitate water trading between and within the urban and rural sectors
- encourage innovation in water supply sourcing, treatment, storage and discharge
- achieve improved pricing for metropolitan water (National Water Commission, 2010a).

Principles for water planning are specified by the National Water Commission, shown in Box 3.

3.2 COORDINATION AND ALIGNMENT

TWCM planning recognises local governments' ongoing responsibility for planning and promoting sustainable water management. This responsibility is still required, even after the recent separation in SEQ of water service provision from the traditional local government services. TWCM planning gives local governments an opportunity, in collaboration with water service providers and the state government, to better manage and influence key water cycle services for their communities. It helps to ensure that there is coordinated and aligned management of the water cycle, and that community aspirations in local government Community Plans are translated into relevant actions and strategies. It will also provide an opportunity for local governments to internally coordinate their existing water cycle responsibilities (see Section 4.3) for greater efficiency and effectiveness.

Box 3 Water Planning Principles of the National Water Commission

Future water planning should:

- achieve a shared understanding of sustainable levels of water extraction so that over-allocation is both rectified and avoided in the future
- improve our knowledge of groundwater-surface water connectivity, with significantly connected systems to be managed as one integrated resource
- factor in the impacts of climate change and the effects of interception activities (e.g. farm dams, forestry) on future inflows and recharge
- ensure that environmental outcomes are clearly specified, decisions are based on best available information, and environmental managers have adequate resources
- increase inputs from socio-economic analyses and incorporate consultation to improve the quality of decisions and build community confidence in the fairness of outcomes
- give higher priority to ensuring that the values and interests of indigenous people are considered
- be better integrated with regional natural resource management planning and urban water supply planning
- provide adequate resources to develop and implement water plans, and evaluate their outcomes
- improve monitoring and compliance of water use.

Source: National Water Commission (2010b)

3.3 PLANNING IS BETTER THAN REACTING

Rapidly reacting to water cycle crises typically means fewer viable solutions are considered, resulting in solutions with higher net costs. TWCM planning can promote solutions that optimise overall community costs by evaluating a broad suite of options, with time to investigate and resolve any social, technological, and financial issues. This comparison is illustrated in Figure 3.

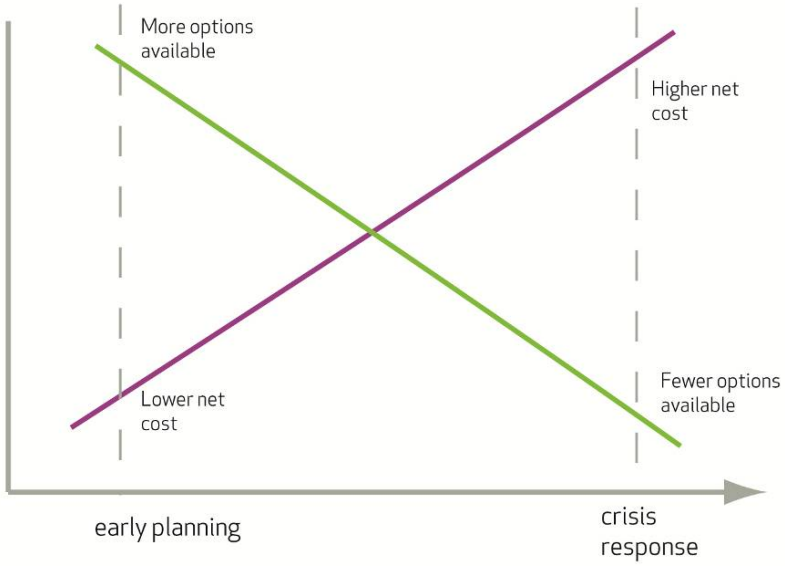


Figure 3 Early planning for water management leads to better outcomes compared to responding to crises

3.4 PLANNING FOR CLIMATE CHANGE

TWCM planning provides a process to consider and incorporate the implications of climate change into decision-making processes for water. It is anticipated that, over time, climate change will impact on a number of issues that may be incorporated into TWCM Plans, such as:

- yield and sources of bulk water supply sources
- yield of local rainwater and stormwater harvesting schemes
- demand patterns for water supply
- micro-climates and liveability in urban and rural areas
- groundwater conditions
- biodiversity, catchment and riparian conditions
- coastal management
- flood and storm surge levels and frequency
- pumping and treatment costs (energy costs and greenhouse gas (GHG) emissions).

Appendix B contains a summary of key messages and approaches to dealing with climate change in water planning that are emerging from the National Water Commission.

3.5 PLANNING FOR POPULATION GROWTH

From 2006 to 2031, the population of South East Queensland is expected to grow from 2.8 million to 4.4 million people (DIP, 2010). By 2031, an additional 754,000 dwellings will be required, as well as supporting infrastructure and services. This impact will impose significant social, economic, and environmental pressures on the region.

Social research undertaken as part of the 2010 Queensland Growth Management Summit found concern about marine and waterway health had the strongest influence on residents' perceptions of whether population growth will be a good thing or a bad thing for South East Queensland (TNS Social Research 2010), as shown in Figure 4. Water supply is also a strong influence on resident's perceptions of population growth.

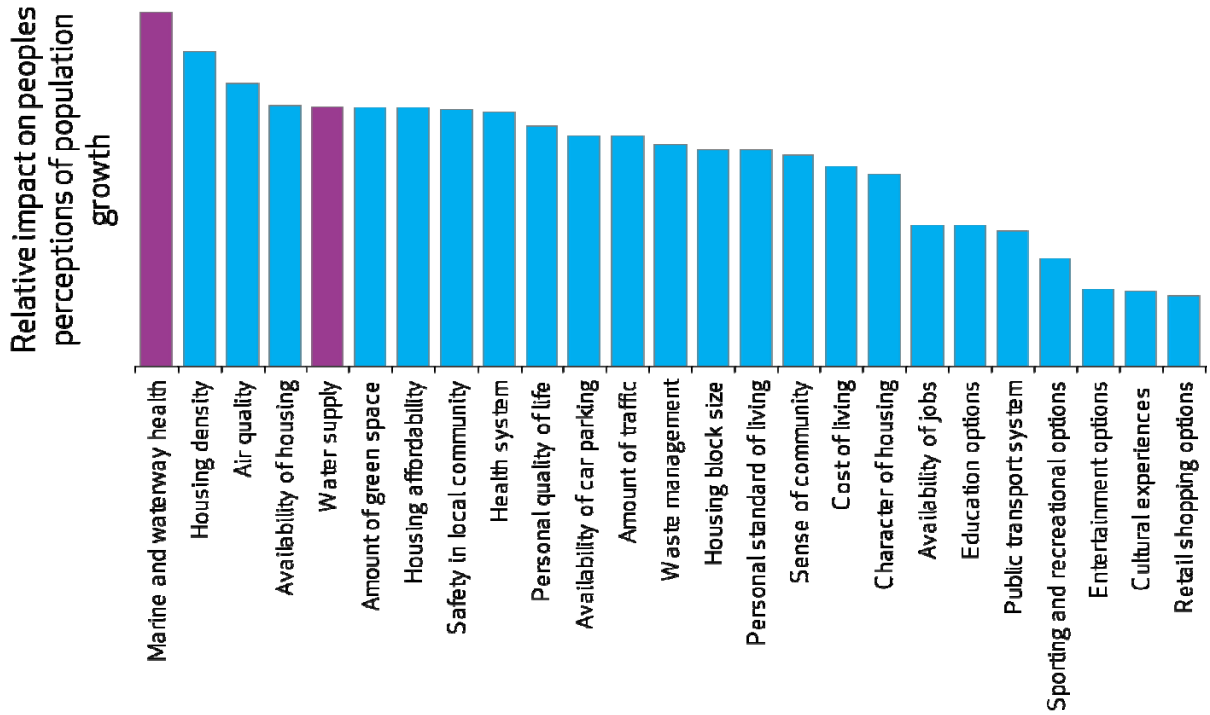


Figure 4 Key impacts on perceptions of population growth (TNS Social Research, 2010)

3.6 MANAGING WATERWAY DECLINE PRODUCTION

A TWCM approach is required to build the resilience of our waterways, and address point and diffuse pollution entering South East Queensland waterways. In urban areas, the growing population is placing significant pressures on SEQ's catchments and waterways. In rural areas, the deterioration of creek banks and gullies needs to be reversed to safeguard aquatic ecosystems, water supply, recreation and food capacities of the catchment.

Since 2000, significant investments have been made to reduce point-source pollution by upgrading wastewater treatment plants. Consequently, in spite of increasing population, less sewage-based pollutants have entered Moreton Bay. By effectively managing sewage, which is the dominant nutrient input to our waterways during dry weather and drought conditions, Moreton Bay maintained a good ecosystem health grade from 2002 until 2008 (ranging from B- to B+)[3].

In 2008–2009, South East Queensland received the highest annual rainfall since the *Ecosystem Health Report Card* was first released in 1999. This rainfall led to increased stormwater flows, which flushed and improved the conditions for some of the freshwater streams. However, the increased rainfall also carried high loads of nutrients and sediment from the catchments (diffuse-source pollution), creating a detrimental impact on some of our waterways, particularly estuarine receiving waters. In 2009, Moreton Bay received the lowest ecosystem health grade (D) in over a decade—a significant decline from the previous year's grade (B-), as shown in Figure 5 (South East Queensland Healthy Waterways Partnership, 2010). The 2010 grade (C) for Moreton Bay, although an improvement from last year, is only a partial recovery and Moreton Bay is still falling short of its ten year average of a B grade. Further information on the health and pressures of South East Queensland waterways can be obtained at www.healthywaterways.org.

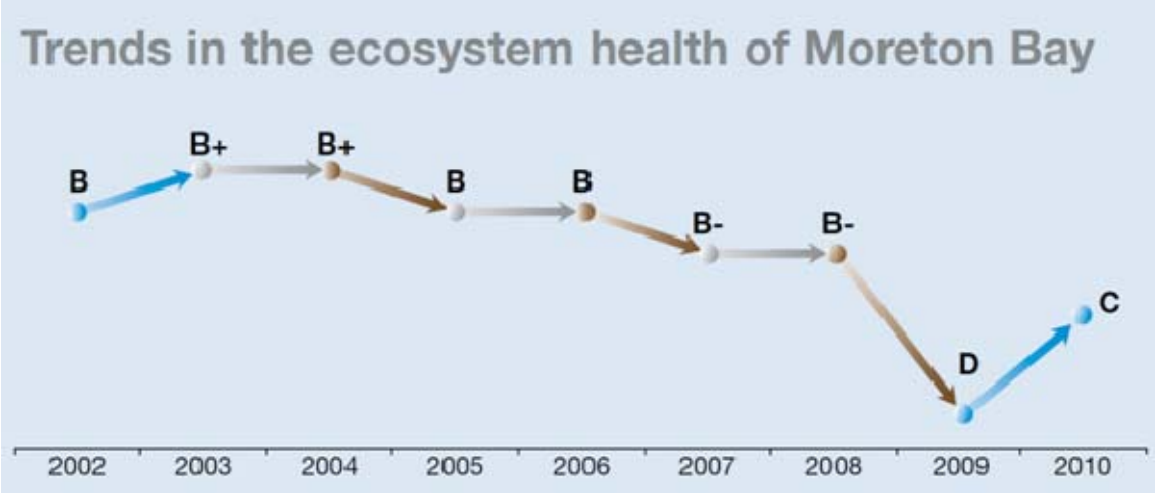


Figure 5 Moreton Bay Ecosystem Health Grades 2002–2010

The costs of environmental decline in South East Queensland have been documented in a report commissioned by SEQ Catchments (MJA, 2010), which found significant risks for several sectors in South East Queensland attributable to the decline in the condition of natural resources. The sectors most at risk are agriculture, nature-based tourism, the recreation industry, and government services such as health costs, costs of environmental rehabilitation and water treatment. The social costs of a decline in natural resource condition are substantial—these costs could be as high as $5.2 billion between now and 2031 (MJA, 2010).

[3] The ambient ecosystem health of South East Queensland's waterways is independently monitored and reported on an A to F scale through the Ecosystem Health Monitoring Program Report Card, which is managed by the South East Queensland Healthy Waterways Partnership (see www.healthywaterways.org).

3.7 ADDRESSING INCREASES IN WATER SUPPLY COSTS

Water reform at national and state levels is based on transparent, full cost recovery pricing. As a result, subsidies that mask the true cost of providing water will progressively be removed. For example, until recently most residential water pricing reflected the cost of distribution and retail services, but did not include the costs of dams. The total cost of water to society is a combination of the bulk water price, retail charges, as well as social and environmental externalities, as shown in Figure 6.

Significant increases in bulk water price are forecast for South East Queensland to account for existing bulk water assets and new water infrastructure including desalination, purified recycled water, new storages, and the regional pipeline network. Bulk water prices in South East Queensland are forecast to increase from a regional average of $788/ML in 2008–09 to $2,967/ML in 2017–18 (2010-11 dollars) (QWCa, 2010). The 10-year price path projections are based on assumed interest rates and consumption patterns, and reflect not only existing bulk water assets, but also significantly improved water security.

The rise in bulk water costs to better reflect the true cost of water will significantly change the relative cost-effectiveness of a range of water management options such as demand management, smart metering, stormwater harvesting, localised recycling (dual reticulation), and rainwater tanks. Many of these measures have not been given serious consideration due to the perceived inexpensive nature of traditional water supplies. This change in bulk water prices will be a major driver for TWCM.

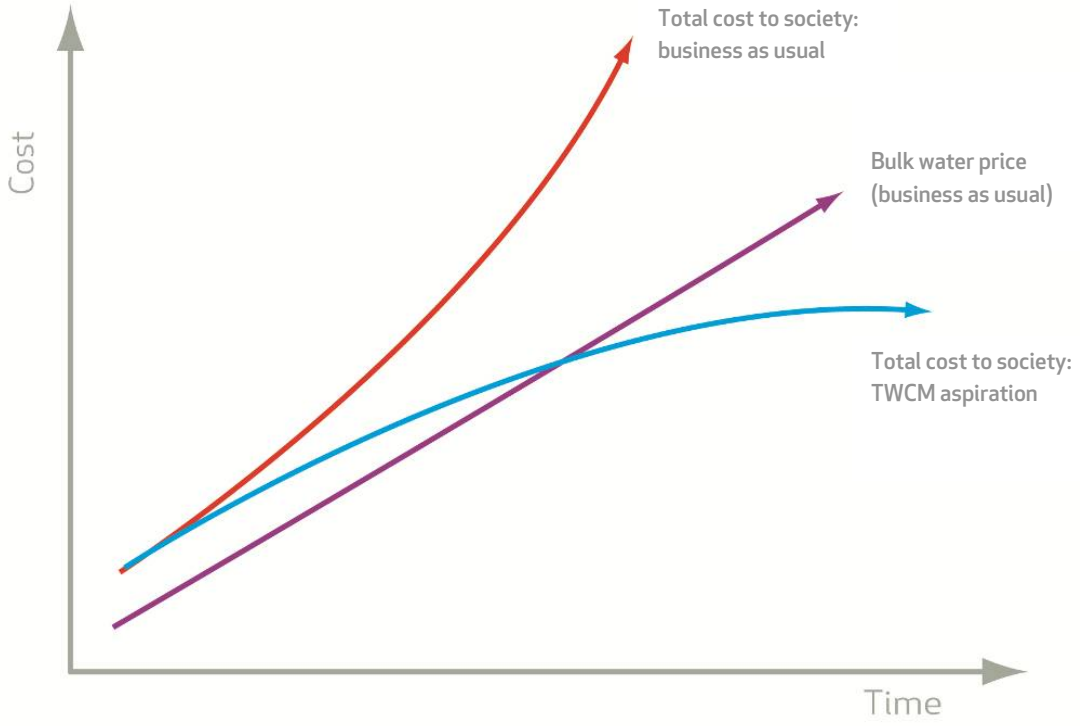


Figure 6 Bulk water prices in SEQ are forecast to rise to about $2,967/ML over the next eight years, and the total cost to society (which includes retail costs and social and environmental externalities) will rise at a higher rate

3.8 DEMONSTRATION OF PRUDENCY AND EFFICIENCY IN WATER PRICING

TWCM Plans will help to demonstrate prudency and efficiency for setting water prices that reflect economic, social and environmental considerations. Further information is provided in Section 4.5.2.

3.9 IMPROVED KNOWLEDGE ABOUT WATER MANAGEMENT OPTIONS

There is a significant and growing body of literature about the costs, benefits, and operation of a range of non-traditional water management options. The cost of traditional water and wastewater treatment has risen in recent years as a result of more stringent drinking water and discharge quality standards, and higher community expectations about water reliability and reducing the environmental impact of stormwater and wastewater. Conversely, the trends in innovative water treatment technologies are moving towards increasingly effective treatment options at lower costs, similar to the trends in computing and other areas of technology.

These trends reveal the significant value of TWCM as a tool to evaluate alternative solutions to water cycle issues. TWCM planning will help determine whether better environmental and social outcomes can be realised at a lower overall cost than traditional water management options.

Across Australia, a variety of technologies such as reverse osmosis, desalination, water recycling plants, dual reticulation schemes, and stormwater harvesting schemes are now being implemented. Actual data on the cost and performance of these systems is progressively allowing more informed water planning to occur. In South East Queensland, significant knowledge is being generated through the Urban Water Security Research Alliance (see http://www.urbanwateralliance.org.au/).

A literature review on the costs and benefits of decentralised systems will be available in 2011 via www.waterbydesign.com and will be a useful reference source for assessing options during TWCM planning. It covers direct and indirect benefits and costs of:

- wastewater treatment and reuse
- greywater reuse
- stormwater harvesting, including possible aquifer storage and recovery and managed aquifer recharge
- sewer and water mining
- third-pipe reticulation.[4]

[4] Rainwater tanks were not included in the review.

4 STATUTORY FRAMEWORK AND RESPONSIBILITIES FOR TOTAL WATER CYCLE MANAGEMENT IN SOUTH EAST QUEENSLAND

4.1 LEGISLATION, POLICIES, AND PLANS

TWCM Plans need to be responsive to current state and national legislation, policy, and plans for ecologically sustainable development.[5] The statutory and planning framework for TWCM in South East Queensland is shown in Figure 7.

Table 1 summarises the relationship of each piece of legislation , policy and plan to TWCM Plans. A brief description of each instrument is included in Appendix A. A more detailed description of the EPP Water 2009 requirements for TWCM planning is in Section 4.2.

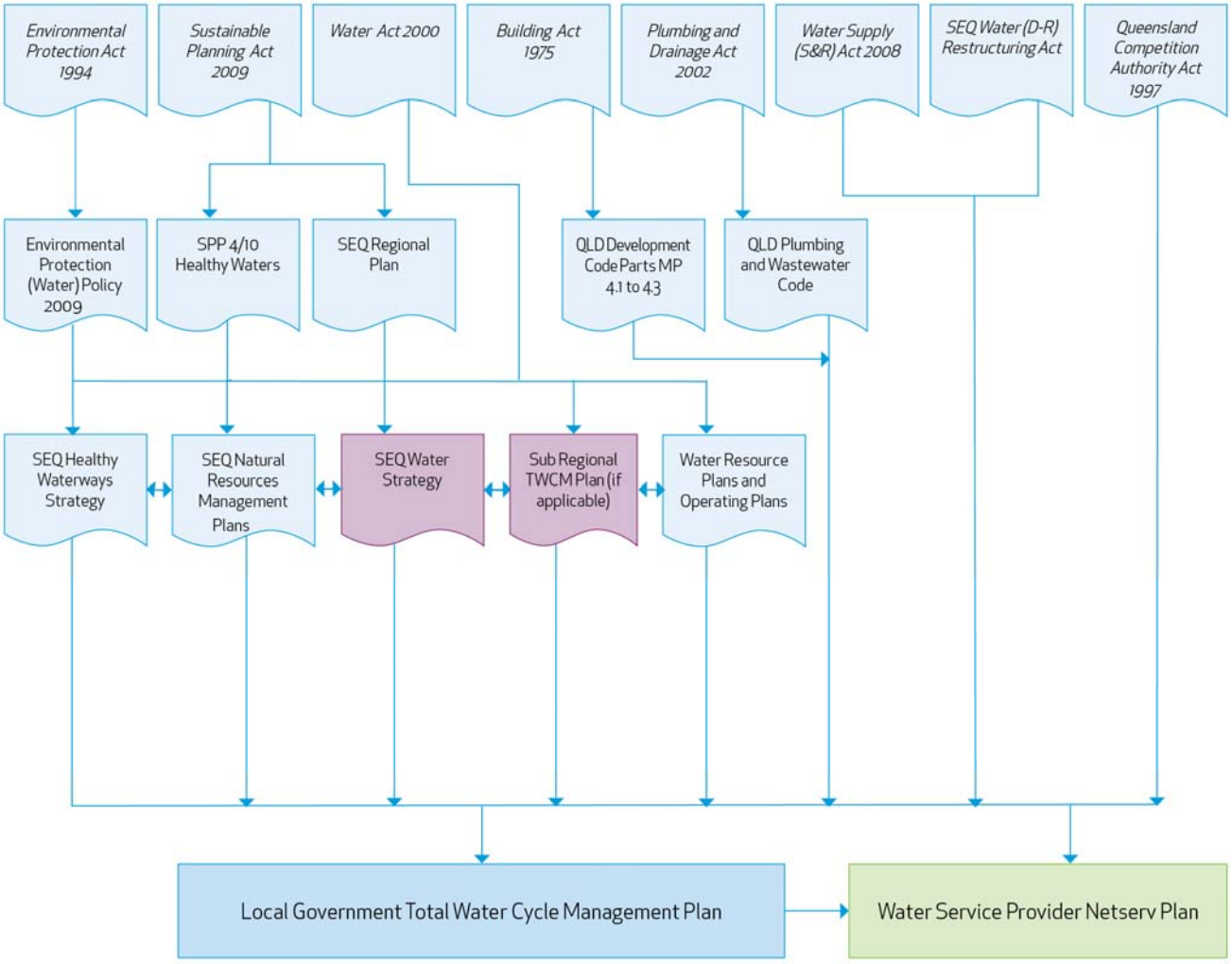


Figure 7 Statutory framework for TWCM Planning in South East Queensland

[5] These represent a perspective in a particular point in time and it can be expected that these may change and evolve over time for a variety of reasons.

Table 1 Relationship of legislation, policies and plans to Total Water Cycle Management in South East Queensland

Legislation, policy, and plans	Relevance to TWCM
Environmental Protection Act 1994	Protects Queensland's (water) environment, while allowing for development that is ecologically sustainable
Environmental Protection (Water) Policy 2009	Establishes the requirement for TWCM Plans, including what should be incorporated, the endorsement and certification process, and the publication process.
SEQ Healthy Waterways Strategy 2007–2026	Provides a regional framework within which organisations, such as local governments, can develop and implement strategies to improve the health of waterways. Local governments have participated in the development of this Strategy and committed to actions to improve waterway health.
Water Act 2000	Requires the sustainable use of water resources for human and environmental needs and mandates that water must be managed in a sustainable and integrated way to provide secure and reliable water supplies at an acceptable quality for all uses.
SEQ Water Strategy and Moreton and Mary Water Resource Plans	TWCM Plans must consider these statutory instruments. If inconsistencies arise due, for example, to different planning scales, local governments should bring these issues to the attention of the Queensland Water Commission (for SEQ Water Strategy) and DERM (for Water Resource Plans). An agreed position must be reached before finalising TWCM Plans.
Sustainable Planning Act 2009	TWCM Plans will provide a transparent planning basis for inclusion of trunk water cycle infrastructure in Priority Infrastructure Plans (PIPs), Infrastructure Charges Schedules, and Infrastructure Agreements as per the *Sustainable Planning Act 2009*.
State Planning Policy 4/10 Healthy Waters	Intended to ensure that development is planned, designed, constructed, and operated to manage stormwater and wastewater in ways that protect water environmental values specified in the EPP Water 2009. The policy informs the objectives and targets adopted in TWCM Plans.
SEQ Regional Plan 2009–2031	TWCM Plans must consider the SEQ Regional Plan, including Desired Regional Outcome 11 (see Box 1). The SEQ Regional Plan also provides information about population growth and future development areas. The SEQ Regional Plan requires Sub-Regional TWCM Plans to be prepared for greenfield urban growth areas in South East Queensland where significant new bulk water supply infrastructure is required. The SEQ Regional Plan notes the need for local government TWCM Plans.
SEQ Natural Resource Management (NRM) Plan 2009–2031	Contains a single set of measurable targets for the condition and extent of environmental and natural resources in SEQ (see Box 4) and informs the SEQ Regional Plan. The planning objectives and targets adopted in TWCM Plans should help achieve the targets in the SEQ NRM Plan to support the Desired Regional Outcomes in the SEQ Regional Plan and maximise efforts to manage natural resources.
Plumbing and Drainage Act 2002 and Queensland Plumbing and Wastewater Code	Regulates plumbing, drainage, and onsite sewerage work associated with implementing the acceptable alternative water sources listed in the Queensland Development Code Mandatory Parts 4.2 and 4.3. TWCM Plans need to be cognisant of these requirements when identifying, assessing and recommending alternative water supplies.

Legislation, policy, and plans	Relevance to TWCM
Building Act 1975 and the Queensland Development Code (Mandatory Parts 4.1, 4.2 and 4.3)	Regulates use of water efficient appliances and alternative water sources to comply with minimum water savings targets for new residential dwellings, and new commercial and industrial buildings. Acceptable alternative water sources listed in QDC MP 4.2 and 4.3 include rainwater collected from roofs, stormwater, greywater, and dual reticulation. TWCM Plans will need to ensure the minimum mandatory requirements of QDC MPs 4.1, 4.2 and 4.3 are achieved.
Water Supply (Safety and Reliability) Act 2008	Any new local recycled water scheme or new bulk water supply recommended in TWCM Plans will be regulated by this Act. The Actalso requires water service providers to prepare operational plans.
SEQ Water (Distribution and Retail Restructuring) Act 2009	Establishes the three distributor–retailers that provide water and sewerage services in South East Queensland and requires each distributor–retailer to have a Water Netserv Plan by 1 July 2013 (see Section 4.4.3).
Queensland Competition Authority Act 1997	Sets out powers and functions of the Queensland Competition Authority for pricing practices in monopoly and near monopoly businesses. Includes the public interest matters the authority must have regard to, such as environmental impacts.

Box 4 SEQ NRM Plan Targets relevant to TWCM

W1—Environmental flows	By 2031, environmental flows will meet aquatic ecosystem health and ecological process requirements.
W 2—Groundwater levels	By 2031, 75% of South East Queensland Groundwater Resource Units will have groundwater levels within identified acceptable annual ranges.
W 3—Groundwater quality	By 2031, groundwater quality (nutrients and electrical conductivity measurements) in all South East Queensland Groundwater Resource Units will be within identified acceptable annual ranges.
W 4—Groundwater dependent ecosystems	By 2031, the condition of groundwater ecosystems and groundwater dependent ecosystems will be within identified acceptable annual ranges.
W 5—High Ecological Value waterways	In 2031, High Ecological Value waterways in South East Queensland will maintain their 2008 classification.
W 6—Waterways maintenance and enhancement	In 2031, scheduled water-quality objectives for all South East Queensland waterways will be achieved or exceeded.
W 7—Waterway restoration	By 2031, waterways classified as ranging from slightly to moderately disturbed or highly disturbed will have ecosystem health and ecological processes restored.

4.2 REQUIREMENTS UNDER THE EPP WATER 2009

Under Section 19 of EPP Water 2009, local government TWCM Plans must include provisions about:

- the collection, treatment, and recycling of wastewater, stormwater, groundwater and other water sources
- the integration of water use in the local government area
- stormwater management to improve quality and flow.

Consideration must also be given to:

- demand management[6]
- increased water recycling and ways to use it
- stormwater harvesting
- impacts of land use on natural flow of waters, water quality objectives, and drinking water supplies
- forecast of water supply requirements for the area.

Box 5 is an extract of the EPP Water 2009, detailing content requirements for TWCM Plans.

Section 20 of the EPP Water 2009, about wastewater treatment plants, does not apply to local government TWCM Plans in South East Queensland under Section 100a (5) of the *South East Queensland Water (Distribution and Retail Restructuring) Act 2009*. Under Section 99BP (1)(d) of this Act, distributor-retailers are required to include in their Water Netserv Plans information on TWCM for water supply and wastewater. This may include for each wastewater treatment plant information about effluent management, wastewater recycling, sewerage system overflows, and biosolid management. While Section 20 does not apply to local governments, a local government TWCM Plan is required under Section 19 of the EPP Water 2009 to include provisions about wastewater recycling, other water sources and integration of water use.

Section 22 of the EPP Water 2009, about environmental plans to control trade waste entering sewerage services, applies to sewage service providers. In SEQ from the 1 July 2010, distributor–retailers are the sewage service providers[7]. Under Section 99BP(1)(f) of the *South East Queensland Water (Distribution and Retail Restructuring) Act* 2009, distributor-retailers are required to include in their Water Netserv Plans information about trade waste management. However, if matters related to trade waste management are likely to influence local government TWCM planning then these matters should be considered during the planning process.

Local governments must have regard to a range of other guidelines, plans and programs, including the SEQ Regional Plan, the SEQ regional water security program, and any sub-regional TWCM Plan (see Section 4.5.1). Provisions about stormwater quality management should consider State Planning Policy 4/10 Healthy Waters and the Urban Stormwater Quality Planning Guideline[8].

The EPP Water 2009 sets out requirements for plans to be certified, endorsed, and published (see Section 9). The EPP Water 2009 also contains requirements for monitoring and reporting on TWCM Plan implementation and periodic review (see Section 10).

---

[6] Demand management is about optimising the use of water relative to the sources available. Typically, demand management conserves water. The *Water Supply (Safety and Reliability) Act 2008* defines demand management for water as including "...(a) reducing demand for water; and (b) increasing the efficiency of water supply works; and (c) increasing the efficiency of the use of water by end-users; and (d) substituting a process that does not use a water resource for one that does use a water resource; (e) substituting one water resource for another." In some instances, demand management may seek to maximise the use of water, for example maximising landscape irrigation to dispose of surplus stormwater or recycled wastewater.

[7] Under Section 100a (5) of the *South East Queensland Water (Distribution and Retail Restructuring) Act 2009*, section 22 does not apply to the distributor-retailer as a sewerage service provider on and from the day a distributor-retailer has a Water Netserv Plan.

[8] This guideline is referenced in the State Planning Policy 4/10 Healthy Waters and its supporting document State Planning Policy Guideline for Healthy Waters. The document has not yet been released by DERM but an earlier draft titled the Draft Urban Stormwater—Queensland Best Practice Environmental Management Guidelines 2009 is available from http://www.derm.qld.gov.au/environmental_management/water/environmental_values_environmental_protection_water_policy/pdf/spp-healthy-waters.pdf (accessed 21 December 2010).

Under Section 18 of the EPP Water 2009, implementation of an existing TWCM Plan by a local government is acceptable if the Plan meets the requirements set out in the policy, even if it was not originally prepared for these purposes.

Box 5 Content requirements for Local Government TWCM Plans in SEQ under EPP Water 2009 (Reprint No. 1B, 16 July 2010, Division 2, 19)[9]

2) A local government's total water cycle management plan must include provisions about—

(a) the collection, treatment and recycling of waste water, stormwater, ground water and other water sources; and

(b) the integration of water use in its area.

...

(4) The local government must consider including in the plan—

(a) a strategy for demand management for water in its local government area; and

(b) ways to increase recycling of waste water and stormwater for purposes including, for example, industrial or agricultural purposes; and

(c) ways to use recycled waste water; and

(d) opportunities for stormwater harvesting for use as a water source; and

(e) the impacts of existing and future land use in the area on water cycle management, including the following—

(i) impacts of the use on the natural flow of waters;

(ii) impacts of the use on water quality objectives for waters;

(iii) the risks to drinking water supplies caused by the use; and

(f) a forecast of the water supply requirements for the area.

21 Total water cycle management—urban stormwater quality management

(1) A local government's total water cycle management plan must include provisions about its stormwater quality management to improve the quality and flow of stormwater in ways that protect the environmental values of waters affected by the local government's urban stormwater system.

(2) The local government must consider including in the plan provisions about—

(a) identifying urban stormwater quality management needs for developed and developing areas that are consistent with the local government's priority infrastructure plan under the Planning Act; and

(b) the opportunities for stormwater harvesting, recycling or re-use; and

(c) incorporating water sensitive urban design in developed areas within a stated period; and

(d) managing urban stormwater quality and flows for development in the local government's area, having regard to the following documents—

(i) any site specific documents;

(ii) the [Queensland Water Quality] guidelines;

(iii) relevant guidelines published by the department about stormwater quality; and

(e) monitoring and reporting processes for stormwater quality management.

[9] When preparing a TWCM Plan, the EPP Water 2009 requirements should be checked against the current version of the legislation available at www.legislation.qld.gov.au.

4.3 LOCAL GOVERNMENTS' TWCM RESPONSIBILITIES

Local government responsibilities for TWCM include:

- developing and implementing local government TWCM plans
- forecasting spatial trends and changes in densities
- policy development—local laws, interaction with State agencies, review of TWCM Plans
- amending Planning Schemes, Priority Infrastructure Plans, and codes
- Local Area Planning and Development Approvals—consistency with codes, legislation and TWCM Plans, including SPP 4/10 Healthy Waters and SEQ Regional Plan 2009–2031 Implementation Guideline No. 7: Water Sensitive Urban Design
- catchment management—rural landholder and other community involvement
- development control—compliance, erosion and sediment control, and grey water approvals
- environmental management, including monitoring and education programs
- waterway management and amenity
- managing stormwater, including quality, quantity and climate change implications
- managing flood risk—including floodplain and coastal inundation[10], climate change, and natural disaster management
- community education and engagement for an informed and supportive community.

Figure 8 shows local governments responsibilities for TWCM, including key activities and processes, and how different functional areas should be involved in developing and implementing TWCM Plans. By setting a corporate vision and direction for TWCM, TWCM planning allows for coordination of responsibilities and provides opportunities for greater efficiency and effectiveness across the organisation.

A TWCM Plan is one of a number of strategies or plans prepared by a local government to define how they will deliver on the long-term vision described in their Community Plan and the strategic direction in their Corporate Plan.[11] The TWCM plan will be guided by the Community Plan and Corporate Plan, but will may also inform future revisions of them by defining specific TWCM priorities and actions. Similarly, annual Operational Plans, budgets, Capital Works Programs and Planning Schemes will be informed by actions in TWCM Plans.

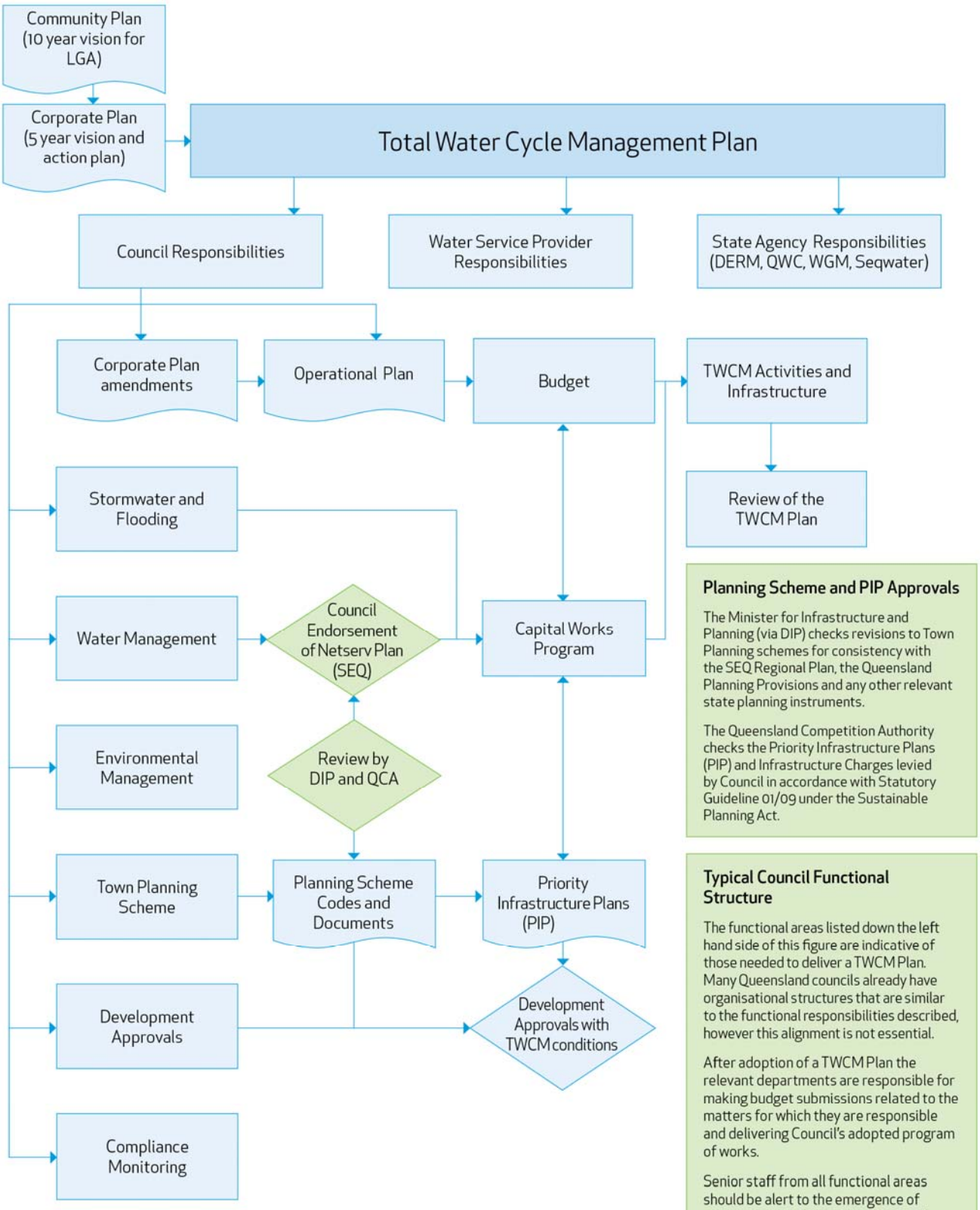
TWCM Planning will inform future revisions of Planning Schemes by:

- providing a TWCM vision and objectives to be included in Councils strategic framework
- amending Strategic Land Use Plans to reflect TWCM opportunities and constraints
- amending Planning Scheme Policies and Codes to reflect TWCM recommendations
- identifying trunk water cycle infrastructure to include in the Priority Infrastructure Plans
- identifying capital costs and timing of implementation for water cycle infrastructure for incorporation in Infrastructure Charges Schedules
- identifying trunk water cycle infrastructure to be provided by the private sector under Infrastructure Agreements.

As a key partner in the development of sub-regional TWCM Plans (see Section 4.5.1), local governments will provide input to planning objectives and to identifying and evaluating management options for regional water supply security.

[10] As per State Planning Policy 1/03 *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide.*

[11] A detailed description of community, corporate, and annual operational plans can be found in the Local Government (Finance, Plans and Reporting) Regulation 2010.



Planning Scheme and PIP Approvals

The Minister for Infrastructure and Planning (via DIP) checks revisions to Town Planning schemes for consistency with the SEQ Regional Plan, the Queensland Planning Provisions and any other relevant state planning instruments.

The Queensland Competition Authority checks the Priority Infrastructure Plans (PIP) and Infrastructure Charges levied by Council in accordance with Statutory Guideline 01/09 under the Sustainable Planning Act.

Typical Council Functional Structure

The functional areas listed down the left hand side of this figure are indicative of those needed to deliver a TWCM Plan. Many Queensland councils already have organisational structures that are similar to the functional responsibilities described, however this alignment is not essential.

After adoption of a TWCM Plan the relevant departments are responsible for making budget submissions related to the matters for which they are responsible and delivering Council's adopted program of works.

Senior staff from all functional areas should be alert to the emergence of issues that would best be addressed via a review of the TWCM Plan.

Figure 8 Local governments' TWCM responsibilities[12]

4.4 WATER SERVICE PROVIDERS' TWCM RESPONSIBILITIES

4.4.1 Context

Under the *South East Queensland Water (Distribution and Retail Restructuring) Act 2009,* local government-owned water businesses in South East Queensland have been aggregated to create three new integrated distribution and retail authorities.[13] The distributor-retailers are also water service providers and sewage service providers in accordance the requirements of the *Water Supply (Safety and Reliability) Act 2008*. They are separate legal entities but remain under local government ownership.

Distributor-retailers have the following primary functions:

- purchase water from the SEQ Water Grid (via the Water Grid Manager) and distribute to customers
- collect, transport, and treat wastewater and sewage from its customers
- bill customers for water supply and sewage services
- provide particular planning and development assessment functions as required under the *Sustainable Planning Act 2009*.

4.4.2 TWCM responsibilities

Water service providers will play a key role in developing, endorsing and implementing TWCM Plans. They are in a unique position to recognise and respond to issues such as water security, receiving water quality, and timing and staging of development to minimise infrastructure capital and operating costs. TWCM Plans will guide many of the strategic and operational functions of water service providers.

Figure 9 shows water service providers' TWCM responsibilities and how they are influenced by TWCM planning, including the anticipated relationship between TWCM Plans and Water Netserv Plans (see Section 4.4.3). In summary, key responsibilities for water service providers in TWCM include:

- assist in preparing TWCM Plans—representatives from the water service providers should be part of the project team who prepares the TWCM Plan, the Leadership Group and the Project Reference Group (see Section 6.1.1)
- endorse the plans as required under the EPP Water 2009 (see Section 9)
- policy and planning—including Local Area and Master Plans, and servicing new developments in an efficient way consistent with local government planning assumptions
- development approvals—consistency with policies, codes, and Priority Infrastructure Plans.
- wastewater treatment and monitoring the impact of discharges to waterways
- developing options for increased sewage recycling to enhance water security and improve waterway health
- trade waste management
- demand management— implementation of behaviour change and educational campaigns
- drinking water quality
- asset delivery mechanisms—expertise in major project costs and procurement options
- financial analysis of water, wastewater, and recycled water infrastructure options
- costing of initiatives

[12] Figure 8 assumes a typical functional structure used by local governments across South East Queensland. However, the allocation of responsibilities to implement specific parts of TWCM Plans will need to be adapted to match local institutional arrangements.

[13] The three distributor–retailers are Queensland Urban Utilities (servicing Brisbane, Ipswich, Lockyer Valley, Scenic Rim and Somerset); Allconnex Water (services Gold Coast, Redlands and Logan); and Unitywater (servicing Moreton Bay and Sunshine Coast).

- discussions with regulators

For water service providers, an important outcome from the TWCM planning process is the strategic justification for planning, delivering, and operating new infrastructure. The evaluation of different alternatives, and the endorsement of a particular solution by local governments and relevant state agencies, will assist distributor–retailers to justify proposed infrastructure to financial and environmental regulators and the community (i.e. to demonstrate prudency in infrastructure planning and expenditure).

Water service providers may use the TWCM planning process to consider amending master planning and capital works programs. Typically, a review of customer service standards, areas that are to be serviced with water, wastewater and recycled water, and timing issues may be revisited in the detailed TWCM planning processes.

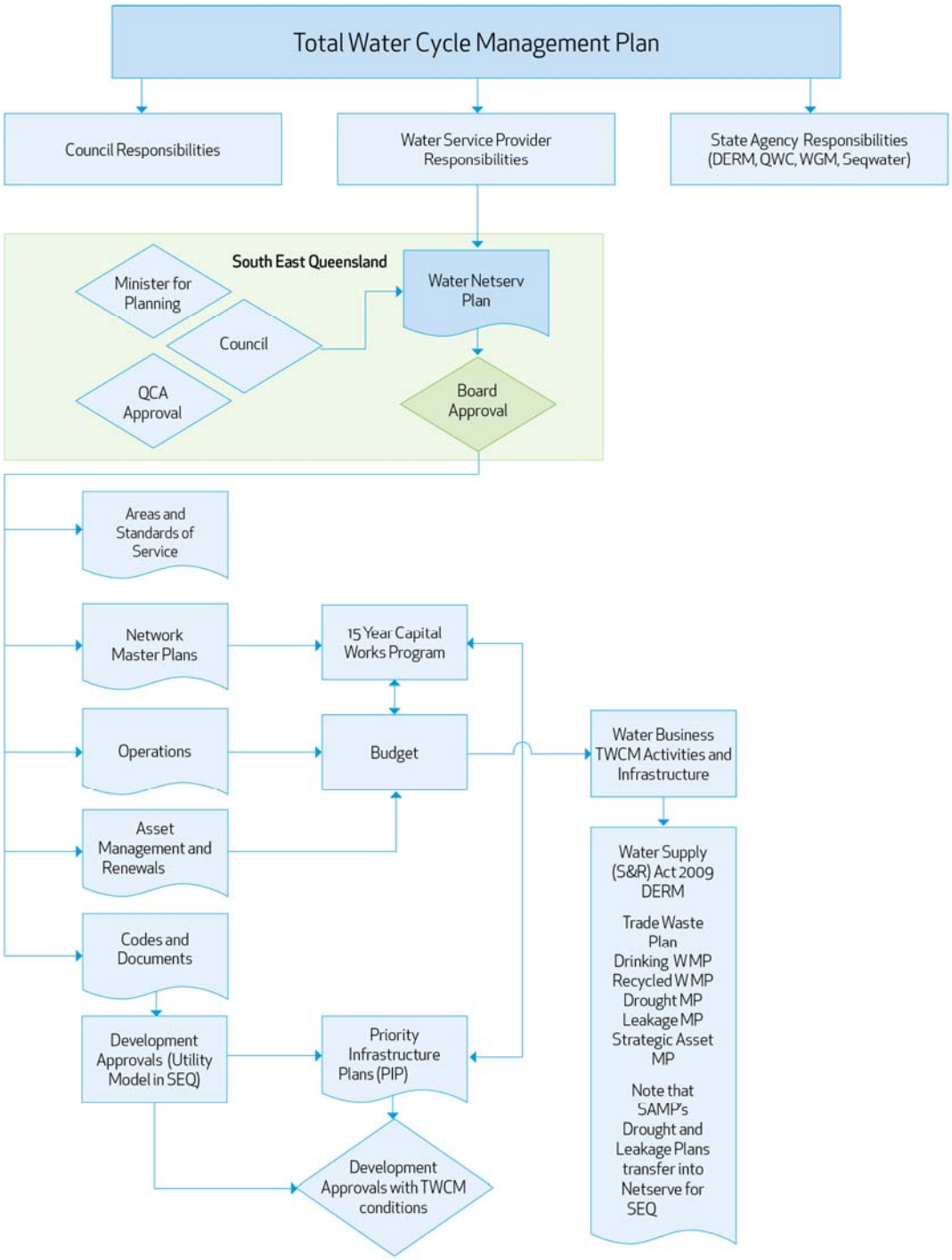


Figure 9 Water service providers' TWCM responsibilities and how they are influenced by TWCM planning

4.4.3 Water Netserv Plans

The *South East Queensland Water (Distribution and Retail Restructuring) Act 2009* requires each water service provider to have a Water Netserv Plan by 1 July 2013. Water Netserv Plans are the operational plan for water service providers in South East Queensland. They will link existing processes and mechanisms that will deliver total water cycle solutions and will detail the distributor–retailers' networks and services for water and wastewater. Water Netserv Plans will plan for:

- strategic business operations
- delivering water and wastewater infrastructure within at least a 20-year time horizon
- delivering a safe reliable and secure water and wastewater service
- integrating land use and infrastructure planning for water and wastewater services
- managing the water and wastewater services in a way that seeks to achieve ecological sustainability.

In developing a Water Netserv Plan, distributor–retailers must have regard to local governments' TWCM Plans under section 99BQ(1)(c) of the Act. They must also, as noted in Section 4.2, include information about trade waste management and TWCM for water and wastewater. Section 4.7 further describes the relationship between local government TWCM Plans and Water Netserv Plans.

Distributor–retailers are required to review Water Netserv Plans before the end of each five-year period after 1 July 2013.

4.5 State entities' TWCM responsibilities

Several state government entities may play a role in developing or implementing elements of local government TWCM Plans. The state government's responsibilities for TWCM may include:

- planning and managing existing and proposed bulk water sources
- estimating climate change impacts on bulk water supplies
- managing growth and affordable housing
- developing Water Resource Plans and managing water allocations
- setting water quality and flow objectives
- development approvals for new infrastructure
- managing policy issues—nutrient trading or evaluation of innovative water cycle solutions
- undertaking changes to Queensland Development Codes (e.g. water efficiency standards)
- planning and advising the Minister on state-significant water cycle infrastructure.

Table 2 notes the role of various state agencies in TWCM. Figure 10 shows the key state government entities and their functions relevant to TWCM planning. State government will not formally review or endorse local government TWCM plans (refer to Section 9 for details of plan endorsement and certification requirements).

An understanding of the role of each of the state-owned water entities will evolve throughout the TWCM Planning process and may differ between local government areas, depending on the nature of the issues being addressed and the options being considered. The relevant agencies should be involved early in the development of TWCM Plans if there are significant policy issues, or if a preferred solution involves infrastructure of significance to the state government or infrastructure owned by the state government.

Table 2 The role of key state entities in TWCM

Stakeholder[14]	Role in TWCM
Department of Environment and Resource Management	DERM, through the *Environmental Protection Act 1994* and the EPP Water 2009, administers environmental planning legislative requirements including compliance, review and amendment.
Department of Infrastructure and Planning	DIP, through the *Sustainable Planning Act 2009*, manages the process for development to deliver ecologically sustainable outcomes, the effects of development on the environment, and coordinates and integrates planning at the local, regional, and state levels.
Queensland Water Commission	In partnership with local government and distributor–retailers, the QWC is responsible for leading the preparation of sub-regional TWCM Plans under the SEQ Regional Plan. Refer to Section 4.5.1 for details. Collaborates with local government to integrate sub-regional TWCM and local government TWCM planning. Will provide advice to the Minister, for a Regional Water Security Program on water infrastructure of regional significance, and provides input into SEQ Infrastructure Plan and Program on regionally significant water infrastructure projects. Consideration and feedback on local water supply initiatives where there is the potential to impact on the System Operating Plan and Levels of Service obligations for the South East Queensland Water Grid.
Queensland Competition Authority (QCA)	Adjudicates on the water charges schedule in the Water Netserv Plan.
Seqwater	Seqwater will provide strategic and technical input to TWCM planning. TWCM is a key component of Seqwater's business in order to: facilitate collaboration with all water grid entities to provide levels of service and improve water delivery to the community; respond decisively to the challenge of sustainability; deliver the knowledge and technologies for efficient, effective and integrated whole-of-catchment management; deliver diversified products and services to maximise the whole-of-water-use cycle performance of catchment assets and capabilities; and integrate bulk water supply and reliability throughout SEQ. Seqwater's corporate initiative integration project will develop strategy and policy that will improve processes and standards for whole of cycle delivery in accordance with the *Water Act 2000*, SEQ Regional Plan, EPP (Water), *Water Supply (Safety and Reliability) Act 2008* and the Australian Drinking Water Guidelines. These strategies and policies will provide a mechanism for linking with sub-regional and local government TWCM planning processes.
WaterSecure[15]	Strategic and technical input to TWCM planning. The level of involvement will depend on the interaction of local TWCM initiatives with manufactured water supplies.

[14] DERM have advised that the Department of Employment, Economic Development and Innovation (DEEDI) and Queensland Health have no significant role in TWCM planning.

[15] The two bulk water authorities (Seqwater and WaterSecure) will be merged into a single supply authority by 1 July 2011.

Stakeholder[16]	Role in TWCM
LinkWater	Strategic and technical input to TWCM planning. The level of involvement will depend on the interaction of local TWCM initiatives with bulk water transfer pipelines.
SEQ Water Grid Manager	To balance the needs of the community and the environment when managing the water needs of the regional. The Grid Manager will make strategic and operational decisions that are based on coordinating the production and transport of water to where it is needed most and at the lowest possible cost.
ULDA	Provide land use planning input to TWCM Planning for defined Urban Development Areas (UDAs) and to have regard to a local government's TWCM Plan within Development Schemes prepared for UDAs.

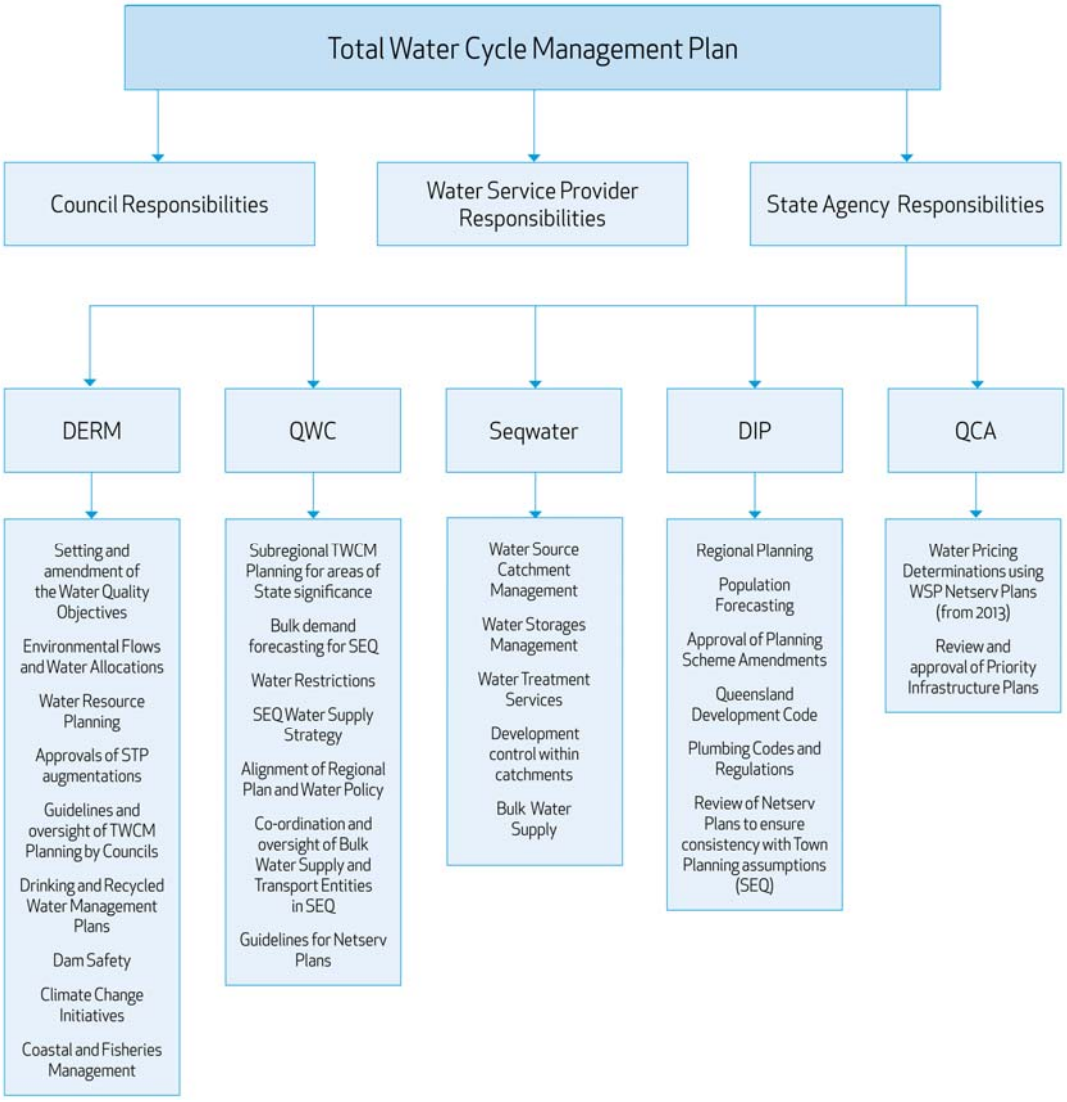


Figure 10 Key state government entities' TWCM responsibilities and how they are influenced by TWCM planning

[16] DERM have advised that the Department of Employment, Economic Development and Innovation (DEEDI) and Queensland Health have no significant role in TWCM planning.

4.5.1 Queensland Water Commission and Sub-Regional TWCM Plans

In South East Queensland, the QWC is responsible for water supply policy and the inclusion of infrastructure projects into the SEQ Infrastructure Plan and Program for future funding.

The *South East Queensland (SEQ) Regional Plan 2009–2031* identifies the QWC as the lead agency for developing Sub-Regional TWCM Plans. The QWC (2010b) has developed a *Draft Framework for South East Queensland Sub-regional Total Water Cycle Management Planning* that sets out the intent of the sub-regional TWCM planning. Sub-Regional TWCM Plans will be undertaken for 'selected areas where large scale development and significant infrastructure is to occur' to plan water service infrastructure needs using TWCM principles before development. Areas identified for sub-regional TWCM planning are Ripley Valley, Palmview, Caloundra South, and Caboolture West. These Sub-Regional TWCM Plans began in late 2010 and will be completed by early 2012. Sub-Regional TWCM Plans will take into account the optimal outcome of water supply for the broader South East Queensland as well as the for the specific region.

The QWC will lead the process of sub-regional TWCM planning in partnership with stakeholders such as state government agencies, local governments, water service providers, the distributor–retailers and Healthy Waterways.

If a local government includes an area where the QWC is leading supply-focused sub-regional TWCM planning, a clear agreement between the local government and the QWC should be established. This agreement should define roles, responsibilities, and the interface between sub-regional TWCM planning and local government TWCM planning.

The Sub-Regional TWCM Plans will help ensure all aspects of the regional water cycle are considered when planning for growth and water supply security. Sub-Regional TWCM Plans will also help to integrate land use policy and decisions with water supply planning for urban and rural purposes, and waterway health.

Sub-Regional TWCM Plans may include:

- capture, storage, distribution, and treatment infrastructure and performance standards required to meet water cycle outcomes
- viability of adopting savings above the Queensland Development Code (QDC MP 4.2 and MP 4.3), including the capture and use of stormwater to reduce demand on potable water and to protect the environment
- preferred sewerage treatment systems to achieve high level of reuse using least overall cost planning for sewage treatment and reuse
- how development in the declared water supply catchments should be managed to protect water quality
- where future local purified recycled schemes may be located
- consideration of environmental, social and economic factors in water supply management to assist in identifying the least overall cost solution
- options to optimise demand management and other water cycle outcomes.

Sub-Regional TWCM Plans must be consistent with the SEQ Water Strategy. The findings from sub-regional TWCM planning processes may influence planning assumptions for future revisions of the SEQ Water Strategy.

Section 4.7 further describes the relationship between Sub-Regional TWCM Plans and local government TWCM plans.

4.5.2 Queensland Competition Authority

Under the *Queensland Competition Authority Act 1997*, the QCA's roles in relation to the water industry are to:

- investigate and report on the pricing practices of certain declared monopoly or near monopoly business activities of state and local governments at the direction of the Premier and Treasurer (the Ministers)
- receive, investigate, and report to Ministers on competitive neutrality complaints
- mediate or arbitrate access disputes and water supply disputes
- at the direction of the Ministers, investigate and report on matters relevant to the implementation of competition policy (Section 10(e)).

The Premier and the Treasurer have referred the monopoly distribution and retail water and wastewater business activities of Queensland Urban Utilities, Allconnex Water and Unitywater to the QCA for price monitoring from 1 July 2010 to 30 June 2013. The QCA will not review or endorse the Water Netserv Plans; QCA's role is currently limited to price monitoring with the new entities responsible for setting water and wastewater prices. It is envisaged that a more rigorous regulatory framework will apply form 1 July 2013, with the QWC developing the regulatory framework and pricing policies to apply from this date.

In conducting a price monitoring investigation under the *Queensland Competition Authority Act 1997*, the QCA must take into account social and environmental considerations and any legislation and government policies related to sustainable development.

4.6 OTHER STAKEHOLDERS

Table 3 describes the key role of other stakeholders in TWCM planning. Section 6.1.1 recommends a Project Reference Group (PRG) is established. Local government should consider including the stakeholders noted in Table 5 on the PRG.

Table 3 Roles of other key stakeholders in TWCM planning

Stakeholder	Role in TWCM
Community, catchment, environment groups	An informed and supportive community is an important enabling factor for sustainable urban water management. Advocates for community desires for water and environmental protection and improvement.
Significant land owners	Ensures planning for future development or land use is consistent with TWCM planning. May ultimately be required to implement the recommendations of the TWCM Plan or enter into an agreement to contribute towards a TWCM outcome.
Healthy Waterways	Development of TWCM planning guidelines. Capacity building to assist local governments and distributor–retailers prepare, consider and implement TWCM Plans. Decision support framework for TWCM Planning.
Researchers (e.g. Urban Water Security Research Alliance, Cities as Water Supply Catchments)	Provide research information, data and tools to assist planning.
Natural Resource Management bodies (e.g. SEQ Catchments)	Act as an intermediary between all levels of government, community, and industry to make the connections, secure financial support, coordinate activities, and provide advice and administrative support to deliver measurable, long-term outcomes for natural resources.
Traditional owners (e.g. South East Queensland Traditional Owners Alliance)	Advocate for the rights and interest of traditional owners.
Industry bodies (e.g. Australian Industry Group, Urban Development Institute of Australia)	Advocate for industry positions on matters affected by TWCM.

4.7 RELATIONSHIP OF LOCAL GOVERNMENT TWCM PLANS WITH OTHER WATER PLANS

Figure 11 illustrates the relationship between local government TWCM Plans, Sub-Regional TWCM Plans, and Water Netserv Plans. Where practicable, it would be efficient to undertake sub-regional TWCM planning and local government TWCM planning concurrently to take advantage of common planning process such as multi-stakeholder planning workshops.

There are a number of legislative mechanisms that act as drivers for coordination and collaboration between local governments and Water service providers when preparing TWCM Plans and Water Netserv Plans. Under Section 23 (2)(b)of the EPP Water 2009, the local government TWCM Plan is to be endorsed by the distributor-retailer. In developing a Water Netserv Plan, distributor–retailers must, under section 99BQ(1)(c) of the *South-East Queensland Water (Distribution and Retail Restructuring) Act 2009*, take local governments' TWCM Plans into consideration. Under Section 99BS (1)(d)of the Act, the Water Netserv Plans are to be endorsed by local governments to ensure they are consistent with local planning assumptions. This should include those assumptions developed as part of the local government TWCM planning process. Local governments are encouraged to align the review of their TWCM Plan to the review of Water Netserv Plans for water service providers who operate within their jurisdiction.

Under Section 19 (3)(d) the EPP Water 2009, local government TWCM Plans must have regard to the findings of the Sub-Regional TWCM Plans. The area targeted, scope of investigation, and level of detail may differ for Sub-Regional TWCM Plans and local government TWCM Plans. The similarities between sub-regional TWCM planning and local government TWCM planning includes identifying and mapping of key local area TWCM drivers and issues. The two planning processes will use this common information to contextualise TWCM management responses.

Regional alignment of plans can occur through mechanisms such as:

- SEQ Regional Coordination Group
- CEOs Committee for Natural Resource Management
- Council of Mayors environment committee.

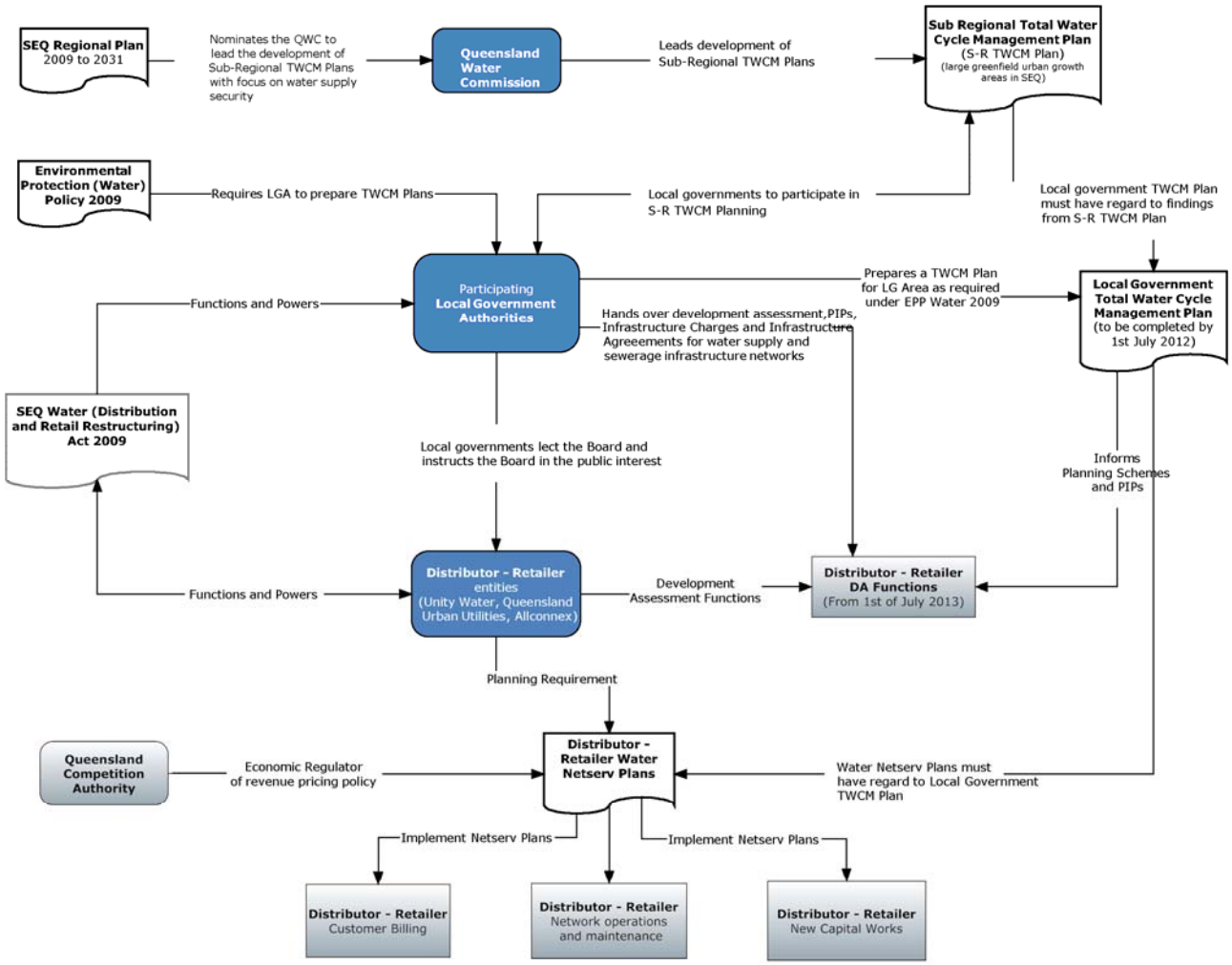


Figure 11 Relationship between Sub-Regional TWCM Plans, local government TWCM Plans and Water Netserv Plans

5 RECOMMENDED APPROACH

The recommended approach to develop a TWCM Plan is shown in Figure 12. The key phases of the recommended approach are:

- developing a TWCM strategy (Section 6)
- undertaking detailed planning (where necessary) (Section 7)
- preparing an implementation plan (Section 8)
- finalising the plan, including endorsement, certification and publication (Section 9)
- monitoring, reporting and reviewing the plan (Section 10).

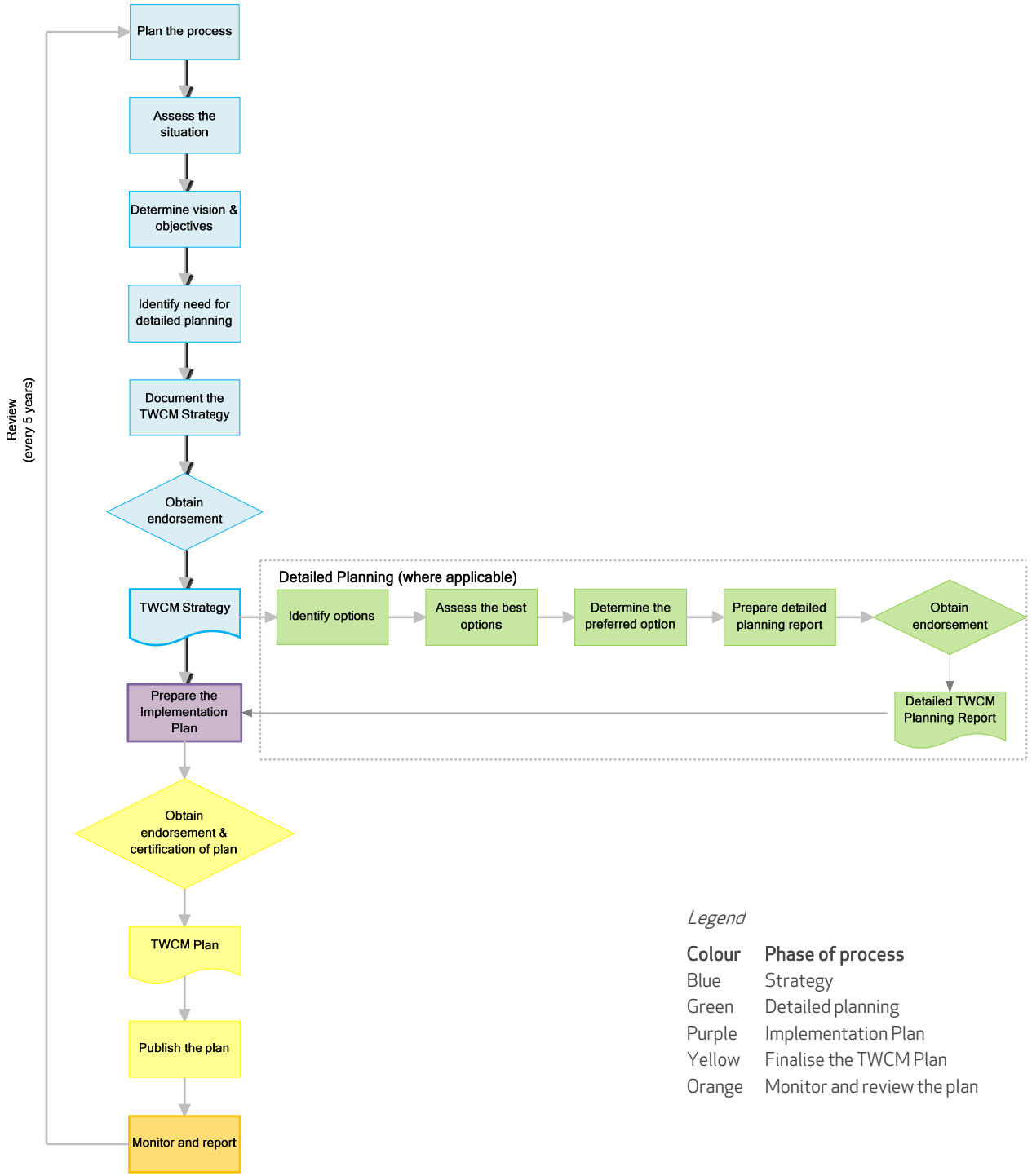


Figure 12 Approach for preparing a TWCM Plan

6 TOTAL WATER CYCLE MANAGEMENT STRATEGY

The TWCM Strategy is a strategic document, covering entire local government areas, outlining the vision and objectives for managing all aspects of the water cycle, documenting the existing state of knowledge, and identifying the planning actions required to achieve the vision. Development of the TWCM Strategy is an essential first step in the development of a TWCM Plan and must be undertaken prior to Detailed Planning.

6.1 PLAN THE PROCESS

The first step in developing a TWCM Strategy and ultimately the TWCM Plan involves assembling the groups who will create and oversee the development of the plan. It also involves determining the available funds, resources, and timeframes for the plan.

6.1.1 Assemble groups

Preparing and implementing a local government TWCM Plan involves a broad range of stakeholders. To successfully prepare a TWCM Plan, a consultative approach to the development of plans is required. It is recommended three groups are established:

- leadership group
- project team
- project reference group (PRG) (i.e. across-boundary, multi-disciplinary steering group).

The roles and function of each group are shown in Table 4. Group structures and activities will vary between local governments, taking local circumstances into consideration. Local governments need to assess the full list of stakeholders to involve in TWCM planning.

Table 4 Recommended groups to prepare a Total Water Cycle Management Plan

Group	Role	Membership
Leadership Group ('Project owners')	• Oversee the preparation of the TWCM Plan • Coordinate support from within their respective management areas • Promote implementation of TWCM Plan • Chair[17] to provide other local government executives and elected representatives with progress updates • Chair to facilitate resourcing and funding requests as they arise • Ultimately responsible for implementing the actions identified under the TWCM Plan.	• The Leadership Group should include: – the Executive Manager or Director from the department delegated to prepare the TWCM Plan – the delegated Project Manager from the Project Team – the Principal or manager level representatives from the local government's strategic planning, infrastructure, flooding, stormwater, and environmental management areas – a management representative from the water service provider • Typically chaired by the most senior representative.

[17] The National Urban Water Governance Program research papers include information on the "champion phenomenon" in sustainable urban water management champion (e.g. Taylor, 2010), including the role of executive champions.

Group	Role	Membership
Project Team ('Doers')	Prepare the plan, including coordination of day-to-day activities, such as: • research • investigations • workshops • progress reports • authoring of the TWCM Strategy and Implementation Plan • coordinating consultation and communication. Most of the TWCM planning process will be carried out by the Project Team in consultation with the Project Reference Group, reporting through the Leadership Group.	The Project Team will: • have a nominated project manager to represent the Project Team in Leadership and Project Reference Group meetings • vary in size from local government to local government, but should be sufficiently resourced • include staff from local government, Water service provider and consultants if they are used. TWCM Plans can be developed in-house, depending on the experience and availability of council and water service provider staff.
Project Reference Group (PRG) ('Stakeholders')	The PRG will act in a consultative role. The PRG will: • contribute to information gathering and knowledge sharing • endorse the vision and objectives • identify issues • define planning areas and priorities • participate in determining and analysing options for water cycle management • review the TWCM Plan • endorse the action plans. The PRG may make recommendations to the Leadership Group for additional resources or support as required. The formality, frequency and duration of meetings will vary from area to area.	The PRG should include a mix of representatives to help create ownership of the process across the organisation and across the community, including: • relevant local government staff representing all elements of the water cycle and disciplines and may include disciplines not traditionally associated with the water industry, such as social planners and community engagement and education experts • representatives from the water service provider • community and industry groups • state government agencies, such as the Queensland Water Commission • other significant stakeholders, such as the Urban Land Development Authority, Seqwater, LinkWater and WaterSecure • adjoining local councils where applicable e.g. a shared water resources or water service provider. An independent chair should be appointed. The PRG can seek specialist advice, facilitated by the Project Team. Representatives may change over time and when more detailed planning is undertaken within identified planning areas.

6.1.2 Determine resources and timeframes

The financial and human resources and time needed to prepare a TWCM Plan will vary depending on the extent of detailed planning required, the scale of the area, and the complexity of the issues and solutions developed. The resources and timeframes should be identified early in the process given TWCM Plans need to be prepared by 30 June 2012 to meet the EPP Water 2009 requirements and to inform the first round of Water Netserv Plans.[18] Subsequent updates of TWCM Plans and Water Netserv Plans will provide future opportunities for alignment.

While strategy development should identify the need for detailed planning, existing knowledge and experience can be used for early estimates of detailed planning requirements. Most local governments in South East Queensland are likely to need to undertake at least some detailed planning as part their TWCM Plan (A in Figure 13). As a contingency, councils may wish to ensure budget planning for the 2011/12 financial year allocates sufficient resources to undertake detailed TWCM planning. Detailed planning may not be required for some TWCM Plans (B in Figure 13) by the mid-2012 deadline (C in Figure 13).

Where applicable, consideration should also be given to the timing of QWC-led sub-regional TWCM planning and the Urban Land Development Authority planning timeframes.

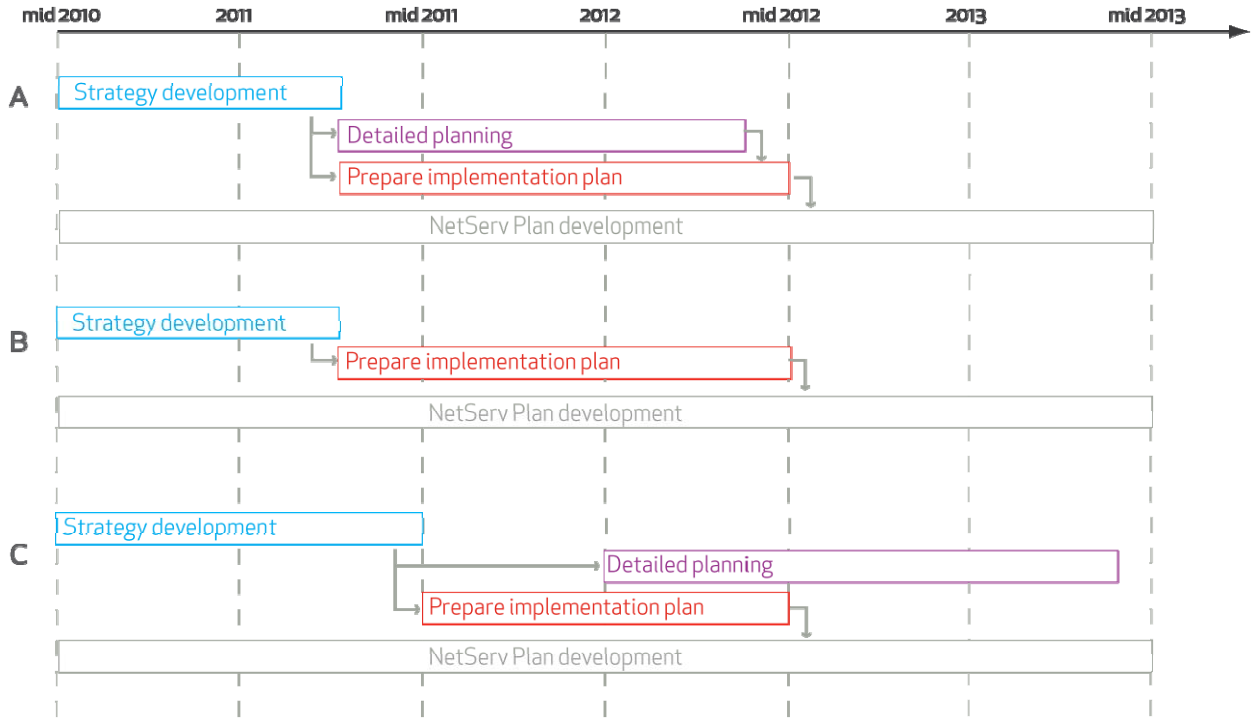


Figure 13 Indicative timelines for preparation of TWCM Plans and the relationship to Water Netserv Plan timeframes.

[18] Netserv Plans need to be prepared by 1 July 2013 and require consultation, endorsement, and certification by various entities before finalisation (refer to Chapter 4, Part 4 of the *South East Queensland Water (Distribution and Retail Restructuring) Act 2009*). To ensure relevant state interest checks and approval is obtained for Netserv Plans, distributor–retailers will need to have their Netserv Plans completed and submitted to the State Government by approximately 30 June 2012.

6.2 ASSESS THE SITUATION

This step focuses on gathering information and providing a sound foundation for further TWCM planning.

6.2.1 Review strategic documents, plans, and instruments

The PRG should review and consider the principles, objectives, and commitments relating to water that are in existing strategic documents, plans, and statutory planning instruments. These documents may include the local government's Community Plan, Corporate Plan, Operational Plan, and Planning Scheme and non-local government instruments such as the SEQ Regional Plan, the SEQ Water Strategy, the Moreton Region Water Resource Plan, the SEQ NRM Plan, and the SEQ Healthy Waterways Strategy.

The PRG may recommend amendments to the strategic documents to either establish total water cycle management as a recognised priority or to reinforce existing statements and priorities for water management.

6.2.2 Identify key water cycle elements

Identify and describe the key elements of the water cycle in the local government area. This is required to develop a holistic understanding of the water cycle, identify key water cycle elements and infrastructure, including a spatial understanding of the boundaries of the water cycle, a detailed description of water cycle elements, and likely future pressures.

Determine the boundaries of the water cycle

Map the current boundaries and elements of the water cycle that impact on the local government area. Spatially accurate maps are useful for identifying significant elements. The map should clearly show items such as:

- external water sources
- urban areas
- agricultural areas
- significant natural waterways, including wetlands
- water storages
- the local government boundary
- significant catchment boundaries
- water treatment facilities
- sewage treatment facilities and discharge points
- recycled water facilities
- desalination facilities
- groundwater and aquifers
- significant geographical features.

Describe the current water cycle

Describe the water cycle characteristics. This description should detail relationships between catchments, water resources, and the urban and rural environment.

Document the current state of each of the water cycle elements. This may need to be done on a catchment-by-catchment basis or for a defined network. Characteristics of the water cycle elements that should be captured include catchments and receiving waters, water resources, urban environments, and rural (non-urban) environments.

Catchments and receiving waters

Briefly describe the catchments within the local government areas and their receiving waters, including: dominant topographic features, landform processes, fluvial geomorphology, and hydrology of catchments.

Detail land uses, riparian corridors, protected areas, sensitive areas, wetlands, estuaries, and floodplains.

Describe key waterway health issues, and trends.

Water resources

Summarise all water resources currently available for use within the water cycle planning area and estimate their sustainable yield. This sets the context of water availability and may take the form of a mass balance. Existing sources should be described in detail including bulk supplies transferred from outside the local government area, and typical volumes of effluent, recycled water, stormwater, and rainwater.

Urban environments

Describe local government and distributor–retailer water infrastructure and customers. Include schematic system diagrams to show flow and process to and from local communities, with all components.

Outline all existing urban water supply systems, including raw water sources, major infrastructure such as treatment plants and bulk supply mains, typical bulk demands and sustainable yields, performance, regulatory compliance, and condition of the assets. Groundwater extraction should be included.

Document the urban sewerage system including sewage treatment plants, trunk infrastructure, flows, licence conditions and compliance, key sources of trade waste, on-site systems regulated by local government, recycled water schemes using effluent. Outline the current effluent management strategy.

Onsite sewerage systems should also be documented as potable water services may be connected to properties, which can impact on local surface or groundwater sources used for raw or potable water. Include plans for where onsite sewerage systems may be planned for replacement by a reticulated sewerage system.

Describe stormwater systems within urban areas including typical stormwater pollutants and the receiving waters of stormwater networks.

Describe any potential flooding characteristics of urban areas including identification of the dominant source of the flooding, such as local drainage, regional creek, or river or coastal inundation from storm tides.

Rural (non-urban) environment

Rural environments and communities are inextricably linked to the water cycle. The productivity of rural lands is underpinned by its access to water for irrigation of crops and grazing pastures and for livestock watering. The nature of rural activities often means that the landscape is constantly changing with the seasonal cycles of planting and harvesting or movement of livestock. During some of these times the land may be more vulnerable to erosion or flooding. Understanding the water cycle needs of rural communities will assist with protecting their productivity and preserving their water resources.

Describe the rural economy and related extractive uses of water (irrigation, mining).

Describe irrigation networks and water allocation frameworks.

Describe any potential flooding characteristics.

Describe seasonal land use patterns that may impact on the quality of runoff to local waterways.

Define the typical runoff pollutants anticipated from the rural land uses within each catchment.

Identify drainage paths, channel networks and receiving waters and describe their condition.

Describe current and future pressures on the water cycle

Consider specific pressures such as the impact of forecast population growth and future land use, climate change, the replacement of ageing infrastructure, and add to the descriptions of the water cycle where appropriate. Consideration of community knowledge and attitudes about water may also be important.

6.2.3 Compile an inventory of supporting investigations and knowledge

Compile an inventory of existing investigations and knowledge. The purpose of the inventory is to identify the existing resources and knowledge within the water cycle planning area and to identify gaps in the documented understanding of the

water cycle. This step of the process allows local knowledge and experience to be recognised in the early stages of the planning process.

This inventory can include any operational, management, or strategic plans relating to:

- water supply
- water allocations
- water demands
- trade waste
- waste water
- recycled water
- stormwater
- groundwater
- flooding
- storm tides
- catchments
- waterway health.

TWCM Plans must consider the EPP Water 2009 requirements listed in Box 4.

Reference the inventory spatially to the key water cycle elements.

Each key water cycle element should be supported by a commentary on the context and relevance of the referenced material. If there are no references, or where a referenced document is out of date, include statements to add to the knowledge basis for future planning.

Include a summary and preliminary assessment of the accuracy and suitability of any available data and provide a detailed data appendix. All assumptions for predictions and modelling results should be listed and justified.

Note any missing information as a data gap. Include clear details of how and why any estimation is made so TWCM Plan reviews can reassess these estimates. Where future trends are unknown for a significant factor, considering upper and lower limits may be appropriate.

6.2.4 Fill key data gaps

If there are data gaps that are key to understanding the water cycle or to identifying objectives, issues and pressures, then this data will need to be collected. Data collection can range in complexity and can vary from using panels of experts to field studies and investigations.

6.3 Determine TWCM Vision and Water Cycle Management Objectives

A vision and objectives for TWCM needs to be defined. The vision and objectives should be informed by reviewing strategic documents, plans, and instruments (refer to Section 6.2.1) and agreed by key stakeholders, including the PRG and leadership group.

Vision

The timeframe for the TWCM vision may vary across local governments to align with other strategic documents; however, the vision should define the desired future state for water in the region for at least the next 20 years. It should be a long-term, aspirational view describing how the local government would like water to be managed. For example, Brisbane City Council's Water Smart Strategy vision is 'to support the liveability of Brisbane by managing water sustainably'.

Objectives

Determining objectives is an important step in moving towards the completion of TWCM planning and objectives for the next five years should be developed and documented as part of the TWCM Strategy. The objectives are targets to achieve in the short term to assist in moving towards the vision. The objectives are essential for identifying TWCM issues and form the basis for determining an optimal solution and monitoring the effectiveness of the plan. Objectives may represent strategic objectives, management objectives for specific elements of the water cycle or regulatory compliance standards.

System-wide objectives need to be established, which are likely to be a portfolio of measures, against which solutions can be assessed. At least one objective for each of the key water cycle elements should also be documented. Each objective should recognise an agreed outcome for the performance of that water cycle element and may reference specific targets required for regulatory compliance. Targets may include formal licences, agreements, and levels of service for water supply and wastewater treatment. These objectives may vary for each element throughout the local government area. However, caution should be taken with identifying objectives for each element. For example, it may be necessary to trade off between local-scale objectives to achieve regional objectives.

In setting objectives, consider:

- National Water Initiative objectives
- parts 4 and 5 of the EPP Water 2009
- specific Environmental Values and Water Quality Objectives for waterways in each local government area listed in Schedule 1 of the EPP Water 2009
- water resource plans (particularly environmental flow objectives and ecological assets and outcomes)
- the desired outcomes, targets and principles of the SEQ Regional Plan, SEQ NRM Plan, SEQ Healthy Waterways Strategy and SEQ Water Strategy
- SPP 4/10 Healthy Waters, its guideline, and the Urban Stormwater Quality Planning Guidelines 2010
- specific targets required for regulatory compliance, which may include formal licences, agreements, and levels of service for water supply and waste water treatment
- customer service standards for water and wastewater provision given the linkage between TWCM and Water Netserv Plans
- objectives and targets in existing council plans and documents, including the Community Plan and Corporate Plan.

The community's aspirations for water should be identified and captured in TWCM planning through ensuring the objectives reflect the Community Plan and environmental values. Additional community engagement may be desirable to better understand the community's aspirations.

To assist with monitoring the implementation of the plan, the objectives should be 'SMART', i.e. **S**pecific, **M**easurable, **A**chievable, **R**ealistic, and **T**imely.

The potential influence of climate change will need to be incorporated into all levels of the decision-making process. Climate change may not necessarily feature as a separate objective; however, climate change should form a basis for determining if water cycle management objectives are likely to be met under a range of climate scenarios. Appendix B contains a summary of key messages and approaches to dealing with climate change in water planning that are emerging from the National Water Commission.

6.4 IDENTIFY THE NEED FOR DETAILED PLANNING

6.4.1 Identify and assess water cycle management issues

A 'water cycle issue' is an important topic, problem, or challenge that needs to be resolved and is a trigger for detailed planning. Specific issues should be identified and appended to the mapping and descriptions of the water cycle.

To identify any water cycle issues, evaluate if:

- the TWCM objectives are currently being met
- existing or planned strategies are sufficient to achieve the objectives in the near future
- TWCM objectives will continue to be met if the water cycle changes in response to pressures
- the TWCM objectives could be better achieved through a more integrated approach that captures the synergies between inter-related parts of the water cycle.

The evaluation of water cycle management objectives may reveal that present actions and formally adopted plans will sufficiently address the identified issues. In this case further TWCM planning is unlikely to be required.

It is also important to make sure that the potential reasons why objectives not being met are clearly identified and described.

6.4.2 Issues risk assessment

If objectives are not being met or are unlikely to be met in the future, the risks (likelihood and severity) associated with failure to meet the objective should be assessed. The Australian and New Zealand Standard *31000:2009 Risk management — Principles and guidelines* provides a standard framework for risk assessment that can be used.

Some parts of the water cycle may only have low risk issues. However, even relatively low risk issues should still be identified and documented to demonstrate due diligence and ensure transparency. Documenting all issues also reduces the cost of future investigations and planning activities.

The PRG should have a shared understanding of the issues to promote stakeholder buy-in to the solution. The PRG needs to prioritise and rank the issues, bearing in mind that many issues are inter-related and may best be addressed as sets of issues that could have overlapping or synergistic solutions. For example, looking at breaches of wastewater discharge limits and water supply security threats together may yield a different set of solutions, such as demand management and recycling, compared to them being treated as separate issues, which could conclude that infrastructure augmentations are necessary.

When looking at the water cycle issues and associated risks there is likely to be three basic outcomes:

- Low risk: All issues are being effectively and efficiently managed. In this scenario, **detailed planning is not required** and a local government can skip to preparing an Implementation Plan.
- Medium Risk: The existing management approaches are adequate for effectively and efficiently managing the issues, but they are not being implemented well, so some improvements are needed. This should be documented in the Implementation Plan as an action. **Detailed planning may be required but not at this stage**, so the local government can skip to 'Preparing an Implementation Plan'.
- High to Extreme Risk: The existing management approaches are not capable of managing the issues, or no management is currently in place. In this scenario detailed planning is needed to identify and evaluate new options, such as improved or additional technology. **Detailed planning is likely to be required**.

Examples of high to extreme risk issues that could trigger the need for detailed planning include:

- a potential threat to water supply security
- environmental monitoring showing deterioration in water quality or non-compliance with the defined Water Quality Objectives for waterways in the region
- significant forecast population growth or changes in land use
- significant capital expenditure on water cycle assets
- proposed changes to service areas or standards
- concerns about flooding.

6.4.3 Determine planning areas

Where management approaches are not adequate to address existing or future pressures, or no management is currently in place, define planning areas to focus further detailed planning investigations. Water cycle planning areas can encompass the entire local government area, or be a subset of the total area. Planning areas may encompass a single issue or a number of issues.

For example, if an issue relates to a significant receiving environment, then the planning area should be the whole catchment contributing to that receiving environment. If urban expansion is creating pressures on water supply infrastructure, then the development area could be defined as a planning area. If a current or future land use within a rural setting is identified as being linked to an issue then a detailed planning area may defined over this land use.

Local governments will need to verify if planning areas are designated by the QWC for sub-regional TWCM planning. The sub-regional TWCM plans will be used to identify where there are regionally significant issues relating to bulk water supply and security in key growth areas. They will not usually satisfy the requirements of the EPP Water 2009. The local government will need to lead detailed TWCM planning, of which the QWC work will make a significant contribution. If there is any overlap, the local government will need to make sure there is a clear agreement about the respective roles and responsibilities and put a mechanism in place to ensure alignment between the local government TWCM plan objectives and work undertaken by QWC.

6.4.4 Prioritise planning areas

Prioritise planning areas to focus resources for detailed planning. The process should be well documented and transparent.

Prioritising planning areas should:

- be undertaken through consultation with the PRG
- reflect the objectives established for total water cycle management
- consider the risks associated with the issues identified
- take into account the timeframes for determining water cycle management solutions and infrastructure needs, including the need to inform Water Netserv Plans (water service providers) and coordination with sub-regional TWCM planning and Development Scheme preparation for UDAs
- allow for the extent of planning already undertaken
- consider the capacity of local government and the distributor–retailer to undertake the detailed planning and to implement the solutions

In some instances, detailed planning may be required to resolve a specific issue related to an individual element of the total water cycle, such as bulk water supply, wastewater disposal options, or flooding. However, the real value of TWCM planning is exploring the synergies between different parts of the water cycle.

Without detailed planning, it is more difficult for local governments to provide specific instructions to water service providers for inclusion into Water Netserv Plans, and more difficult for a water service providers to demonstrate prudency in establishing a preferred infrastructure solution.

If there is a clear consensus among the stakeholders of the priorities, showing this agreement should be sufficient without further analysis. However, if there is no consensus among stakeholders, a multi-criteria analysis may be required (see Section 7.2).

Detailed planning may need to be undertaken for multiple areas either simultaneously or subsequently. This will depend on the priority and the available resources.

6.5 Document the TWCM Strategy

A TWCM Strategy must document:

- a full description of the water cycle, including boundaries
- data on the water cycle, including documenting any existing knowledge and information collected to fill key gaps
- the vision and objectives for TWCM
- an assessment of how the water cycle may change in response to pressures such as climate change, population growth, and aging infrastructure
- identified issues where existing and planned management actions are not meeting TWCM objectives or will fail to address changes in response to pressures
- prioritisation of planning areas
- areas where detailed planning is to be undertaken to develop TWCM solutions to address identified water cycle issues, including timeframe, responsibility, estimated cost and how this links to other planning processes, such as Water Netserv planning.

A TWCM Strategy provides a sound basis to undertake detailed planning (where applicable) and prepare an implementation plan.

The TWCM Strategy should be endorsed by the water service provider and by the council at this point.

7 DETAILED PLANNING

Detailed planning is the 'optioneering' process that generates preferred water management solutions. It will optimise the water management system, not specific components of the water cycle, taking into account economic, environmental and social factors. Detailed planning should be transparent, allowing all stakeholders to participate in formulating, exploring, and adopting water cycle management scenarios.

Detailed planning is only required where it is identified as necessary in the TWCM strategy.

This section describes an approach to detailed planning adapted from the Water Services Association of Australia's Sustainability Framework (Lundie et. al. 2008).

Current national and regional research into integrated planning methods and tools will inform the detailed planning process. Additional information and resources to assist with detailed planning will be available from www.waterbydesign.com.au in time.

7.1 IDENTIFY OPTIONS

For any planning area, there is likely to be a range of issues affecting multiple parts of the water cycle. Therefore, a combination of measures and actions is likely to be required to optimise outcomes.

7.1.1 Generate preliminary options

At this stage of the process, only conceptual options should be considered; no detailed information is required. All possible options (including combinations) should be identified so that innovation and integration is not limited and all possible outcomes are considered.

The choice of preliminary options should not be constrained by political or policy positions. The potential for options to be delivered that may be inconsistent with current government positions can be reflected in the assessment criteria and weighting applied in subsequent steps. Similarly, the distribution of costs and benefits (i.e who pays and who benefits) associated with particular components of TWCM solutions should not influence the identification or screening process. Distribution of costs and benefits to the community should be dealt with after the multi-criteria assessment.

Preliminary options may be informed by investigations and case studies relating to all the elements of the water cycle.

In developing options, consider integrated management approaches and an understanding of the water linkages within the water cycle system. For example, a sewerage treatment plant could be upgraded to meet pollution reduction requirements to a purified recycled water treatment plant and, in doing so, provide a new water source. The upgrade may provide opportunities to meet local water demands and increase the potential for cost recovery.

Check that the EPP Water 2009 requirements have been considered.

Box 6: Tips for generating options

SCAMPER is an acronym for a useful list of words that can be applied as stimuli to make you think differently about each issue.

Substitute	What can you substitute?
Combine	What can you combine or bring together somehow?
Adapt	What can you adapt for use as a solution?
Modify	Can you change the item in some way?
Put to other uses	How can you put the thing to different or other uses?
Eliminate	What can you eliminate?
Rearrange	What can be rearranged in some way?

7.1.2 Select criteria to evaluate preliminary options

Establish criteria to screen preliminary options and assess the performance of prioritised options in detail. These criteria will form the basis of a multi-criteria assessment.

Criteria should be measurable indicators of the objectives and should be carefully selected to enable differentiation between the options. At least one criteria must be selected to reflect each objective. The criteria should preferably cover all relevant elements of the water cycle and have direct relevance to specific TWCM issues and drivers. Criteria may significantly influence the decision-making process, so it is important to ensure the PRG agrees to the selected criteria. The Water Services Association of Australia's Sustainability Framework (Lundie et. al., 2008) suggests several principles for selecting criteria to ensure a comprehensive and consistent assessment of each option. These principles are summarised in Box 6.

Box 6 Principles to consider when selecting criteria for multi-criteria analysis

Principle	Description
System boundaries	The system boundary delineates the options under consideration from the remaining environment and economy. The system boundaries have to be defined consistently across all options and criteria. Ideally, the system boundaries should be identical for all criteria.
Comprehensiveness	The selected criteria should allow for sufficient performance monitoring and measurement of the options. The selected criteria should be able to detect any possible problem shifting within each option or between options.
Applicability	The selected criteria should be examined the same way for all options.
Transparency	Justification should be developed to support the selection or omission of criteria to promote transparency and communication during consultation.
Data quality	Data quality requirements should be explicitly defined. High quality data or data with reported uncertainty is crucial for the correct interpretation of each criteria used to assess options. Data quality must be consistent for each criteria.
Practicability	The criteria needs to reflect the decision making and the assessment tools. The criteria should reflect the complexity of the options being considered.
Temporal–spatial aspects	Each criteria should cover the same time period and spatial domain.

The potential influence of climate change will need to be incorporated into all levels of the decision-making process. Climate change may not necessarily feature as a separate criteria; however, the performance of all criteria should be measured under a range of climate scenarios. Appendix B contains a summary of key messages and approaches to dealing with climate change in water planning that are emerging from the National Water Commission.

7.1.3 Funding and economic criteria assessment

When assessing an option against economic criteria, a number of factors need to be considered, beyond the total cost to implement. These factors may include potential sources of the funds to contribute to the implementation, the timeframes for implementation over which the cost will be spread, and any deferred costs (savings) that may be identified if an option is implemented.

Funding sources for options may include existing local government capital works programs, state or federal subsides, state or federal grants, private sector investment, special levees and rates and development infrastructure charges under a Priority Infrastructure Plan or Infrastructure Agreement.

The economic assessment of an option should also consider when the substantial costs of options are borne. Some options may require significant upfront capital investment to establish a network or major treatment facility; others may be staged over a number of years or even decades as growth occurs.

These are potentially complex factors to consider throughout options assessment process. Basic assumptions may be adequate for undertaking the preliminary assessment; however, as more detailed assessments are pursued, professional economic advice may help the decision making process and further assist in demonstrating 'prudency and efficiency' to the economic regulators.

7.1.4 Screen preliminary options

If a broad selection of preliminary options is identified, the number of options should be reduced to a set that can be thoroughly assessed. Options can be screened using qualitative or coarse quantitative information. The screening process should broadly assess each option against the criteria, and ensure risk, resilience an d uncertainty are considered (see Box 7). A subset of the criteria may be adopted to simplify the screening process. Options that violate objectives or criteria should be eliminated early. During the screening process, options can be modified to better satisfy objectives or criteria.

Box 7 Risk, resilience, and uncertainty (from Blackmore et. al. 2009)

Good management decisions do not simply focus on the way a system performs when all is going well. They also take into account the risk of the system failing, and its inherent resilience.

Resilience is a desirable property of a system that enables it to respond to shocks and return to a satisfactory state of functionality within a reasonable time.

It is therefore incumbent on those responsible for the screening of preliminary options to consider risk and resilience before ruling an option 'in' or 'out'.

Further, little of the knowledge that is brought to the decision table is entirely certain. Uncertainties can be intrinsic (the result of randomness), epistemic (limited by the amount of available data or our limited knowledge of a particular process), or the result of something that has not yet been thought of (Donald Rumsfeld's 'unknown unknowns'). Understanding uncertainty is a necessary part of risk management and therefore must be considered in the decision making process. Tracking uncertainty through the decision making process is essential to ensure informed and confident decision are made.

The screening process must be well documented and supported by the PRG and the Leadership Group. All stakeholders who are potentially responsible for implementing solutions, either through capital expenditure or operational activities, should also be involved. The screening process should be reviewed and endorsed by the Leadership Group.

This is a critical stage of the decision-making process, where viable options could be disregarded due to poor supporting evidence, leading to sub-optimal options being considered.

The certifying engineer should critically review the screening process. While it is not a requirement for the certifying engineer to endorse the options, their review may reveal weaknesses in the supporting evidence, which may influence the outcome of the screening process.

It is highly recommended that a sign-off is received from the PRG and leadership group before proceeding to more detailed assessment of options.

7.2 ASSESS THE BEST OPTIONS

Undertake a detailed assessment of the remaining options. In assessing options, it is important that relevant technical expertise is used to support the project team and PRG.

7.2.1 Gather data on options

Key data gaps will have been identified in the TWCM Strategy. Some of these key data gaps, including cost estimates and impact of the proposed options on waterway health, may be need to be filled. Data requirements should be identified so that options can be adequately assessed. Information on modelling platforms that can be used will be made available via www.waterbydesign.com.au/twcm.

Data on risk cost is important to include in the economic assessment. Risk cost is determined by considering the possible risks associated with an option, their probability of occurrence, and the cost of that occurrence (Pamminger, 2008).

7.2.2 Generate a performance matrix

To begin the detailed assessments of options, generate a performance matrix from collected or derived data for each option. Report against each criteria. Ensure consistent units of measure are reported in the performance matrix and that similar levels of confidence are used. It is unlikely data quality will be consistent, so the quality of the data and possible sources of uncertainty should be documented. An example of the structure of a performance matrix is included in Appendix C.

There may be a large number of criteria for assessment in the performance matrix. Some criteria may cancel out others or may be neutral across options. Individual criteria can be excluded from further analysis if the performance of all options is identical or very similar.

Populating the performance matrix with quantitative and qualitative performance data is one of the most significant and important tasks in Detailed Planning. It requires an inter-disciplinary evaluation of each option using a range of fit-for-purpose modelling tools and other quantitative and qualitative assessment frameworks.

7.2.3 Normalise the results

The indicator results for each criterion will need to be normalised before any ranking or weighting factors are applied. Normalisation converts the criteria results into uniform, dimensionless numbers or 'scores' for further analysis. Three approaches are suggested (Lundie et al., 2008) for converting indicator results into scores and are noted in Table 5. These are the 'min-max', 'ranges' and 'distance to target' approaches. The min-max approach may overstate the differences between options when in fact their performance might be quite similar. Therefore 'ranges' and 'distance-to-target' approaches are preferable. The ranges approach is the most widely applied in practice.

7.2.4 Weight criteria

Establishing weightings, or rankings, for the criteria is a critical important step in the detailed planning process.

The preferred and most straightforward approach for ranking results is to apply a direct weighting to the primary and secondary criteria. Using direct weighting, a weight is assigned to each criteria and the sum of all weights equals 100%. Refer to Appendix C for an example.

Other methods, such as establishing a consensus based rank order for each criterion may also be used at this stage. This approach may prove difficult if there is a large number of criteria and stakeholders.

Table 5 Approaches to convert indicator results into scores

Approach	Description
Min-Max approach	The best indicator result gets the highest score of 100, while the worst indicator result scores lowest (i.e. 0). All indicator results in between are scaled in a linear manner. Refer to Appendix C for an example using the performance values.
Ranges approach	For each indicator, minimum and maximum boundaries might be defined if more sophisticated information is available (from similar previous projects) on what is technically achievable. For example, options under consideration may perform better than worst case, but they may be inferior to the best available technology. In this case the option would be scored higher than 0 but less than 100 when applying the value function. Refer to Appendix C for an example using the performance values.
Distance-to-target approach	The distance-to-target weighting method ranks criteria performance as being more important the further away it is from achieving aspirational targets. This approach can be applied when unambiguous aspirational targets are defined.

7.3 DETERMINE THE PREFERRED OPTION

The objective of this step is to determine a final recommendation for the preferred suite of options. By this stage of the decision-making process, PRG members should be familiar with the process and methodologies adopted in the early steps of the multi-criteria analysis. To facilitate this, step-by-step documentation of the process undertaken to this point should be available.

7.3.1 Aggregate normalised criteria scores

In most cases, it will be appropriate to adopt a straight-forward linear additive method of deriving an overall weighted value for each option from aggregating the normalised criteria scores. See Appendix C for an example. It may be useful to complete the score aggregation process using both the Min-Max and Ranges methods. The results from both methods may reveal a consistency in the ranking of options that is supported by both methods, or it may reveal an inconsistency in the rankings that can be further explored to improve overall understanding of the decision making process.

Comparing options in various ways can help reveal the trade-offs between elements of the water cycle. The spider plots shown in Figure 14 can be useful to understand how the relative criteria and weightings influence the overall weighted value for an option.

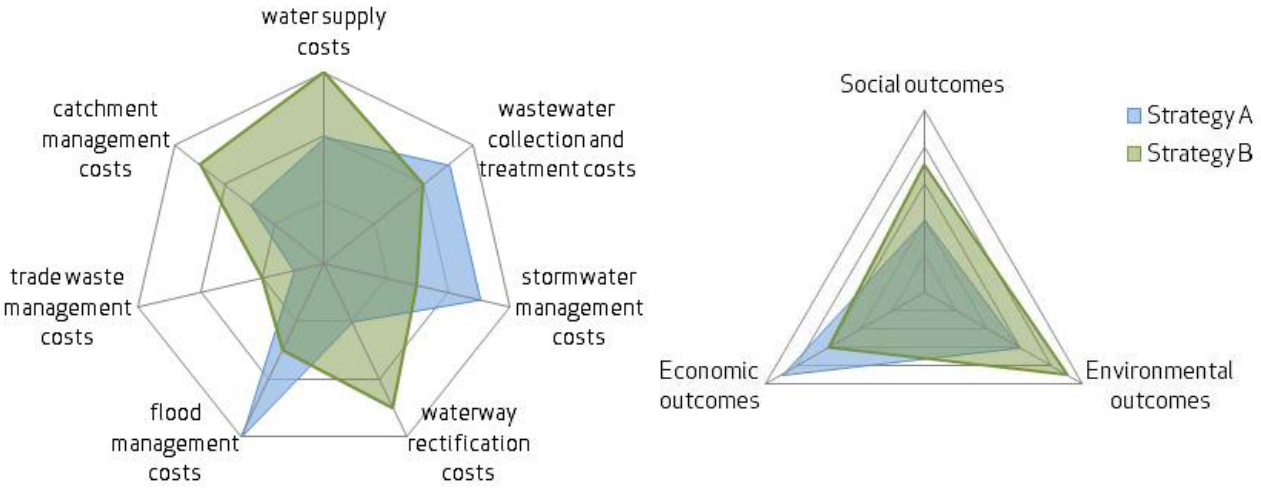


Figure 14 Visual tools such as spider plots are useful in understanding the relative performance of various options

7.3.2 Undertake sensitivity and scenario testing

Before a final recommendation is made, a scenario testing exercise should be undertaken to test how options perform:

- with different weightings (such as anticipated future weightings)
- when short and long-term performance is considered
- under different population growth scenarios
- under different climate change scenarios.

Different weightings

Scenarios may be tested where the relative weighting distributions between economic, social and environmental criteria are adjusted.

Exploring the results of the scenario tests will provide greater understanding of the sensitivity of the adopted approaches and assumptions. The results may reveal a level of consistency in the ranking of options that provides confidence in making a final decision, or it may reveal inconsistencies in the rankings, which will need to be understood to make a final decision. See Appendix C for an example rankings compared for sensitivity testing.

Societal values will change over time. In an economic analysis of climate change, Garnaut (2008) makes the point that due to either increased affluence or environmental decline, future generations will place a higher value on non-market environmental services—the environment will be more highly valued in the future. This highlights the need to evaluate solutions based on both short and long-term performance, with weightings assigned based on current values and tested against hypothetical weighting sets of future generations. In setting hypothetical future weightings, it may be useful to first establish a hypothetical weighting set based on historical social values (say in 1960). This exercise will help in understanding the intergenerational equity implications of the proposed solutions.

Short and long-term performance

Various strategies may perform differently when assessed over short, medium, long or very long timeframes. Binney (2010) found significant variances in the short and long-term sustainability performance of water management strategies. For example, solutions that appear to be optimal over a 5-year period may be suboptimal over longer timeframes such as short-term demand management without longer term supply-side planning. This exercise may reveal trade-offs between outcomes and benefits now versus those in the future.

Population growth scenarios

The nexus between population growth, water demand, and environmental impacts should be considered when testing preferred management options for sensitivity to changes in the assumed population growth. The basis for population projections used in any network or catchment modelling should be identified and understood by the PRG. Population data from the Planning Information and Forecasting Unit (PIFU) of DIP will form the basis of most projections used for TWCM planning. However, there are many methods for deriving population projections. Some population projections are industry-specific. Population projections adopted across the various sectors of water management may not be the same. If this is the case, it is important to confirm the assumed trends in population growth are at least consistent and focus sensitivity testing on variations in trends, rather than achieving a specific target population. Sensitivity testing for population growth should consider scenarios of slow, medium, and fast growing population trends. It will be important to also consider how population impacts on the solution, for example through increased water demand or increased wastewater loads and the sensitivity of the preferred solution to these forecasts.

Climate change scenarios

As noted in Section 3.4, it is anticipated that, over time, climate change will impact on a number of issues that may be incorporated into TWCM Plans. Climate change scenarios will need to be developed and incorporated into the decision-making process. Ashbolt and Maheepala (2008) describe three main bases for generating climate change scenarios for total water cycle planning:

- scenarios based on global climate model simulations and regional downscaling
- hypothetical scenarios of changes in specific climate variables or extension of current climate trends
- analogue scenarios that can be based on selected parts of the historical climate record or may use records from another location.

The most rigorous and widely accepted approach is to base climate change scenarios on global climate model simulations with the global climate projections 'downscaled' to the regional level. Where 'downscaled' data is unavailable or does not represent local conditions, an approach based on hypothetical or analogue scenarios may need to be considered. The risk with hypothetical or analogue-based scenarios is that they may not represent a reasonable projection of future climate, potentially resulting in over-investment or under-performance. Decision makers in the TWCP process need to be cognisant of the limitations of the scenarios chosen for testing the impacts of climate change.

There are three basic uncertainties that remain in climate change projections:

- the amount of future GHG emissions and concentrations in the atmosphere
- the global atmospheric response to changes in GHG concentrations leading to increased average surface temperatures
- how changes in the climate will vary from region to region and how each region will respond to increases in global surface temperatures.

The National Water Commission's resource paper (Fane, et. al. 2010) notes that the first uncertainty can be addressed by considering possible future emission trajectories and the resulting GHG concentrations as presented in the Intergovernmental Panel on Climate Change (2000) Special Report on Emissions Scenarios. The second can be addressed by considering the rate of warming in different climate models. The third uncertainty can be addressed, at least in part, by considering the differing spatial patterns of climate change in mulitple climate models.

The paper also notes that for the next 20 years or so, the uncertainties in projected regional climate change will be dominated by the differences between the results from the various climate models rather than differences between emissions trajectories, whereas beyond 2030 there is greater uncertainty about the emissions trajectory.

Due to the inherent uncertainties around climate change, it is recommended that a series of scenarios be chosen to test the sensitivity of the response to deviations from an 'expected' scenario. The chosen scenarios should reflect high, medium, and low ranges of climate change. The medium scenario should represent the 'best estimate' or most likely change agreed to for the region in question, and the high and low scenarios should typically represent the wet and dry extremes respectively.

When determine a high scenario based on GHG emissions, it should be noted that current monitoring of global GHG concentrations is tracking on or above the Intergovernmental Panel on Climate Change high scenario. Consideration should be given to aligning the best estimate (medium scenario) with current high GHG emission scenarios from the Intergovernmental Panel on Climate Change (2000).

It is also recommended that a worst-case scenario is considered in addition to the high, medium, and low scenarios. The worst-case scenario may be useful to test the adequacy of adaptive TWCM measures. It is not recommended to use a worst-case scenario to determine a supply–demand balance.

Planners should also be aware of natural climate variability. Natural climate variability should be reflected as a shift in the baseline climate data prior to the application of projected climate change parameters.

7.4 Prepare the Detailed Planning Report

For each detailed planning exercise, a detailed planning report must be prepared. This will be an important document for communicating the recommended option within Council and to critical stakeholders. It will be a key basis for informing Water Netserv planning, and for demonstrating prudency and efficiency for the purposes of infrastructure expenditure and cost recovery.

The detailed planning report will document the detailed planning process and outcomes, including:

- description of detailed planning area, drivers and objectives (consistent with TWCM Strategy)
- stakeholders involved
- options considered
- rationale for screening options
- assessment criteria and commentary
- data on performance of options
- weightings, multi-criteria analysis results
- sensitivity and scenario testing results

- details of the recommended solution and rationale for its selection
- identified issues associated with the recommended solution (e.g. risks, institutional reforms required)
- trigger points for review of the detailed planning undertaken.

Implementation actions relating to the recommended solution should be documented at this stage for inclusion in the Implementation Plan (refer to Chapter 8).

The Detailed Planning Report can be used to demonstrate prudency for the purpose of establishing water prices by clearly documenting the process, results of the multi-criteria analysis and recommendation. If the recommended solution is contrary to the results produced by the multi-criteria analysis, then this decision will need clear justification and full stakeholder support.

8 TWCM IMPLEMENTATION PLAN

TWCM Implementation Plans set out the strategies and actions to achieve the vision for the water cycle. Realisation of the vision may take many years as systems are gradually updated and the components of the water system are integrated. The effort required to successfully implement TWCM Plans depends on the complexity of the water cycle issues identified and the range of preferred solutions to meet TWCM objectives.

TWCM Implementation Plans need to be prepared regardless of whether detailed planning is undertaken or not.

TCWM Implementations Plan should specify:

- strategies to achieve that vision over a 20-year period
- actions to be implemented within the next five years to achieve the five-year objectives
- a framework detailing how implementation of the plan will be monitored and reported
- identify trigger points that may prompt a review of the plan or elements of the plan, in addition to the statutory five year review period.

The actions should:

- specify updates to existing strategic, operational, and planning documents to reflect TWCM objectives as identified during development of the TWCM Strategy (see Section 6.2.1)
- note program and activities that are already being implemented and those that need to be reviewed or improved
- specify activities that need to be undertaken within the next five years to implement the preferred water cycle solutions where detailed planning was undertaken
- set out additional detailed planning to be undertaken where the need was identified during Strategy development (see Section 6.4).

As detailed planning is undertaken for other planning areas, the outcomes can be incorporated as an addendum to the TWCM Plan. This allows detailed planning to occur across multiple areas and timeframes without the need to regularly amend the TWCM Plan.

For each action, the Implementation Plan should identify as a minimum:

- who is responsible
- who will support implementation
- an estimate of the cost to complete
- a timeframe for completion.

The breakdown of responsibilities for each action will depend on a local government's corporate structure and the relationship with the local water service provider (see Section 4.4).

When setting timeframes for each action, many actions within TWCM Plans will need to align with dates in legislation and policy requirements. For example:

- adopted TWCM outcomes need to be reflected in Water Netserv Plans, which must be finalised by 1 July 2013
- Stormwater and flooding matters, SPP 1/03 (Mitigation for Adverse Impacts of Flooding)
- *Sustainable Planning Act 2009* matters including Catchment Management Plans and Priority Infrastructure Plans
- Town Planning Scheme (including codes) amendments as required by the *Sustainable Planning Act 2009*, including PIPs and Infrastructure Charges in accordance with the *Sustainable Planning Act 2009* Statutory Guideline 01/09
- updating plans required by the *Water Supply (Safety and Reliability) Act 2009* until a Water Netserv Plan is approved
- Drinking Water Quality Management Plans required by water service providers by March 2011
- formal reviews of TWCM Plans are required within five years of them being adopted by local government.

The responsible entity should be consulted to ensure a reasonable estimate of the time needed to complete each action is set. This will also help with ownership and acceptance of the responsibility for delivering the specific action.

9 FINALISE THE TWCM PLAN

9.1 OBTAIN FINAL ENDORSEMENT

Under Section 23 of the EPP Water 2009, the relevant water service provider must 'endorse' the local government's TWCM Plan.

It is recommended that the local government consult with, and obtain support for the plan from, those organisations that will be responsible for actions within a TWCM Plan. This may include state government agencies, government-owned corporations, third-party water service providers, or community groups.

As shown in Figure 12 (Section 5), the recommended process suggests that endorsement is obtained from relevant parties during the planning process to help ensure agreement throughout the process and to the outputs, and to limit the opportunity for impediments in obtaining endorsement when the plan is finalised. This may include endorsement by the project reference group, leadership group, other relevant entities, the CEO of the water service provider and Council.

It is anticipated that each local government will be required to endorse the final TWCM Plan and provide an approval for it to be published by resolution of the council. Formal endorsement of the local government's final TWCM Plan should be obtained from at least the CEO of the water service provider before seeking endorsement from the council.

9.2 OBTAIN INDEPENDENT CERTIFICATION

Under Section 23 of the EPP Water 2009, a professional engineer registered under the *Professional Engineers Act 2002* must independently certify that the TWCP Plan complies with the requirements of the policy. Independent certification by the registered professional engineer should:

- ensure the process followed to prepare the TWCM Plans was generally in accordance with the process described in these guidelines
- ensure relevant professionals representing other disciplines such as (but not limited to) environmental science and town planning have participated in the planning process and, where appropriate, have provided support for the parameters and analysis undertaken within their field of expertise.

The certification required by a registered professional engineer may refer to the supporting statements of satisfaction issued from a variety of professionals who have participated throughout the process.

The independent certification is intended to verify that an appropriate process has been followed to prepare the TWCM Plan and that there are no fundamental flaws in the parameters or measures adopted through the assessment process. The independent certification is not certification of any performance or ultimate outcome of any option considered or adopted.

The independent certification should be provided progressively throughout the TWCM planning process to limit the opportunity for impediments in obtaining certification when the plan is finalised. This should be anticipated at the start of the planning process to allow for engaging appropriately qualified professionals throughout the various stages of the planning process. Key points of the TWCM planning process where certification may be sought are noted in Box 1.

9.3 PUBLISH THE TWCM PLAN

Under Section 17 of the EPP Water 2009, the certified and endorsed plan must be published on the local government's website.

A layer should also be added to local governments' geographic information systems to document the defined planning areas where detailed TWCM planning has been undertaken and finalised, or needs to be undertaken as part of a master planning or development approval process.

Box 8 Key points of the TWCM planning process where independent certification may be sought

TWCM Strategy

- ✓ Identification of key water cycle elements:
  - determine the boundaries of the water cycle
  - describe the current water cycle
  - future pressures on the water cycle
  - determination of objectives for each of the water cycle elements
- ✓ Issues risk assessment
- ✓ Prioritisation of planning areas
- ✓ Strategy documentation.

Detailed Planning

- ✓ Preliminary options assessment
  - identification of preliminary options
  - criteria selection for preliminary options
  - screening of preliminary options
- ✓ Assessment of the best options
  - data gathering
  - performance matrix
  - normalising results and criteria weighting
  - sensitivity testing
  - final recommendations
- ✓ Detailed planning report.

TWCM Implementation Plan

Includes:

- ✓ Strategies
- ✓ Actions
  - who is responsible?
  - cost estimate?
  - timeframe.

10 MONITOR AND REVIEW THE TOTAL WATER CYCLE MANAGEMENT PLAN

10.1 MONITOR IMPLEMENTATION AND PROGRESS

Under Part 6, Division 1, Section 17 of the EPP Water, local governments must report on their TWCM Plan's implementation to the Chief Executive of DERM with four years of the plan being published.

Council must monitor implementation of the TWCM Plan by:

- nominating a responsible officer, generally the head of a department or division
- checking that the actions identified in the Implementation Plan are being delivered in a timely manner
- monitoring that the adopted suite of management activities or infrastructure solutions are adequately responding to the issues identified, and in doing so achieving the TWCM objectives.

Ensuring the actions identified in TWCM Implementation Plans are being delivered is a relatively straightforward process, and can be done by reviewing the tasks and any new documents or procedures that may have been developed and comparing performance against the TWCM Implementation Plan. The review may identify additional tasks that have been completed that were not identified in the original Implementation Plan, but are needed to progress the various solutions.

This review should be undertaken annually, coordinated by the nominated officer and reported to Council.

The second and more difficult aspect of monitoring the TWCM Plan is to evaluate whether the adopted suite of solutions is adequately addressing the issues. This should be undertaken comprehensively at least every four years as part of the formal review and update of the plan. This evaluation will require the responsible section of council or water service provider to measure and compare key performance indicators with those considered during the development of the original plan and any targets that were adopted in the TWCM Plan. The indicators are likely to be related to various water quality and quantity issues, and may also consider other social, environmental or economic targets.

The actual assessments needed will depend on the issues identified and the objectives set in the TWCM Plan. However the following performance indicators (framed as questions) are likely to be common across most local governments:

- Has the water quality of receiving waters improved and do they satisfy relevant Water Quality Objectives?
- Does the operation of the water supply and wastewater network satisfy all legislation, meet customer service standards, and compare favourably with National Water Initiative performance benchmarks?
- Has the energy use required to provide water, stormwater, and wastewater services (per lot) been reduced?
- Are water supply sources as secure as they were?
- Have flooding risks and diffuse sources of pollution been reduced?
- Has recycling of water increased?
- Is the community more engaged and involved in water management and decision making?
- Were the forecast capital and operating costs of the different solutions realistic?
- Did the options perform as expected in terms of water saved and water quality outcomes?

The performance matrix used in the detailed planning process to help choose the preferred solution will be a useful guide when reviewing the progress of the TWCM Plan. The detailed review may find that significant changes in approach are required to deliver Council's vision for water cycle management.

10.2 WATER QUALITY MONITORING PROGRAM

Protecting and improving waterway health is likely to be a central goal of each TWCM Strategy. A water quality monitoring program is needed to identify issues of concern, quantify the significance of issues, and to track the performance of water cycle management and infrastructure initiatives. Local governments should consider updating their existing water quality monitoring programs (if required) so that the information gathered is useful for determining trends in water quality, and to determine whether the defined Water Quality Objectives are being achieved for the major waterways and tributaries in the region. This review of the monitoring programs may occur during, or after, the development of the TWCM Plan.

Typically, local government environmental management and sustainability teams undertake environmental monitoring that may identify changes to trends in surface and groundwater quality. However, other organisations such as water service providers, Healthy Waterways, and state government agencies such as DERM may also undertake environmental monitoring.

Water service providers are required to undertake extensive monitoring of their potable and recycled water supply systems and wastewater discharges. Analysis of these data sets will often identify additional issues of concern such as level of compliance with the *Water Supply (Safety and Reliability) Act 2008* and the *Environmental Protection Act 1994*.

Water quality datasets are very useful for calibrating models and other tools that may assist local governments determine the relative importance of various pollutant sources on waterway health. These same models may be used to predict the response of waterways to the different options being considered as part of the detailed TWCM planning process.

By aligning and examining council, state, Healthy Waterways, and water service provider environmental monitoring datasets, the relative contribution of pollutants from point sources such as sewage treatment plants versus diffuse loads can be determined. This analysis will help develop solutions as part of TWCM Plans, and focus capital and operational expenditure on activities that can make the biggest difference to improving water quality.

Local governments should review their monitoring programs to seek synergies with other agencies, and to ensure the monitoring includes the key physio-chemical and biological parameters that form the water quality objectives for waterways within their area and aligns with key evaluation criteria used in the detailed TWCM planning process. Total water cycle management planning presents a valuable opportunity for agencies and other participating stakeholders to collaborate on monitoring programs. Sharing of data across monitoring programs may assist with calibrating and validating regional and local nested models.

The relevant water quality objectives for riverine (freshwater), estuarine and coastal waters and ground waters are listed in Schedule 1 of the EPP Water 2009.

10.3 REVIEWING TWCM PLANS

Total water cycle management is an ongoing process requiring iteration and refinement overtime. As a minimum, the EPP Water 2009 requires that TWCM Plans are reviewed and updated at least every five years. In addition, the Chief Executive of DERM has the power under the EPP Water 2009 to request a local government to review and amend their plan at any time.

However, within the five-year review periods, there are a number of triggers that may prompt a review of TWCM Plans or more detailed planning. Trigger points that will prompt a plan review and update are to be documented in the TWCM Plan. Triggers include:

- changes in Council priorities that impact on TWCM
- the outcomes of any detailed TWCM planning or subregional TWCM planning
- deterioration in water quality of surface or ground water, or the potable water supply shown by environmental monitoring
- increases in forecast population growth or significant changes in proposed land use
- significant capital expenditure on water cycle assets, replacement of aging assets, improvements that satisfy more stringent compliance standards, or capacity augmentations
- potential threats to water supply security
- revision of related plans, including Water Netserv Plans.

The range of triggers requires vigilance from local government and water service providers.

All stakeholders in the PRG need to be aware of matters under their operational control that could trigger a review of TWCM Plans.

TWCM Implementation Plan should assign responsibility for the regular five-year review to the head of each of department involved in the preparation of the Plan. As a minimum, this would include the strategic planning, environmental and stormwater management departments, and the water service provider.

As part of the five-year review of a TWCM Plan, Councils should consider the effectiveness of the various actions chosen to address the water cycle issues of concern and be prepared to amend the TWCM Plan if a more effective way of realising Council's vision for managing the water cycle emerges.

Local governments are encouraged to align the review of their TWCM Plan to the review of Water Netserv Plans for distributor-retailers who operate within their jurisdiction.

11 BIBLIOGRAPHY

Ashbolt, S.C. and Maheepala, S. (2008). *Assessing the impact of climate change on urban water systems:Overview of methods*. Paper presented to the Water Down Under confernce, Adelaide Australia 14-17 April.

Australian and New Zealand Standard *31000:2009 Risk management—Principles and guidelines.*

Binney, P. (2010). Triple bottom line mapping over time to promote continuing sustainable performance for utility capital programs and operations. Paper presented to the *Australian Water Association OzWater 2010 conference*, Brisbane Australia 8–10 March 2010.

Blackmore, J.M., Dandy, G.C. , Kuczera, G. and Rahman, J. (2009). *Making the most of modelling: A decision framework for the water industry*. Paper presented to the 18th World IMACS / MODSIM Congress, Cairns Australia 13–17 July 2009.

Brown, R. and Farrelly, M. (2007). Institutional impediments to advancing sustainable urban water management: a typology. *Proceedings of the 13th International Rainwater Catchment Systems Conference and the 5th International Water Sensitive Urban Design Conference*, 21–23 August, 2007, Sydney, Australia. For conference info go to: www.rainwater2007.com/.

Council of Australia Governments (COAG), (2010). *National Urban Water Planning Principles*. Accessed at http://www.environment.gov.au/water/policy-programs/urban-reform/nuw-planning-principles.html, viewed 1 September 2010.

Department of Environment and Resource Management (DERM), unpublished, *Urban Stormwater Quality Planning Guidelines*.

Department of Infrastructure and Planning. (2010). *South East Queensland*. Accessed at http://www.dip.qld.gov.au/seq, viewed 22 July 2010.

Fane, S., Blackburn, N. and Chong, J. (2009). *Sustainability Assessment in Urban Water Integrated Resource Planning*. National Water Commission.

Fane, S., Patterson, J., Maheepala, S. and Kirono, D. (2010). *Incorporating climate change into Urban Water Integrated Resource Planning*. Australia: National Water Commission.

Garnaut, R (2008). The Garnaut climate change review. Cambridge University Press, Melbourne, Accessed at http://www.garnautreview.org.au/pdf/Garnaut_prelims.pdf, viewed 1 September 2010.

Infrastructure Australia., *Review of Urban Water Security Strategies*, May 2010, Recommendation 2. Accessed at http://www.infrastructureaustralia.gov.au/public_submissions/uws/index.aspx), viewed 1 September 2010.

Intergovernmental Panel on Climate Change (2000). *Emissions Scenarios Special Report*. Intergovernmental Panel on Climate Change. Cambridge University Press. http://www.ipcc.ch, viewed 1 September 2010.

Lundie, S., Ashbolt, N., Livingston, D., Lai, E., Karrman, E., Blaikie, J. And Anderson, J. (2008). *Sustainability Framework*. Water Services Association of Australia.

Marsden Jacob Associates (2010). *Managing what matters: The cost of environmental decline in South East Queensland*. Brisbane, SEQ Catchments.

National Water Commission (2010a). Urban water reform. Accessed at http://www.nwc.gov.au/www/html/129-urban-water-reform.asp?intSiteID=1, viewed 28 July 2010.

National Water Commission (2010b). *Water Planning in Australia: National Water Commission position*. Accessed at www.nwc.gov.au/resources/documents/6._Water_Planning_-_PS1.pdf, viewed 2 September 2010.

Queensland Water Commission. (2010a). Bulk Water Prices. Accessed at

http://www.qwc.qld.gov.au/myfiles/uploads/SEQ%20Water%20Reform/Bulk%20water%20prices%20update%20190808.pdf, viewed 15 December 2010.

Queensland Water Commission. (2010b). *Draft Framework for South East Queensland Sub-regional Total Water Cycle Management Planning*, Unpublished, Brisbane.

State of Queensland (Queensland Water Commission) (2010d). *South East Queensland Water Strategy*. Brisbane. Accessed at http://www.qwc.qld.gov.au/planning/seqwaterstrategy.html, viewed 1 September 2010.

Pamminger, F. (2008). *Advancing the infrastructure selection process – case study*. Yarra Valley Water, Melbourne, viewed 21 January 2010, <http://www.yvw.com.au/yvw/Home/AboutUs/ReportsAndPublications/ResearchPublications.htm>.

Sharma, A., Grant, A., Gray, G. and Mitchell, G., Grant, T. and Opray, L. *Sustainability of Alternative Water and Sewerage Servicing Options*. CSIRO Urban Water.

South East Queensland Healthy Waterways Partnership (2008). *South East Queensland Health Waterways Strategy 2007–2012*. Brisbane.

South East Queensland Healthy Waterways Partnership (2010). *Ecosystem Healthy Monitoring Program Report Card 2009 for the waterways and catchments of South East Queensland*. Brisbane. Accessed at http://healthywaterways.org/EcosystemHealthMonitoringProgram/Home.aspx, viewed 1 September 2010.

State of Queensland (Department of Environment and Natural Resource Management) (2009). *South East Queensland Natural Resource Management Plan 2009–2031*. Brisbane.

State of Queensland (Queensland Department of Infrastructure and Planning) (2009). *South East Queensland Regional Plan 2009-2031*. Brisbane.

Taylor, A., 2010. *Sustainable Urban Water Management: The Champion Phenomenon*. National Urban Water Governance Program, Melbourne. Accessed at: http://www.watersensitivecities.org.au/?page_id=1730, 1 September 2010.

TNS Social Research. (2010). *Queensland Growth Management Summit 2010 Social Research on Population Growth and Liveability in South East Queensland*. Accessed at http://growthsummit.premiers.qld.gov.au/about-growth/assets/growth-summit-social-research-paper.pdf, viewed 1 September 2010.

Water Services Association of Australia and International Water Association (2010). *Outcomes from the 'Cities of the Future' workshop held at Ozwater'10 in Brisbane 9-10 March 2010*. Accessed at https://www.wsaa.asn.au/About/News/Pages/default.aspx, viewed 1 September 2010.

Wilson, G., Pamminger, F., Narangala, R., Knight, K., Tucker, S., and McGrath, J. (2005). *Stormwater for potable reuse can be part of a greenfield urban water solution: Kalkallo case study.* Publisher unknown.

APPENDIX A LEGISLATIVE AND POLICY CONTEXT

The Environmental Protection Act 1994

The *Environmental Protection Act 1994* provides for the protection of Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development). The purpose of the Act is achieved by integrating environmental values into land use planning and management of natural resources and ensuring all reasonable and practicable measures are taken to protect environmental values from all sources of environmental harm. In respect of the water cycle, the Act is primarily concerned with the quality of water resources and the management of potential environmental impacts.

The Environmental Protection (Water) Policy 2009

The *EPP Water 2009* is a subordinate piece of legislation to the *Environmental Protection Act 1994* and serves to enhance or protect the environmental values of Queensland waters. A key way this will be achieved is through local governments preparing TWCM Plans in accordance with this guideline.

Local Government TWCM Plans

Local Government TWCM Plans are a requirement of the EPP Water 2009 and are to be completed by 1 July 2012. It is essential that the detailed requirements are checked against the current version of the legalisation available at www.legislation.qld.gov.au.

The SEQ Healthy Waterways Strategy 2007–2026

The *EPP Water 2009* allows for the development and implementation of healthy waters management plans to improve water quality. In SEQ, the healthy waters management plan is the *SEQ Healthy Waterways Strategy 2007–2012* (SEQHWS). This strategy is a negotiated plan to maintain and improve the health of the waterways of South East Queensland. It contains a set of 12 integrated Action Plans that contain over 500 actions that the Queensland government, local governments and other partners have committed to undertake between 2007 and 2012. The targets in the Strategy have been incorporated into the *SEQ Natural Resource Management Plan*.

The SEQHWS provides a regional framework within which organisations, such as local governments in preparing their TWCM Plans, can develop and implement strategies to improve the health of waterways.

The SEQHWS supports the desired regional outcomes of the South East Queensland Regional Plan (SEQRP), and important actions within the SEQHWS give effect to the SEQRP's principles and policies on waterway health.

Water Act 2000

The *Water Act 2000* is primarily concerned with the sustainable use of water resources for human and environmental needs and mandates that water must be managed on a sustainable and integrated basis to provide secure and reliable water supplies at an acceptable quality for all uses.

The SEQ Water Strategy and Moreton and Mary Water Resource Plans

The SEQ Water Strategy and the Moreton and Mary Water Resource Plans and Resource Operating Plans, developed under the *Water Act 2000*, provide important regional context on integrated water management, water supply security, sustainable water allocation, and environmental flows objectives. A TWCM plan will need to be consistent with these statutory instruments. Should inconsistencies arise, say due to the different planning scale, it is incumbent on the local government to bring these to the attention of the QWC (for SEQ Water Strategy) and DERM (for Water Resource Plans) and for an agreed position to be reached before finalising the TWCM plan.

Sustainable Planning Act 2009

The *Sustainable Planning Act 2009* manages land use planning in Queensland for ecological sustainability. The purpose of the Act is achieved by managing the process by which development takes place, including: ensuring the process is accountable, effective, and efficient and delivers sustainable outcomes; and managing the effects of development on the environment including managing the use of premises. The Act provides for integrated land use and infrastructure planning to deliver least cost development sequencing at the regional and local government scales and provides for funding of trunk infrastructure through statutory state and local government instruments including state government Infrastructure Agreements and Regulated Infrastructure Charges and local government PIPs, Infrastructure Charges Schedules and development specific Infrastructure Agreements.

A Local government TWCM Plan will provide the transparent planning basis for inclusion of trunk water services infrastructure in a Local government PIP, Infrastructure Charges Schedules, and Infrastructure Agreements.

State Planning Policy 4/10 Healthy Waters

The State Planning Policy 4/10 Healthy Waters is intended to ensure that development is planned, designed, constructed, and operated to manage stormwater and wastewater in ways that protect water environmental values specified in the EPP Water 2009. The Policy sets out planning requirements and development assessment criteria for stormwater, waste water, and waterway management under the *Sustainable Planning Act 2009*. The Policy does not address potable water, water resource or groundwater management, or stormwater runoff in rural areas.

The policy will inform the objectives and targets adopted in a local government TWCM Plan for managing stormwater and wastewater to protect water environmental values for non-tidal waters.

SEQ Regional Plan 2009–2031

The SEQ Regional Plan 2009–2031 is made under subdivision 2 and part 6 of the *Sustainable Planning Act 2009*. The SEQ Regional Plan advances the purpose of the Act by providing an integrated planning policy for the region. It establishes the preferred pattern and nature of land use to meet forecast population growth in the planning region, while protecting and enhancing social, economic and environmental systems. The SEQ Regional Plan also establishes, amongst other matters, target population densities and land use intent within discrete development areas (greenfield and infill) within the planning region.

The SEQ Regional Plan sets out a Desired Regional Outcome and a range of principles, policies and programs related to the way water must be planned and managed.

A local government TWCM plan must be consistent with the planning assumptions in the SEQ Regional Plan, and with the desired regional outcome 11.

The SEQ Natural Resource Management Plan 2009–2031

The SEQ Natural Resource Management Plan 2009–2031 (SEQ NRM Plan) contains a single set of measurable targets for the condition and extent of environmental and natural resources in SEQ. The targets, which have been negotiated and endorsed by state and local governments, are designed to assist with implementing the relevant desired regional outcomes, principles and policies of the SEQ Regional Plan. For water, the SEQ NRM Plan sets targets for environmental flows, groundwater levels, groundwater quality, groundwater dependent ecosystems, High Ecological Value waterways, waterway maintenance and enhancement, and waterway restoration. The planning objectives and targets adopted in local government TWCM plans need to align with the SEQ NRM Plan.

Sub-Regional TWCM Plans (S-R TWCM Plans)

S-R TWCM Plans are a requirement of the SEQ Regional Plan and are to be prepared for greenfield urban growth areas in SEQ where significant new bulk water supply infrastructure is required. The SEQ Regional Plan tasks the QWC) with leading the preparation of S-R TWCM Plans in partnership with local governments and Water Service Providers. S-R TWCM plans will have a focus on developing water cycle solutions for water conservation, water supply augmentation and drinking water quality management outcomes.

Where a local government area includes an area where the QWC is undertaking water supply focused S-R TWCM planning, a clear agreement between the local government and the QWC should be established. It should define roles, responsibilities and the interface between S-R TWCM planning and local government TWCM planning.

Water Supply (Safety and Reliability) Act 2008

The *Water Supply (Safety and Reliability) Act 2008* provides for the safety and reliability of water supply in Queensland by regulating water and sewerage services and recycled water quality and drinking water quality for protecting human health.

Any new local recycled water scheme or new bulk water supply recommended in a local government TWCM Plan would be regulated by this Act.

Plumbing and Drainage Act 2002 and Queensland Plumbing and Wastewater Code

The Plumbing and Drainage Act 2002 (the Standard Plumbing and Drainage Regulation 2003), and the Queensland Plumbing and Wastewater Code regulate, among other matters, plumbing and drainage work and on-site sewerage work associated with implementing the acceptable alternative water sources listed in the Queensland Development Code Mandatory Parts 4.2 and 4.3.

A local government's TWCM plan will need to be cognisant of these requirements when identifying, assessing and recommending alternative water supplies.

Building Act 1975 and the Queensland Development Code

The *Building Act 1975* and the Queensland Development Code (Mandatory Parts 4.1, 4.2 and 4.3) regulate, amongst other matters, use of water efficient appliances and use of alternative water sources to comply with minimum water savings targets for new detached and attached residential dwellings and minimum connected pedestals (to be supplied by alternative water sources) for new commercial and industrial buildings. Acceptable alternative water sources listed in QDC MP 4.2 and 4.3 include rainwater collected from roofs, stormwater, greywater, and dual reticulation.

A local government's TWCM Plan will need to ensure the minimum mandatory requirements of QDC MPs 4.1, 4.2 and 4.3 are achieved.

APPENDIX B SUMMARY OF NATIONAL WATER COMMISSION KEY MESSAGES AND APPROACHES FOR DEALING WITH CLIMATE CHANGE IN WATER PLANNING

Integrated Resource Planning

The National Water Commission (NWC) is currently preparing resources to assist water planners with incorporating climate change into urban water Integrated Resource Planning. Integrated Resource Planning is a process of planning water services in such a way that ensures the efficient and sustainable management of water, energy and other resources. Demand management and water, energy, and resource conservation are central to this process.

The NWC's 'Integrated Resource Planning for Urban Water' project is being led by the Institute for Sustainable Futures (Institute for Sustainable Futures) at the University of Technology, Sydney in collaboration with NWC, Water Services Association of Australia, CSIRO, Brisbane City Council, Riverina Water County Council and Wagga Wagga City Council. The project will deliver a series of resource papers intended to inform a national water industry audience and to specifically assist urban water planners in dealing with emerging issues such as climate change in supply-demand planning.

For further details on this project please visit the NWC's website and access Integrated Urban Water Management under the Raising National Water Standards Program.

Four core messages to come from one of the project's resource paper, *Incorporating climate change into Urban Water Integrated Resource Planning* (Fane, et. al. 2010), are:

- The mitigation of green house gases (GHGs) needs to be a parallel objective to climate change adaptation in urban water supply-demand planning.
- Demand management programs that increase water use efficiency help to meet both climate change mitigation and adaptation objectives.
- The 'best estimate' of expected climate change should be included in calculations of the longer-term supply-demand balance as well as in yield estimates for new climate dependent options.
- Knowledge of climate science is evolving and there is a significant amount of uncertainty in the current knowledge. However, the uncertainty around future climate due to climate change can be managed. Management of the uncertainty can occur via either strategies aimed at decreasing vulnerability to climate change or by both decreasing vulnerability and increasing adaptive capacity of urban water systems.

Setting objectives

The NWC resource paper (Fane, et. al. 2010) suggests that objectives for climate change mitigation may include:

- accounting for GHG emissions of water demand and supply-side options and conservation measures in decision-making
- managing urban water in a manner that the GHG intensity of water service provision is minimised
- moving water utility operations towards 'carbon neutrality'.

For adaption objectives, the NWC resource paper (Fane, et. al. 2010) makes the distinction between climate change resistance and climate change resilient stances to adaption.

A climate change resistance stance focuses on reducing the vulnerability of the urban water system to the impacts of climate change.

A climate change resilient stance looks to reduce the vulnerability but also will focus on increasing adaptive capacity of urban water systems.

For adaption objectives, the paper illustrates the variations in perspectives that may be taken on climate change adaption in urban water using the diagram in Figure B-1.

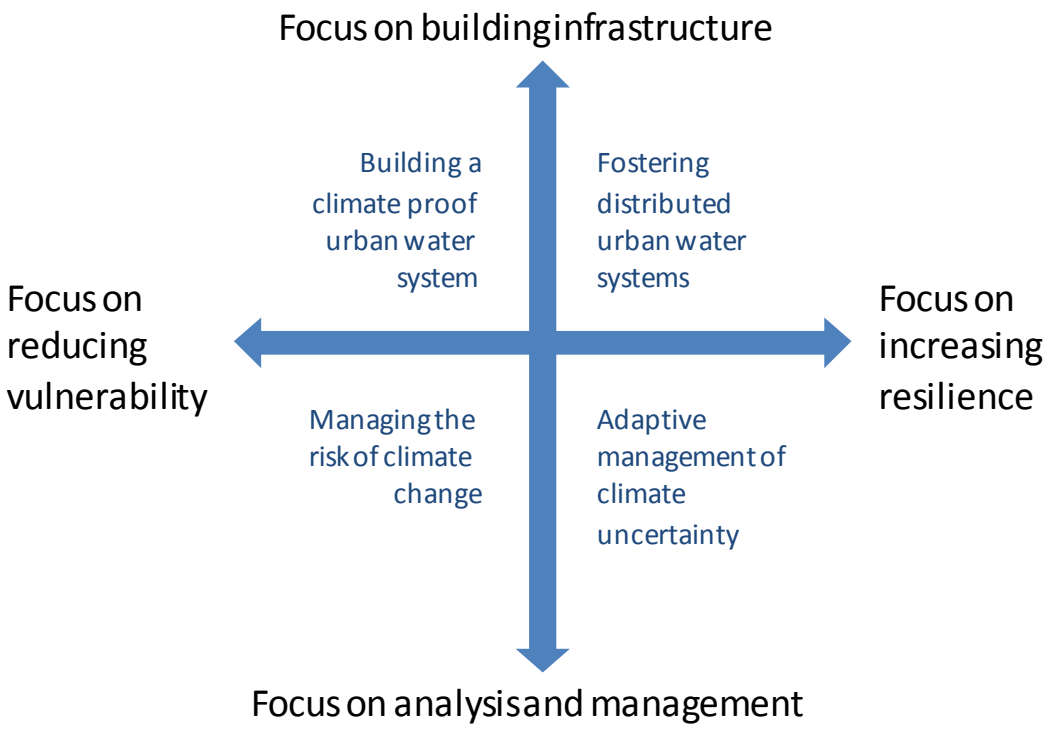


Figure B1 Differing perspectives on climate change adaption in urban water planning (Fane, et. al. 2010)

More adaptive planning

The NWC resource paper (Fane, et. al. 2010) acknowledges that even in regions where water planning is conducted with a strong climate change resistant stance the uncertainties associated with climate change mean that planning is likely to become more adaptive.

It suggests more adaptive planning approaches may include:

- adaptive management
- developing adaptive measures
- more monitoring and evaluation
- reconsidering planning periods
- better integration of short-term (drought) and long-term planning
- governance for adaptive planning.

The paper describes these approaches in more detail. A summary is provided here.

Adaptive management

Adaptive management is described as approaches that are flexible in their response to a range of possible futures, and are responsive in that they enable new understandings about uncertain conditions to feedback and determine the appropriate response. Adaptive management is identified as being valuable in regions where both the potential for climate extremes as well as the expected averages for climatic and hydrologic variables are in doubt.

Developing adaptive measures

Developing adaptive measures is described as the preplanning of measures that can be deployed as events unfold such as water restrictions.

More monitoring and evaluation

The adaptive approach to planning identifies the need for increased monitoring and evaluation of a range of parameters. In the context of climate change it is acknowledged that many water utilities have already started monitoring the energy and GHG emissions of their water supplies and demand management programs. Adaptive approaches to managing climate

uncertainties will require an ongoing monitoring of key climate and hydrological variables as well as constant monitoring of the conditions of the existing system.

Planning periods

The paper recognises the need to reconsider long-term planning periods in light of climate uncertainty. It suggests that plans that allow for changes as the future unfolds rather than looking to meet community needs projected 50 years forward will prove advantageous in the long run.

Better integration of short-term (drought) and long-term planning

The paper also recognises that adaptive management has the potential to make appropriate short-term decisions that also align with long-term supply-demand goals. For instance, a 'readiness option' that was developed as an adaptive measure for drought, once implemented, may become the new long-term supply for a given urban area.

Governance for adaptive planning

The paper identifies the likely key to the success of adaptive management approaches as being well defined and well communicated governance arrangements and public engagement in the planning and on-going management processes. It states that without and engaged public that has been part of and trusts the planning process, a climate change response based on adaptive management is likely to fail in the face of calls for new large-scale supply to 'secure' water supplies.

An engaged public that understands the issues and the uncertainties associated with climate change could potentially tolerate more regular drought response measures as they will more clearly identify with the need for their response and the effects of their action. Some of the issues involved in public participation in Integrated Resource Planning are covered in the NWC resource paper *Sustainability assessment in urban water Integrated Resource Planning* (Fane et. al. 2009).

APPENDIX C EXAMPLE TABLES FOR MULTICRITERIA ANALYSIS

Table C-1 Example of a performance matrix

Primary criteria	Secondary criteria	Units	Option 1	Option 2	Option 3
Environmental	Freshwater extraction	Ml/y	50	70	20
	Greenhouse gas emissions	kt (CO_2 eq)/year	89	104	63
Economic	Capex	$	600,000	750,000	900,000
	Opex	$/year	72,000	56,000	106,000
Technical	Design life	Year	10	13	15
	Reliability	(# out of 5)	4	3.5	3
	Ease of operation	(# out of 5)	4.5	3	2.7
Health	Risk of infection (DALY[19])	DALY	1	-1.25	4.73
Social	Acceptability	(# out of 5)	4	3.5	3
	Organisational Capacity	(# out of 5)	4.5	4	3.5

[19] DALY (Disability Adjusted Life Years) The sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability. World Health Organisation.

Table C-2 Example of Performance Matrix using Min-Max Normalisation scores

			Performance Values			Min-Max Normalisation scores		
Primary Criteria	Secondary Criteria	Units	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
Environmental	Freshwater extraction	Ml/y	50	70	20	0	40	100
	Greenhouse gas emissions	kt (CO_2 eq)/year	89	104	63	37	0	100
Economic	Capex	$	600,000	750,000	900,000	100	50	0
	Opex	$/year	72,000	56,000	106,000	68	100	0
Technical	Design life	Year	10	13	15	0	60	100
	Reliability	(# out of 5)	4	3.5	3	100	50	0
	Ease of operation	(# out of 5)	4.5	3	2.7	100	17	0
Health	Risk of infection (DALY)	DALY	1	-1.25	4.73	62	100	0
Social	Acceptability	(# out of 5)	4	3.5	3	100	50	0
	Organisational Capacity	(# out of 5)	4.5	4	3.5	100	50	0

Table C-3 Example of Performance Matrix using Ranges Normalisation scores

			Performance Values			Ranges Normalisation scores				
Primary Criteria	Secondary Criteria	Units	Option 1	Option 2	Option 3	Min Range	Max Range	Option 1	Option 2	Option 3
Environmental	Freshwater extraction	Ml/y	50	70	20	10	60	20	-20	80
	Greenhouse gas emissions	kt (CO_2 eq)/year	89	104	63	40	110	30	9	67
Economic	Capex	$	600,000	750,000	900,000	500,000	1,000,000	80	50	20
	Opex	$/year	72,000	56,000	106,000	50,000	100,000	56	88	-12
Technical	Design life	Year	10	13	15	10	20	0	30	50
	Reliability	(# out of 5)	4	3.5	3	1	5	75	63	50
	Ease of operation	(# out of 5)	4.5	3	2.7	1	5	88	50	43
Health	Risk of infection (DALY)	DALY	1	-1.25	4.73	-5	0	-20	25	-95
Social	Acceptability	(# out of 5)	4	3.5	3	1	5	75	63	50
	Organisational Capacity	(# out of 5)	4.5	4	3.5	1	5	88	75	63

Table C-4 Example of Primary, Secondary and Overall Criteria Weighting

Primary Criteria	Weighting	Secondary Criteria	Secondary Weighting	Overall Weighting
Environmental	35%	Freshwater extraction	65%	22.75%
		Greenhouse gas emissions	35%	12.25%
Economic	28%	Capex	45%	12.6%
		Opex	55%	15.4%
Technical	15%	Design life	40%	6%
		Reliability	30%	4.5%
		Ease of operation	30%	4.5%
Health	15%	Risk of infection (DALY)	100	15%
Social	7%	Acceptability	45%	3.15%
		Organisational Capacity	55%	3.85%
Total	100%			

Table C-5 Example of Min-Max and Ranges Weighted Normalised Scores and Ranking

			Weighted Min-Max Normalisation scores			Weighted Ranges Normalisation scores		
Primary Criteria	Secondary Criteria	Overall Weighting	Option 1	Option 1	Option 1	Option 1	Option 2	Option 3
Environmental	Freshwater extraction	22.75%	0.0	9.1	22.8	4.6	-4.6	18.2
	Greenhouse gas emissions	12.25%	4.5	0.0	12.3	3.7	1.1	8.2
Economic	Capex	12.6%	12.6	6.3	0.0	10.1	6.3	2.5
	Opex	15.4%	10.5	15.4	0.0	8.6	13.6	-1.8
Technical	Design life	6%	0.0	3.6	6.0	0.0	1.8	3.0
	Reliability	4.5%	4.5	2.3	0.0	3.4	2.8	2.3
	Ease of operation	4.5%	4.5	0.8	0.0	4.0	2.3	1.9
Health	Risk of infection (DALY)	15%	9.3	15.0	0.0	-3.0	3.8	-14.3
Social	Acceptability	3.15%	3.2	1.6	0.0	2.4	2.0	1.6
	Organisational Capacity	3.85%	3.9	1.9	0.0	3.4	2.9	2.4
		TOTAL	52.9	55.9	41.0	37.0	31.9	24.0
		RANKING	**2**	**1**	**3**	**1**	**2**	**3**

Table C-6 Example of Scenario Testing for Score Weightings

Environmental weighting increased over Economic weighting				
Primary Criteria	Weighting	Secondary Criteria	Secondary Weighting	Overall Weighting
Environmental	45%	Freshwater extraction	65%	29.25%
		Greenhouse gas emissions	35%	15.75%
Economic	18%	Capex	45%	8.10%
		Opex	55%	9.90%
Technical	15%	Design life	40%	6.00%
		Reliability	30%	4.50%
		Ease of operation	30%	4.50%
Health	15%	Risk of infection (DALY)	100	15.00%
Social	7%	Acceptability	45%	3.15%
		Organisational Capacity	55%	3.85%
Total	100%			

Economic weighting increased over Environmental weighting				
Primary Criteria	Weighting	Secondary Criteria	Secondary Weighting	Overall Weighting
Environmental	15%	Freshwater extraction	65%	9.75%
		Greenhouse gas emissions	35%	5.25%
Economic	48%	Capex	45%	21.60%
		Opex	55%	26.40%
Technical	15%	Design life	40%	6.00%
		Reliability	30%	4.50%
		Ease of operation	30%	4.50%
Health	15%	Risk of infection (DALY)	100	15.00%
Social	7%	Acceptability	45%	3.15%
		Organisational Capacity	55%	3.85%
Total	100%			

Table C-7 Example of Weighted Score and Ranking with an Environment criteria emphasis

			Weighted Min-Max Normalisation scores			Weighted Ranges Normalisation scores		
Primary Criteria	Secondary Criteria	Overall Weighting	Option 1	Option 1	Option 1	Option 1	Option 2	Option 3
Environmental	Freshwater extraction	29.25%	0.0	11.7	29.3	5.9	-5.9	23.4
	Greenhouse gas emissions	15.75%	5.8	0.0	15.8	4.7	1.4	10.6
Economic	Capex	8.10%	8.1	4.1	0.0	6.5	4.1	1.6
	Opex	9.90%	6.7	9.9	0.0	5.5	8.7	-1.2
Technical	Design life	6.00%	0.0	3.6	6.0	0.0	1.8	3.0
	Reliability	4.50%	4.5	2.3	0.0	3.4	2.8	2.3
	Ease of operation	4.50%	4.5	0.8	0.0	4.0	2.3	1.9
Health	Risk of infection (DALY)	15.00%	9.3	15.0	0.0	-3.0	3.8	-14.3
Social	Acceptability	3.15%	3.2	1.6	0.0	2.4	2.0	1.6
	Organisational Capacity	3.85%	3.9	1.9	0.0	3.4	2.9	2.4
		TOTAL	46.0	50.8	51.0	32.7	23.8	31.3
		RANKING	**3**	**2**	**1**	**1**	**3**	**2**

Table C-8 Example of Weighted Score and Ranking with an Economic criteria emphasis

			Weighted Min-Max Normalisation scores			Weighted Ranges Normalisation scores		
Primary Criteria	Secondary Criteria	Overall Weighting	Option 1	Option 1	Option 1	Option 1	Option 2	Option 3
Environmental	Freshwater extraction	9.75%	0.0	3.9	9.8	2.0	-2.0	7.8
	Greenhouse gas emissions	5.25%	1.9	0.0	5.3	1.6	0.5	3.5
Economic	Capex	21.60%	21.6	10.8	0.0	17.3	10.8	4.3
	Opex	26.40%	18.0	26.4	0.0	14.8	23.2	-3.2
Technical	Design life	6.00%	0.0	3.6	6.0	0.0	1.8	3.0
	Reliability	4.50%	4.5	2.3	0.0	3.4	2.8	2.3
	Ease of operation	4.50%	4.5	0.8	0.0	4.0	2.3	1.9
Health	Risk of infection (DALY)	15.00%	9.3	15.0	0.0	-3.0	3.8	-14.3
Social	Acceptability	3.15%	3.2	1.6	0.0	2.4	2.0	1.6
	Organisational Capacity	3.85%	3.9	1.9	0.0	3.4	2.9	2.4
		TOTAL	66.8	66.2	21.0	45.7	48.1	9.4
		RANKING	**1**	**2**	**3**	**2**	**1**	**3**

Table C-9 Example of Summary of Ranking Sensitivity Testing

	Weighted Min-Max Normalisation RANKING			Weighted Ranges Normalisation RANKING		
Overall Weighting	Option 1	Option 1	Option 1	Option 1	Option 2	Option 3
Environmental criteria emphasis	3	2	1	1	3	2
Base line	2	1	3	1	2	3
Economic criteria emphasis	1	2	3	2	1	3