Draft report

Secondary water use in the ACT

Report 3 of 2012
May 2012

The Independent Competition and Regulatory Commission (the Commission) was established by the *Independent Competition and Regulatory Commission Act 1997* (ICRC Act) to determine prices for regulated industries, advise government about industry matters, advise on access to infrastructure, and determine access disputes. The Commission also has responsibilities under the ICRC Act for determining competitive neutrality complaints and providing advice about other government-regulated activities. Under the *Utilities Act 2000*, the Commission has responsibility for licensing utility services and ensuring compliance with licence conditions.

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Foreword

This report deals with the use of secondary water in the ACT. This takes a number of forms at different scales involving both public and private provision. In all cases the aim is to provide an alternative to using water supplied through the mains water reticulation system owned and operated by ACTEW. Much of this report is, therefore, taken up with assessing the cost, both community and private, of substituting secondary for primary water.

The first, unsurprising but nevertheless important, conclusion is that the comparative cost of primary and secondary water depends on the plentifulness of primary water. When primary water is plentiful, no secondary source delivers water as cheaply. Following the rains of the last two years, the very substantial investment in improving the primary water system and the sizable reduction in per capita consumption, primary water is plentiful at the moment and is likely to remain so for some time. Hence there is no immediate requirement for investment in alternative, secondary water sources.

While this is a pleasant situation to be in, it would be foolish to imagine that it will persist indefinitely. Dorothea Mackellar’s characterisation of Australia as a country ‘of droughts and flooding rains’ is, if anything, truer today than when she wrote that famous line. Managing Canberra’s water security remains one of the most important challenges confronting the community of the Territory.

This report takes some first, but useful, steps towards formulating a response to that challenge that will enable us to make our community, and each member of it, water secure at an acceptable social, environmental and economic cost.

Malcolm Gray

Senior Commissioner

14 May 2012

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How to make a submission

The Independent Competition and Regulatory Commission (the Commission) welcomes submissions on the draft report as well as any other relevant information that could assist the Commission's inquiry into secondary water use in the ACT. Responses to the draft report should be supported with evidence and data wherever possible.

Submissions may be mailed to the Commission at:

Independent Competition and Regulatory Commission
PO Box 161
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Alternatively, submissions may be emailed to the Commission at icrc@act.gov.au. The Commission encourages interested parties to make submissions in either Microsoft Word format or PDF (OCR readable text format—that is, they should be direct conversions from the word-processing program, rather than scanned copies in which the text cannot be searched.)

Submit your submission documents along with a completed submission cover sheet, which is available on the Commission's website at www.icrc.act.gov.au/waterandsewerage#Inquiry_into_Secondary_Water_Use. For submissions received from individuals, all personal details (for example home and email address, phone and fax number) will be removed for privacy reasons before the submission is published on the website.

The Commission is guided by and believes strongly in the principles of openness, transparency, consistency and accountability. Public consultation is a crucial element of the Commission's processes. It is the Commission's preference that all submissions it receives be treated as public and be published on the Commission's website unless the author of the submission indicates clearly that all or part of the submission is confidential and not to be made available publicly. Where confidential material is claimed, the Commission prefers that this be under a separate cover and clearly marked 'In Confidence'. The Commission will assess the author's claim and discuss appropriate steps to ensure that confidential material is protected while maintaining the principles of openness, transparency, consistency and accountability.

The secretariat may be contacted at the above addresses, by telephone on (02) 6205 0799, or by fax on (02) 6207 5887. The Commission's website is at www.icrc.act.gov.au.

Submissions on the draft report are due with the Commission by **5 pm, Tuesday 12 June 2012**.

Executive summary

The Treasurer issued a reference for the ICRC to inquire into secondary water use in the Territory on 21 September 2011. The terms of reference directed the Commission to consider the opportunity for secondary water development in the Territory including stormwater harvesting programs.

The Commission adopted a broad definition of secondary water sources. Our assessment took account of the Government's water security objective, the ACT's *Think water, act water* strategy and related water sensitive urban design policies. The Commission notes the important role water security has in supporting the social and environmental amenity of the Territory. The Commission's analysis and recommendations address the most cost-effective means of supporting the social and environmental amenity of the Territory and the respective roles of secondary and primary water sources in meeting the Territory's water security objective.

In the course of addressing the inquiry terms of reference, and in response to submissions and discussions with a range of stakeholders, the Commission has made a number of draft findings and recommendations in the body of the report. For ease of reference, the full list is presented below following a discussion of the key findings and recommendations.

Public secondary water investments

The primary water system will, for the foreseeable future, remain the ACT's main source of supply. It is likely that further additions to the primary system will be required over the longer term as the ACT population grows. By supplementing supply, secondary water can potentially postpone further investments in augmenting the primary supply. Secondary water options can therefore be valued in terms of their potential to postpone such investments.

Based on results from the ActewAGL water supply and demand model, the ACT is likely to be water secure for the next 20 years. Existing dams are full and the completion of the enlarged Cotter Dam will increase current ACT dam capacity by more than a third. The ACT is unlikely to face any water restrictions in the near term, and restrictions are only likely to be imposed on rare occasions over the medium term.

Because of this level of security, there is little immediate value to the ACT community in investing in additional public secondary water initiatives. When ACT dams are full, as at present, the value of an extra kilolitre of primary water saved by using secondary water is the cost of treating the primary water and reticulating it to end-users, an estimated cost saving of $0.30/kL. This is much lower than the cost of providing water from any significant public secondary water option canvassed in the inquiry. Moreover, the value of secondary water in postponing the next primary water augmentation is also low as this investment is far distant.

Consequently, the Commission's recommends that further public secondary water investments should not be undertaken now.

Canberra Integrated Urban Waterways Project

The Commission recommends that the Canberra Integrated Urban Waterways Project be restricted to trialling the Inner North pilot stormwater project that is currently under construction. Subject to a well-designed monitoring and evaluation program, with clear and measureable criteria on which to gauge the viability of the Inner North pilot, the trial could produce valuable data to inform future decisions about stormwater as a potential source of secondary water.

Private secondary water investment decisions and government intervention

While household decisions to invest in private secondary water options are largely a matter of individual choice, only simple greywater diversions and pumping systems and unplumbed rainwater tanks are cost competitive with primary water at the ACTEW upper tier price. Given the current level of water security, the positive externalities in promoting private secondary water use are likely to be small. Consequently the Commission found no solid basis for government subsidising private secondary water options.

Similarly, in relation to the Waterways Water Sensitive Urban Design General Code (WSUD Code) mandatory water efficiency requirements placed on estate developers, it is not evident that the costs of government intervention are outweighed by the benefits. The Commission recommends that the ACT Government review these requirements within the context of an adaptive and integrated planning framework.

The Commission identified a number of areas where additional government intervention could potentially facilitate the uptake of private secondary water options. The Commission recommends the ACT Government introduce a residential greywater accreditation system, develop a clear approval pathway for multi-dwelling secondary water schemes, and develop an ACT third-party water infrastructure access regime.

A new adaptive and integrated approach to water supply and demand planning

In valuing public secondary water options in terms of their contribution to postponing additional investments in the ACT primary water supply system, the Commission examined the recent history of water supply and demand planning decisions in the ACT.

Making good decisions in the face of evolving uncertainty and the wide range of potential supply and demand options requires an adaptive and integrated analytical framework, supported by clear lines of accountability and responsibility. The Commission found no such framework in the ACT, but rather an unclear, disjointed and unresponsive approach to decision-making.

In the interests of ensuring a more effective approach to maintaining the ACT's urban water supply and demand balance at least cost, the Commission presents an example of an adaptive, integrated single analytical framework for consideration by the ACT Government. The framework, based on existing institutions, sets out a decision-making process that is responsive to changing circumstances and considers all potential options and the interaction between them on the ACT water system as a whole.

Draft findings and recommendations

Draft finding 4.1

The ACT is likely to be water secure for at least the next 20 years with existing primary water infrastructure when measured against the ACT Government's water security objective.

Draft recommendation 4.1

Given the current water security outlook, the ACT Government should not undertake further secondary water investments now. However, the Inner North pilot stormwater reticulation trial needs to be fully evaluated.

Draft finding 5.1

The ACT community's current water needs can most cost-effectively be met through the ACTEW primary water supply network.

Draft recommendation 6.1

The Commission recommends that the ACT Government consider the provision of water use efficiency rebates and subsidies within the context of an integrated and adaptive planning framework to better assess which options are likely to deliver value to the ACT community.

Draft recommendation 6.2

The Commission recommends that the ACT Government develop and maintain a residential greywater treatment system accreditation approach, such as that operating in New South Wales.

Draft recommendation 6.3

The Commission recommends that the ACT Government undertake a detailed analysis of its Waterways Water Sensitive Urban Design General Code (WSUD Code) planning requirements. The analysis should include the merit of the code's mandatory water efficiency requirements within the context of an integrated and adaptive planning framework, including flow-on impacts on the ACT housing market.

Draft recommendation 6.4

The Commission recommends that, if the ACT Government determines that there is value in retaining mandatory water efficiency obligations on developers in the WSUD Code, the government should:

- ensure that TAMSD is explicitly funded for the ongoing maintenance and operational costs of the infrastructure for which it becomes responsible as a result of the code
- review the operation of planning approval processes to ensure that code requirements are explicitly provided for in the development approval process and that this documentation is provided when new leases are established in an integrated development, to ensure that water assets can be operated in an efficient and effective manner.

Draft recommendation 6.5

The Commission recommends that the ACT Government develop a clear approval pathway for private sector multi-dwelling secondary water schemes, such as third pipe, stormwater harvesting and greywater schemes.

Draft recommendation 6.6

The Commission recommends that the ACT Government begin the development of a clearly defined third-party water infrastructure access regime.

Draft finding 7.1

The Commission finds that:

- under a net Murray–Darling Basin (MDB) Agreement cap or net sustainable diversion limit (SDL), as long as a secondary water initiative directly substitutes for primary water use, it will not hasten the net cap or SDL being reached
- the key difference between the current MDB Agreement cap and ACT SDL proposal under the Basin Plan is that the latter will not provide an ongoing population growth factor
- given the ability to increase the ACT SDL by trading water, the absence of a provision for population growth in the draft Basin Plan will have limited implications for ACT primary or secondary water use.

Draft recommendation 7.1

The Commission recommends that the utility that will own and operate the CIUWP pilot stormwater reticulation networks be licensed under the Utilities Act.

Draft recommendation 7.2

The Commission recommends that the ACT Government include an assessment of the following in the monitoring and evaluation trial phase of the Canberra Integrated Urban Waterways Project:

- technical—volumetric reliability of stormwater ponds under different weather and irrigation demand conditions, service reliability in relation to quality of water provided to end-users
- environmental—impact of stormwater harvesting on the pond environment and reducing nutrient loads downstream, filtrate management plan
- commercial—actual costs to operate and maintain the pilot network by the utility, including administration costs, water demand and supply volumes under different weather conditions
- compliance—compliance with utility licensing conditions.

The ACT Government should also prepare a detailed monitoring and evaluation program workplan and budget, and ensure that there are clear and measurable criteria by which to gauge the viability of the pilot.

Draft recommendation 7.3

The Commission recommends that the ACT Government limit the CIUWP to the Inner North pilot stormwater reticulation network.

The Commission is seeking comment on the draft report and the draft findings and recommendations in particular. The draft report provides an opportunity for all interested parties to inform the final report. It will also ensure that relevant information and views are made public and brought to the Commission's attention.

Glossary

To ensure consistency in the interpretation of the water-related terms used in this paper, definitions are provided below. These definitions are derived from those commonly used in the water sector by a range of key stakeholders, including, but not limited to, water technical specialists, policy makers, and water-related institutions such as the National Water Commission and the Murray–Darling Basin Authority.[1]

Black water is water containing human excrement.

Cost-effectiveness analysis is a method used to identify the option that achieves a target outcome at least cost, or maximises an outcome measure subject to a cost constraint.

Effluent is treated sewage that flows out of a treatment plant.

Environmental flows are intended to compensate for changed river flow patterns as result of dams and water removed from rivers for consumption purposes. The ACT Environmental Flow Guidelines require water to be released from dams or protected from abstraction at certain times to allow rivers to function normally.

Greywater is water from bathrooms (excluding black water), laundries and kitchens.

Levelised cost is a common **cost-effectiveness analysis** assessment tool used for least-cost planning purposes. It is usually calculated as the **present value** of the cost of an initiative divided by the present value of the water supplied (or saved in the case of demand-management measures).

Non-potable water is water other than **potable water**.

Permanent water conservation measures in the ACT impose water efficiency requirements on ACTEW water customers without unduly restricting water consumption. These measures differ from **temporary water restrictions** in that they are intended to permanently reduce the use of **primary water**.

Potable water is water suitable for human consumption (alternatively termed drinking water) as defined by standards established by the National Health and Medical Research Council.

Present value is the present worth of a future sum of money or stream of cash flows. It is calculated by discounting the future sum or stream of cash flows by a specified discount rate.

Primary water is potable water provided through the ACTEW reticulated water supply network.

Rainwater is water collected directly from roof run-off.

Recycled water—see **secondary water**.

Reticulation is distribution through a network of pipes used to transport water to the point where it is consumed.

[1] An online water dictionary is available from the National Water Commission (NWC 2012).

Return flow is the return of treated sewage effluent to the river system for use by other downstream users.

Secondary water is water provided from any source other than the ACT's primary water source, ACTEW's primary water network. It includes water sourced from wastewater (such as treated effluent from a water treatment plant or sewer mining scheme and greywater from bathrooms and laundries), stormwater and rainwater.

Sewage—see **wastewater**.

A **sewer** is an artificial conduit, usually underground, for carrying off wastewater and refuse, as from a town or city.

A **sewerage network** is a network of **sewers** usually connected to a treatment plant.

Sewer mining is the process of tapping into a sewer before it reaches a water treatment plant and extracting the sewage for treatment in a separate treatment facility for use as recycled water.

Stormwater is water run-off in urban environments arising from rainfall, which may be collected for flood mitigation and water quality purposes, and/or stormwater harvesting.

Temporary water restrictions in the ACT are currently applied through a four-stage scheme of progressively higher levels of restrictions based on the scarcity of water. The restrictions are applied as a temporary measure in times of acute water shortage.

Third pipe residential systems bring treated wastewater back to households through an additional pipe for non-drinking purposes such as garden watering and toilet flushing.

Wastewater (or **sewage**) is industrial, residential and agricultural waste material collected from internal building drains and transported through the **sewerage network** for treatment before being discharged to the river system as return flows.

Xeriscape landscaping is landscaping or gardening that reduces or removes the need for irrigation and often includes a reduction in grassed areas and the planting of native or exotic drought-tolerant plants.

1 Introduction

The Independent Competition and Regulatory Commission (the Commission) is undertaking an inquiry into secondary water use in the ACT in response to a reference received from the Treasurer. The secondary water use inquiry is scheduled for completion by the end of June 2012.

The Commission released an inquiry issues paper and a broader context paper on water in the ACT on 23 November 2011.[2] The context paper provides a framework for the inquiry and the Commission's separate but related water and sewerage service review which will determine the prices that ACTEW Corporation (ACTEW) will be able to charge for its water and wastewater services from 1 July 2013.

The draft report is the second step in the Commission's engagement with the ACT community on the inquiry.

1.1 Terms of reference

The Commission was issued with terms of reference by the Treasurer on 21 September 2011 to undertake an inquiry into and assessment of secondary water uses in the ACT. The inquiry is to be undertaken pursuant to sections 15(1) and 16 of the *Independent Competition and Regulatory Commission Act 1997*. In addition to calling for an inquiry into and an assessment of secondary water uses, the terms of reference contain the following specific requirements:[3]

1) The Commission is to report on the following matters:
   a) opportunities for a commercial market in grey water in both commercial and domestic applications and in new construction and retro-fits
   b) the ACT Government's urban waterways, stormwater harvesting programs and associated built wetlands
2) The Commission is to include consideration of:
   a) the economic, environmental and social costs and benefits of the matters set out in 1(a) and (b), with and without the Basin Plan, to the extent possible given that the Basin Plan is under development.

1.2 Inquiry consultation process

The issues paper released by the Commission in November 2011 invited stakeholders to comment on a range of issues related to the inquiry, including the Commission's proposed approach.

A total of nine written submissions were received in response to the issues paper and are published on the Commission's website. A list of submissions received and key issues raised is provided in Appendix B.

The Commission also had a number of meetings with key stakeholders. A list of meetings is detailed in Appendix C. The submissions and meetings have informed the draft findings and recommendations in the draft report.

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[2] ICRC (2011a); ICRC (2011b). The issues and context papers are publicly available on the Commission's website at www.icrc.act.gov.au.

[3] The full terms of reference are reproduced in Appendix A.

The draft report continues the public consultation process that commenced with the release of the issues paper. The Commission welcomes submissions on the draft report as well as any other relevant information that could assist and inform the development of the final report to the Treasurer. Submissions on the draft report are due by **5 pm, Tuesday 12 June 2012**.

The Commission may, if required, hold a public forum before presenting the final report to the Treasurer.

1.3 Inquiry timeline

The Commission proposes the following timeline for the inquiry in order to meet the requirement to report to the Treasurer by the end of June 2012.

Task	Expected date
Release of context paper	23 November 2011
Release of issues paper	23 November 2011
Release of draft report	14 May 2012
Submissions on draft report close	12 June 2012
Final report presented to the Treasurer	30 June 2012

2 Inquiry framework and approach

This chapter provides an introduction to the issues that the inquiry needs to cover in order to respond to the terms of reference. The reference requires an assessment of secondary water uses in the ACT. Commentary on the value to the community of the use of secondary water in the ACT is fundamental to any such assessment. This chapter is, therefore, chiefly concerned with providing a basic framework within which that value can be appraised and the required commentary developed.

For the foreseeable future, any use of secondary water will take place against the background of continuing use of the existing primary water system, ACTEW's reticulated mains water network. The first section of this chapter provides a highly simplified picture of the functioning of that system.[4] That picture enables us to identify the ways in which the primary system could be augmented or used more effectively. These are described in the second section.

Secondary water options form a subset of possible augmentations, which are examined in more detail in the third section. The fourth section provides an introduction to the issues that arise in valuing secondary water options. The final section describes the approach the inquiry applies to the issues that have been identified as relevant to addressing the terms of reference.

2.1 The ACT primary water system

Figure 2.1 is a simplified diagrammatic representation of the ACT primary water system. The system of dams and water treatment plants along with their network of pipes and pumping stations are depicted as the large bucket on the left. Water flows into this bucket from the Cotter and Queanbeyan river catchments serving the ACT's dams. Water flows out of the bucket to serve the needs of water users and meet environmental flow requirements.[5] Water used in a range of domestic and industrial applications generates a stream of wastewater, which is processed through the ACT's water treatment facilities before being returned to the river system downstream of the city. Some water is lost from evaporation and transpiration largely associated with outdoor water use.

Water inflow from the catchments is determined by climatic conditions and the state of the catchments. While precipitation is the principal driver of dam inflow, it can also be affected by temperature and the state of the vegetation in the catchment. For example, the 2003 Canberra bush fires have had a major and continuing impact on the capacity of the affected catchments to translate rainfall into dam inflow.[6]

The extent of outflow from the bucket is largely determined by the demand for water by the ACT community. The volume of water demanded is affected by a wide range of variables, including population growth, efficiency of water use and the price of water.[7]

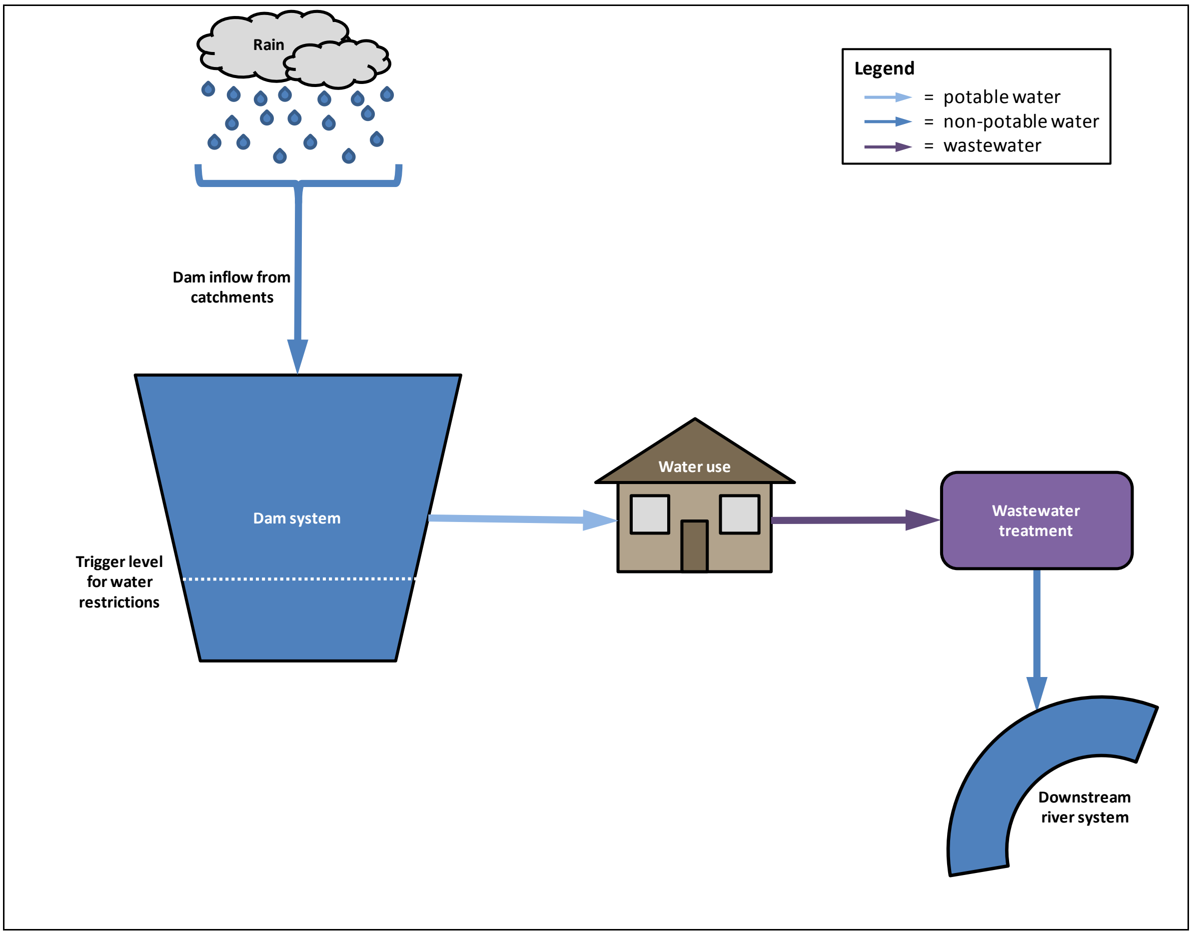
[4] A more detailed description is provided in chapter 4 of the context paper (ICRC 2011a).

[5] For illustration purposes, environmental flow requirements have been included in general urban water use.

[6] These matters are discussed in more detail in section 4.2.

[7] These matters are discussed in more detail in section 4.2.

Figure 2.1: ACT primary water system



The function of the dam system, represented by the bucket, is to provide a buffer between the availability of water from nature and its use by the ACT community: collecting water when nature provides it and making it available to users as they need it. Nature tends to make water available in intermittent concentrated bursts, while water use is more regular and even. The principal function of the dam system is to ensure that water is available to users as they require it. This obviously means that water must be stored and that storage must be large enough to bridge periods when water use exceeds dam inflow. Ensuring that water is available across a wide variety of patterns of dam inflow is usually described as providing water security. The challenge of providing water security is managing the lack of synchronisation between the two.

Average dam inflow generally comfortably exceeds average water demand.[8] When, as now, the bucket is full, the ACT is well placed to maintain water security through a period of drought. If, however, such a drought became extended, the level of water in the bucket would fall, and the capacity of the bucket to continue to provide water security through a further period of drought would be diminished. As the water level in the bucket falls, concern about water security naturally increases. In the ACT, temporary restrictions on water use are progressively introduced as that

[8] Over the last 20 years, combined dam inflows have averaged 148 gigalitres per annum (GL/a) compared to about 57 GL/a average demand.

concern rises beyond a critical level. In figure 2.1 the dotted line in the bucket represents the level that would trigger the introduction of water restrictions.[9]

Water restrictions reduce community welfare. The higher and therefore more restrictive the level of water restrictions and the longer they persist, the greater the loss in welfare that the community suffers. Examples include costs to household as their gardens lose amenity value due to inadequate watering or community recreation costs associated with sports field being closed due to poor grass condition.

While the community would, therefore, prefer to avoid the imposition of water restrictions, it would take an impractically large bucket to ensure that there was always enough water to satisfy the community's demand regardless of the pattern of dam inflows. If the community wishes to manage its water resources rationally and effectively, it needs a mechanism to determine the level of water security it aims to achieve. The ACT Government has announced an objective of ensuring that water restrictions occur in no more than one year in 20. This has commonly been re-expressed by saying that there should be no more than a 5% chance of water restrictions being imposed in any given year.[10]

If the level of water security falls below the target level, the question naturally arises as to what methods are available to restore water security to a satisfactory level. The next section catalogues the options available.

2.2 Augmenting the primary water system

Figure 2.1 suggests four ways of augmenting the primary water system to increase the level of water security:

- provide more inflow to the bucket[11]
- make the bucket bigger
- reduce the demand for water, and/or
- provide alternatives to the primary bucket as sources of water.

Beyond instituting sound catchment management practices, little can be done to increase the volume of dam inflow from the Cotter and Queanbeyan river catchments. The introduction of water trading in Australia, however, opens the possibility of buying water sourced from another catchment. Through ACTEW, the ACT has begun to take up this option, buying rights to some of the water in the NSW portion of the lower Murrumbidgee River and storing this water behind the Tantangara Dam in Kosciuszko National Park on the upper Murrumbidgee. When this option is triggered, water intended for use by the ACT would be released from Tantangara, and flow down the Murrumbidgee River to Angle Crossing. From there it would be pumped through a specially constructed pipeline to Burra Creek which flows into the Queanbeyan River and thence to the Googong reservoir.[12]

[9] Figures 3.1 and 3.2 in section 3.1 show the recent history of rainfall, dam inflow, dam levels and temporary water restrictions in the ACT.

[10] The precise interpretation to be given to the 1 in 20 objective is not immediately obvious, as discussed in section 4.2.

[11] To contribute to water security, such inflow clearly needs to occur when the bucket is not full; otherwise, it simply adds to the flow down the spillway and back into the river system.

[12] For a more detailed discussion of these arrangements, see ACTEW (2012d).

The effective size of the bucket can be increased by building more dams, enlarging existing dams or making more effective use of existing dams. The last dam to be built for the ACT was Googong in 1979. While other new dam proposals have been considered since, none have proceeded.[13] The current construction of a new dam wall below the existing Cotter Dam will take the capacity of that reservoir from about 4 GL to about 78 GL. The Cotter to Googong Bulk Transfer project, which began operating in 2005–06, aims to make more effective use of the existing dams by transferring water from the relatively higher yielding Cotter catchment to the Googong Dam in the relatively lower yielding Queanbeyan River catchment.

Demand for water can be reduced without imposing the costs associated with water restrictions on the community by increasing the efficiency of water use—that is, by extracting the same value in use out of a lower volume of water. Examples include installation of appliances such as dishwashers and washing machines with enhanced water efficiency and using more drought-tolerant plants in gardens.

The final way of augmenting the primary water bucket is to look for additional sources of water supply within the urban area. To distinguish them, such sources are grouped under the label secondary water. Since secondary water is the principal focus of the terms of reference for this inquiry, this option is presented in more detail in the following section.

2.3 Secondary water options

Options for securing a secondary water supply fall into two categories:

- additional ways of harvesting and storing precipitation
- recovering or recycling water for reuse from wastewater.

At the outset it is important to note that, although all water provided to users through the ACT's primary water system is potable, in many cases water provided from secondary sources is not.[14] Although non-potable secondary water can usually be made potable by further treatment, it may not be worth the cost of doing so as there are many applications for non-potable water in the ACT, particularly in irrigation.

Additional water harvesting can take place at the level of the individual household or as a project, public or private, across a number of households. Many Canberra households have rainwater tanks that store water that would otherwise be discharged through the stormwater drainage system. Such water can be used in the home, for example, in the bathroom or laundry, or for watering the garden.[15]

Water can also be collected from the stormwater system, stored in ponds and urban lakes, and made available for subsequent use. Without further treatment, this water is non-potable and is used primarily for irrigation, such as watering sports fields.

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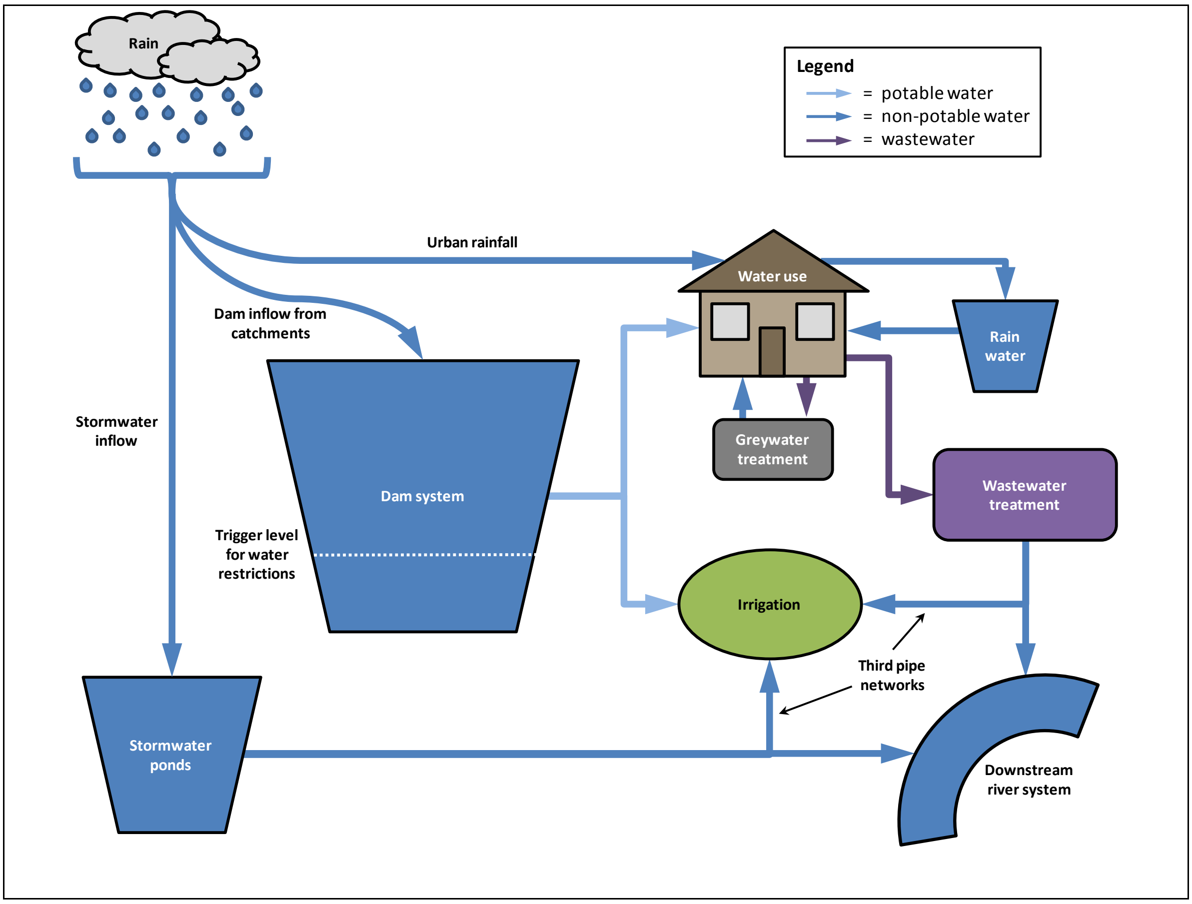
[13] A proposal for a dam on the Gudgenby River near Mount Tennent was considered as part of the Future Water Options review in 2005. See ACTEW (2005a) for more detail.

[14] To supply non-potable water from the ACT's dams would require the construction of a second reticulation network to carry the non-potable water to end-users. The cost of constructing such a network would be high and the cost of rendering dam water potable is relatively low; hence, the construction of such a pipeline has not been seen as economically justified.

[15] This activity is discussed in more detail in section 3.2.2.2.

Such a stormwater harvesting network is shown as the second bucket in figure 2.2. In taking up this option, it is necessary to identify uses for non-potable water and provide the necessary pipe and pump network to transport the water from the storage facility to the end-user. Such a network is often referred to as a third pipe network.[16] In figure 2.2, water uses have been partitioned into those that require potable water and those that do not. Secondary water is shown as supplying the latter while primary water continues to supply both.[17]

Figure 2.2: Secondary water initiatives



Recovering or recycling water can also take place at the individual household level or across households. At the household level, it usually involves using lightly polluted water from, for example, the kitchen sink or the laundry for watering the garden. Such lightly polluted water is termed greywater, and systems that allow its use in this way are called greywater systems.[18]

While it would be possible technically to devise a scheme that collected greywater from a number of households, stored it in a central facility and made it available to a group of households for use in the way described above, the Commission is not aware of any such scheme currently operating in the ACT. Issues related to multi-dwelling secondary water schemes are discussed further in section 6.3.2.

Water recycling can also occur either by extracting water from or as an integral part of the wastewater treatment system. The former is often called sewer mining. The Commission does not

[16] The other two pipes are the primary water reticulation network and the sewerage system.

[17] More detail on projects in the ACT is provided in section 3.2.

[18] This activity is discussed in more detail in section 3.2.2.1.

know of any currently operating sewer mining projects, but the recently decommissioned Southwell Park Sewer Mining Project is discussed in section 3.2.1.1. The Lower Molonglo Water Quality Control Centre (LMWQCC), although serving the primary function of treating the ACT's wastewater before it is returned to the Molonglo River, can and does supply recycled water for non-potable uses.[19] Although the possibility of supplementary processing of the LMWQCC output for potable water purposes has been raised previously, it encountered difficulties in gaining community acceptance and is not further discussed in this report.[20]

A water recycling system is shown as an addition to the wastewater treatment system in figure 2.2, with the treated water used for irrigation purposes. As with harvested stormwater, recycled water needs to be transported from its source to end-users.

These two secondary water options contribute to water security in significantly different ways. As can be seen in figure 2.2, harvesting stormwater draws its supply from the same source as the primary water system (natural precipitation), whereas recycling draws its supply from wastewater. Although there are differences in the ways precipitation is converted to inflow between the primary and stormwater harvesting systems, they are clearly subject to similar influences. Low precipitation means low inflow to both systems.

While the production of wastewater will be related to the volume of water used, only when water restrictions are in force can any association between primary system inflow and water use be expected. Recycling water is, in effect, an increase in the efficiency of water use and has a similar impact on water security. In contrast, additional harvesting is analogous to building a small addition to the dam system.

2.4 Valuing secondary water options

Since even the most ambitious of the secondary water projects that have been canvassed would only make a relatively modest contribution to meeting total water demand, the primary water system will, for the foreseeable future, remain the ACT's main source of supply. It is anticipated that further additions to the primary water system will be required as the population of the ACT increases.[21]

Investments in the primary water system tend to be large and difficult to break up into smaller projects. For example, it is neither practical nor economical to raise the height of a dam wall at the rate of a metre per year to ensure a continuous close match between desired and actual dam capacity. Because of their scale and complexity, investments in the primary water system also have long lead times. Therefore, a decision to proceed with an investment needs to be made well in advance of the date on which it is desired to make use of the facilities provided. Such investments tend also to be long lived, and many of the benefits they provide will accrue to future generations. It is generally thought equitable that those who benefit from an investment should pay for it. Although it is possible to defer payment by borrowing to meet the immediate cost, such deferral comes at the cost of the interest that must be paid on the borrowing, the costs of which can become substantial for an extended deferral.

[19] This and the smaller schemes also operated by ACTEW are described in section 3.2.1.1.

[20] In 2007 ACTEW canvassed its Water2WATER proposal involving purifying Canberra's used water and adding this to the Cotter Dam.

[21] The projections of future water demand underpinning this conclusion are described in chapter 4.

Hence, it is desirable that investments in the primary water system take place close to the time at which they will be needed to maintain the desired level of water security. These characteristics of the primary water system argue for investments in it to be decided in the framework of a long-term plan. Accordingly, the Commission proposes that decisions about investments in the primary water system be made on the basis of a rolling assessment of the capacity of the water system as a whole to provide the level of water security required.[22]

By supplementing supply, take-up of secondary water options can potentially postpone the requirement to make further investments in the primary water system.[23] By providing a sequence of such postponements, take-up of secondary water options can potentially provide an overall water system that meets the required level of water security but has a smaller primary water system at every point in time than would be required without the take-up of the secondary water options.

The value of an extra kilolitre of secondary water depends on the level of the primary water bucket.

If, as is currently the case, the bucket is full, providing an extra kilolitre of secondary water simply causes an extra kilolitre of water to flow over the spillways of the dams in the primary water system. The only saving from the provision of the extra kilolitre of secondary water is the cost of treating a kilolitre of dam water to render it potable and transporting it through the primary reticulation system to users. This cost saving is very small and would need to be considered against the cost of providing secondary water.[24]

If the bucket is not full but significantly above the level that would trigger the imposition of water restrictions, the provision of an extra kilolitre of secondary water means that one less kilolitre of water needs to be taken from the bucket to satisfy the demand for water. This kilolitre of water remains available for future use, thereby making a contribution to water security in the future. Depending on future circumstances, the contribution to water security may be more or less valuable. For example, if the time at which an investment in the primary water system is due is very close, provision of the extra kilolitre of secondary water could give rise to the postponement of that investment, yielding immediate value. Alternatively, if the time at which such an investment is due is far distant, any postponement achieved is also in the far future and thus of lower current value.

Finally, if the level in the bucket is close to the trigger level, providing an extra kilolitre of secondary water may postpone or prevent the imposition of water restrictions and therefore be of significant immediate value.

This last example points to a different role that secondary water options might play. For the reasons given above, the primary water system does not have great short-term flexibility in responding to periods of unusual climate such as a prolonged drought.[25] Even though they may be assessed as unlikely, the severity of the consequences of a prolonged drought should it occur make

[22] Mechanisms that might achieve such a rolling assessment of the primary water supply and demand balance while integrating decisions about secondary water options are discussed in chapter 8.

[23] This assumes that demand is independent of the source of the water—that is, that users will not, for example, use more recycled water because it is believed to have a lower impact on the environment than using primary water. Presumably, the extent of any such offset to the general reduction in demand for primary water would be small.

[24] The work reported in chapter 5 estimates this cost at about $0.30/kL.

[25] One of the advantages of the water trading option discussed above is that it does provide some short-term flexibility in the primary water system.

it desirable to formulate a strategy to deal with such a situation.[26] It is worth considering whether secondary water options have the sort of characteristics that would make them a useful part of such a strategy.

In looking at projects that provide, perhaps uncertain, future flows of secondary water, all these potential ways in which such projects may deliver benefits to the community should be examined.

2.5 Inquiry approach

In the inquiry, secondary water options have been separated from other options to increase water security and, consonant with the terms of reference, given priority in the discussion. The inquiry treats public provision, through government or an agency of or corporation owned by government, separately from private provision, either individual or corporate. The Commission takes the view that public provision needs careful evaluation using the yardstick of community benefit, whereas decisions about private provision are a matter for those meeting the cost or putting their capital at risk. Only in cases where it is suspected that there may be a market failure may there be a case for intervention by government in the making of such private decisions. Market failures relevant to the current inquiry include risks to public health, existence of externalities—for example, whether the community benefits of an individual installing a rainwater tank exceed the benefits to the individual—and the consequences of monopoly control of infrastructure, which is uneconomic to duplicate.

In chapter 3, the inquiry begins its analysis of the issues outlined above by providing context through a brief review of the history of the primary water system and the use and regulation of secondary water in the ACT.

Chapter 4 provides an analysis of the performance of the ACT water system under various assumptions about population and demand growth, with and without the take-up of various secondary water options, against the objective of providing the level of water security nominated by the ACT Government. It concludes by assessing the likely water security benefits of taking up secondary water options now.

Chapter 5 undertakes a cost-effectiveness analysis and considers the broader economic, social and environmental costs and benefits of various public community-scale secondary water options in comparison to the primary water system, from a community-benefit perspective.

Chapter 6 presents a financial analysis of various private household-level secondary water initiatives, with an assessment of the impact of government intervention, such as subsidies and regulatory arrangements, on decisions to invest in them.

Chapter 7 discusses a number of outstanding matters arising from the inquiry and terms of reference.

The analysis undertaken for the purposes of this inquiry has clear implications for the ongoing management of the water system of the ACT. These are presented in chapter 8.

For ease of reference, box 2.1 describes a typology of the typical sources of secondary water, with relevant ACT examples. The typology differentiates public and private secondary water initiatives.

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[26] The discussion of mechanisms for managing the water supply and demand balance in chapter 8 includes providing for a response to emerging crises.

Box 2.1: A secondary water typology

Harvesting precipitation

- Public—Collecting stormwater from rain events in urban ponds and lakes for irrigating sports fields—the ACT Government's Canberra Integrated Urban Waterways Project.
- Private—Collecting rainfall roof run-off in rainwater tanks for household irrigation purposes—primarily a household initiative with the ACT Government providing rainwater tank rebates.

Wastewater recycling

- Public—ACTEW's Lower Molonglo Water Quality Control Centre supplies treated sewage effluent to nearby vineyards (100 hectares) and a golf course (30 hectares).
- Public—ACTEW's North Canberra Water Reuse Scheme provides treated sewage effluent to 70 hectares of ovals and open spaces across North Canberra.
- Public—ACTEW's Southwell Park Watermining Project (now decommissioned) was a sewer mining scheme where a small treatment plant supplied treated sewage effluent to 10 hectares of playing ovals.
- Private—Greywater from bathrooms and laundries can be used to water gardens via a gravity-fed hose from the laundry.
- Private—Greywater storage, treatment and pumping systems allow recycling of wastewater from bathrooms and laundries for irrigation or internal reuse in toilets and laundries.
- Private—Residential third pipe systems (using greywater or treated sewage effluent) can be used for toilet flushing or garden watering—a third pipe system was considered for the Molonglo Valley residential development.

3 ACT water context and recent history

The first section of this chapter provides context for the inquiry by briefly reviewing the recent history of the primary water supply system. The second part provides relevant background information on the range of public and private secondary water initiatives that are assessed in the draft report. Key to this assessment is consideration of the ACT institutional and regulatory arrangements that may affect the take-up, operation or viability of a secondary water source. Current institutional and regulatory arrangements relating to the use of secondary water in the ACT are discussed in the third section (see page 29).

3.1 Primary water supply developments over the past ten years

This section sets out a timeline of the significant developments in the ACT primary water system over the past ten years. It does this by examining the key ACT policy developments and investment decisions against the backdrop of the prevailing climatic conditions and water demand patterns, and their combined impact on the ACT's water supply and demand balance.

Most of the water required to meet ACT (and Queanbeyan) requirements is drawn from the Cotter River catchment (Bendora, Corin and Cotter dams). Water is also drawn from Googong Dam and the Murrumbidgee River to meet peak demands in summer or during extended dry periods.

The timeline of developments is set out in figure 3.1 with combined ACT dam levels and stages of temporary water restrictions illustrating the prevailing water supply situation.[27] Figure 3.2 provides further information on the climatic conditions and shows the annual ACT rainfall and combined dam inflows over the past 20 years.[28] Figure 3.3 shows the per capita water demand in the ACT and Queanbeyan over the same period.

3.1.1 2002 to 2005

3.1.1.1 Water supply situation—starting to deteriorate

The Millennium Drought affected southeast Australia from about 1997 to 2009.[29] Although the drought caused lower than average dam inflows from 1997 to 2001 (see figure 3.2), and relatively high levels of per capita demand (see figure 3.3), the ACT's combined dam level at the beginning of 2002 was a relatively healthy 80% (see figure 3.1).[30,31]

From 2002, continuing drought conditions and from January 2003 impacts of the Canberra bushfires led to a rapid deterioration in the ACT water supply.

[27] The temporary water restriction stages illustrated in figure 3.1 reflect the new restrictions scheme introduced in 2005 in which permanent water conservation measures replaced the old scheme Stage 1.

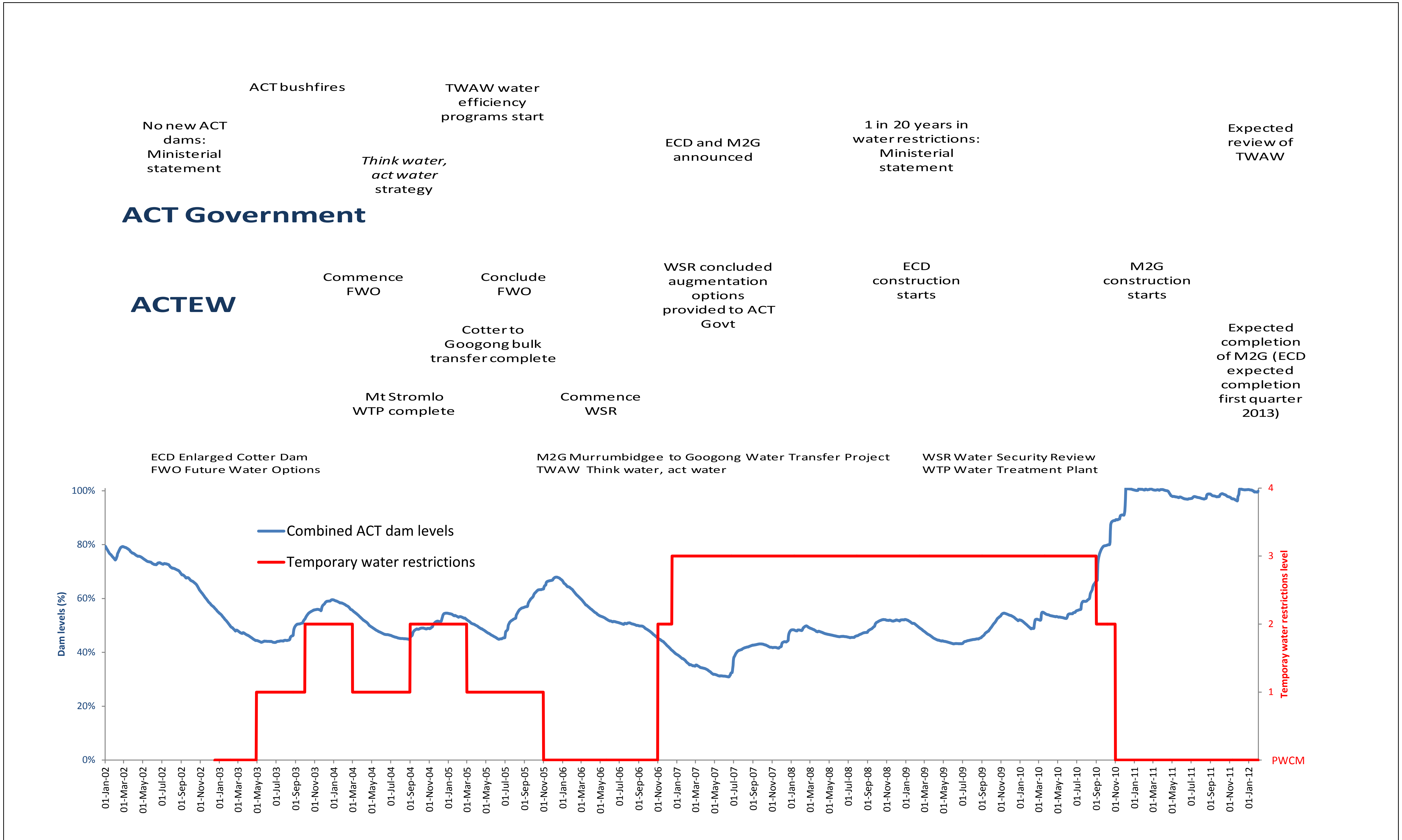
[28] Cotter, Corin, Bendora and Googong.

[29] The term 'Millennium Drought' was coined in Whitaker (2005).

[30] The Commission has adopted 1912 as the starting year to calculate long-term average ACT dam inflows in preference to 1871, which is generally used for calculation purposes because the inflow data for the 1871 to 1911 period is simulated rather than measured data. The Commission's view is that, given the complexity of factors influencing dam inflows, it prefers to use measured data rather than relying on simulated data for calculating the long-term average.

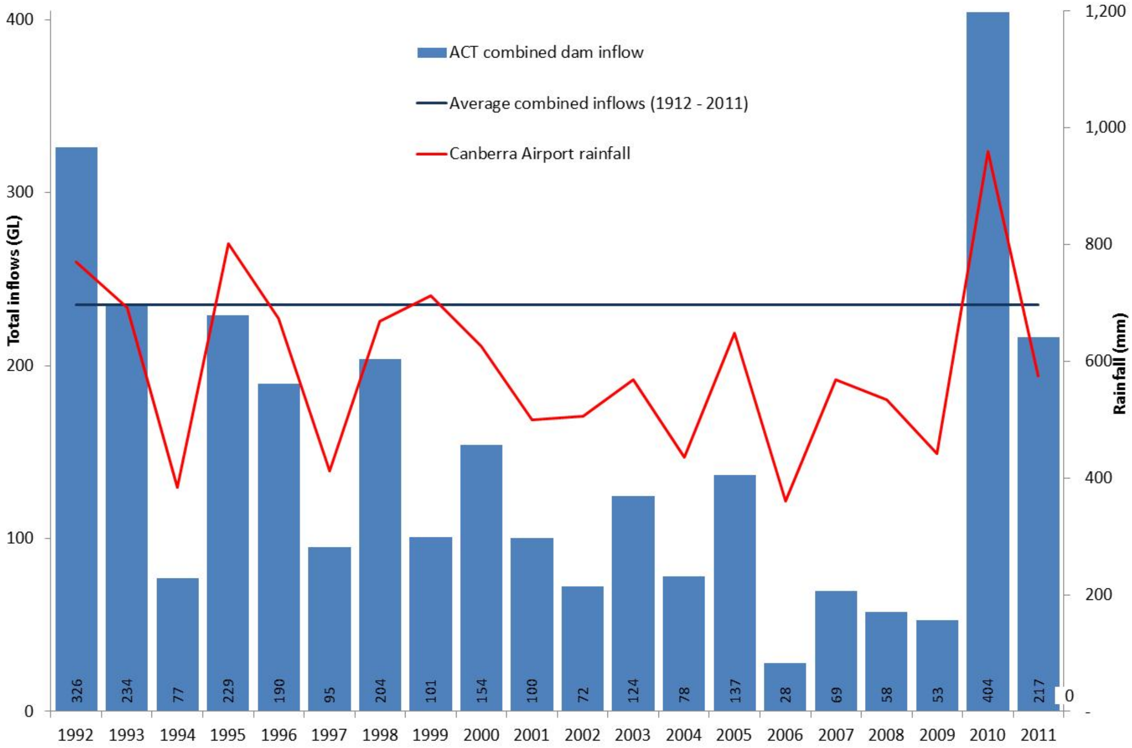
[31] The combined volume of water in the four dams measured as a percentage of the full dam capacity.

Figure 3.1: Timeline of key ACT water security developments over the past decade



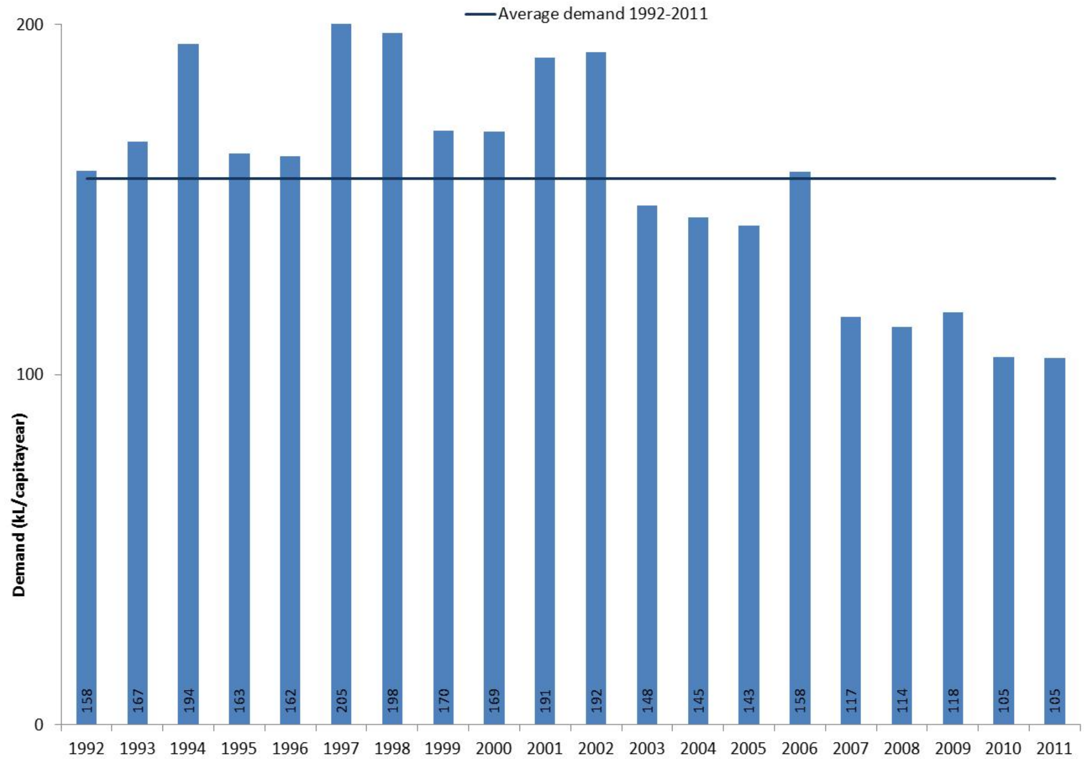
Source: Adapted from ICRC (2011a), p. 19; temporary water restriction and dam level data from ActewAGL.

Figure 3.2: Annual combined ACT dam inflows and Canberra Airport rainfall



Source: ActewAGL.

Figure 3.3: ACT and Queanbeyan annual average per capita water demand



Note: This demand data is not adjusted for climate.

Source: ActewAGL.

The bushfires compounded the deteriorating ACT water supply situation in two ways.

The first and immediate impact was to reduce water quality due to ash run-off into the Cotter catchment, the ACT's major water supply catchment.[32] At the time, the Mt Stromlo Water Treatment Plant was unable to treat this poor-quality water, which meant that the ACT became more reliant on the Googong Dam. In response, ACTEW commissioned an upgrade of the Mt Stromlo Water Treatment Plant in November 2004.

The second and ongoing bushfire impact is a significant reduction in streamflows in ACT catchments, and consequently inflows into ACT dams, due to increased evapotranspiration as the bushfire-affected vegetation recovers.[33] The streamflow reduction impact had more serious water security implications than the initial water quality issue caused by ash run-off, with reduced dam inflows occurring even during years of reasonable rainfall.

As a result of the continued drought conditions and bushfire impact, combined ACT dam levels fell from 80% at the start of 2002 to a low of about 44% by June 2003. In response, Stage 1 and Stage 2 temporary water restrictions were introduced by ACTEW to reduce water demand, which resulted in per capita demand falling from 192 to 143 kL per year between 2002 and 2005 (see figure 3.3).

The ACT had a temporary reprieve in 2005, with a return to average rainfall and reduced demand due to water restrictions resulting in dam capacity rising to about 67% by the end of 2005. This allowed temporary water restrictions to be lifted and a return to permanent water conservation measures (PWCM).

3.1.1.2 Key policy initiatives and investment decisions

In December 2002, Bill Wood, the then Minister for Urban Services, in a ministerial statement about the development of an ACT water resources strategy, announced an aspiration 'to avoid the building of another dam', and stated the need 'to continue taking a series of small steps, with the expectation that we continue to improve our water management until those steps have grown large enough to avoid building that dam'.[34]

The 'no new dams' policy was followed in April 2004 by the introduction of the ACT Government's long-term water resources strategy *Think water, act water* (TWAW).

TWAW identifies ensuring 'that the ACT has an adequate, secure water supply'[35] as a major objective of the strategy. Consistent with the 'no new dams' policy, TWAW states a preference for implementing water efficiency measures before undertaking primary water supply augmentations.

To this end, TWAW identifies a range of measures and targets (see box 3.1) to increase water use efficiency (reduce per capita primary water use) and increase secondary water use as the principal means by which the ACT's future water supply is secured rather than building dams. The strategy noted that future water supply options would continue to be considered if water use efficiency

[32] The fires caused an increase in turbidity and increases in iron and manganese in the water (ACTEW 2012a).

[33] See section 4.2.1.4 for more detail on the bushfire impact.

[34] Wood (2002), p. 4121.

[35] ACT Government (2004c), p. 1.

measures were unable to save enough water to avoid further primary water supply augmentations.[36]

Box 3.1: *Think water, act water* primary water reduction and secondary water use targets

TWAW sets the following targets to reduce per capita primary water consumption:

- a reduction [relative to 2003 consumption] in per capita consumption of mains water by 12 per cent by 2013 and 25 per cent by 2023, to be achieved through:
  - water efficiency measures
  - sustainable water recycling; and
  - use of stormwater and rainwater
- an increase in the use of reclaimed water (treated wastewater) from 5 per cent to 20 per cent by 2013.

Source: ACT Government (2004c), p. 2.

TWAW has an implementation plan that contains a range of specific actions in support of TWAW objectives and targets. These include a number of ACT Government water efficiency rebates, subsidies and programs, which were implemented from December 2004 onwards.[37]

In April 2004, ACTEW produced a report (ACTEW 2004) that identified a range of options for augmenting the ACT water supply. The report identified three options for more detailed assessment: enlarging the Cotter Dam, building the Tennent Dam and transferring water from the Tantangara Dam in NSW to the ACT.[38] ACTEW subsequently commenced the Future Water Options (FWO) project to identify the preferred approach for augmenting the ACT's primary water supply, should it be required. ACTEW presented its FWO project report (ACTEW 2005a) to the ACT Government in April 2005. The key recommendations were:

- immediate implementation of the Murrumbidgee to Googong Pipeline Project (M2G)
- retention of the Enlarged Cotter Dam (ECD) Project and Tennent Dam as future viable options, with ACTEW ready to implement either option without delay if required.[39]

At the same time, and on its own initiative, ACTEW started implementing the Cotter to Googong Bulk Transfer project. This made more efficient use of the existing storage capacity by transferring water from the Cotter catchment that would otherwise spill over the dam walls via ACTEW's water reticulation system and storing it in the Googong Dam.[40]

As an immediate response to the FWO report, in April 2005 the ACT Government announced that it would seek independent technical advice, conduct a whole-of-government review of the report and consult the ACT regional community before announcing a decision on the report.[41] Subsequently, in February 2006, the ACT Government announced its decision not to proceed with the FWO report recommendations. This was on the basis that the Cotter to Googong Bulk Transfer project 'is poised to play a bigger-than-anticipated part in securing Canberra's water supply' and

[36] ACT Government (2004b), p. 4.

[37] See section 6.3 for more information on the ACT Government's water efficiency rebates, subsidies and programs.

[38] The current Tantangara Transfer Project involves transferring water down the Murrumbidgee River to the ACT.

[39] The M2G will allow water to be pumped from the Murrumbidgee River near Angle Crossing to the Googong Dam.

[40] ACTEW (2005b).

[41] Stanhope (2005).

‘it made sense to see precisely what impact the Cotter–Googong transfer would have on the Territory’s capacity before committing the taxpayer to major infrastructure work’.[42]

3.1.2 2006 to 2009

3.1.2.1 Water supply situation—getting much worse

Following the temporary improvement at the end of 2005, the ACT water security situation rapidly deteriorated in 2006 and 2007, with combined dam capacity falling to a low of 31% by mid-2007. This was due to very low rainfall in 2006, which together with the ongoing residual bushfire impact, translated into extremely low annual dam inflows of 28 GL, only 12% of the long-term average inflow of 235 GL/a.

In response, Stage 2 and then Stage 3 temporary water restrictions were introduced in November 2006, with Stage 3 restrictions remaining in force until August 2010. This, together with rising water prices and household water efficiency investments, had the effect of further reducing per capita consumption (see figure 3.3).

3.1.2.2 Key policy initiatives and investment decisions

Following the completion of the FWO project in 2005, ACTEW commenced work on a Water Security Review (WSR). This was intended to further review existing ACT water resources and recommend options to secure the water supply for the ACT and Queanbeyan. ACTEW presented its final WSR report to the ACT Government in July 2007. At that time, combined dam capacity was about 30%.[43]

The report recommended a series of new investments, including enlargement of the Cotter Dam from 4 GL to 78 GL and the M2G project. The report also recommended further analysis of two options independent of rain falling in ACT catchments: the Tantangara Transfer Project and a water purification plant.[44]

In October 2007, three months after receiving the WSR report, the ACT Government announced that ACTEW would undertake the ECD and M2G projects. The ACT Government explained the announcement with reference to the ongoing drought and future climate change uncertainty and the need to ‘put in place a greater range of water security measures—incorporating both supply and demand’.[45]

At the same time it was announced that ACTEW would design a demonstration water purification plant and pursue the possibility of purchasing NSW water entitlements for the Tantangara Transfer Project.

On 26 March 2009, in a ministerial water security statement in the ACT Legislative Assembly, Minister for the Environment, Climate Change and Water Simon Corbell defined the ACT’s overarching water security objective in terms of the probability of time spent in temporary water restrictions. Minister Corbell stated that the parameters being used by the government to gauge

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[42] Stanhope (2006).

[43] ACTEW (2008b).

[44] The water purification plant proposal involved pumping treated effluent from the LMWQCC to a water purification plant and then into the Cotter River catchment to flow into the Cotter Dam.

[45] Stanhope (2007).

supply and supply augmentation proposals against climate change scenarios 'are based around one year in 20 in temporary water restrictions'.[46]

ACTEW commenced construction of the ECD in November 2009 with an expected two-year construction timeframe.

3.1.3 2010 to 2012

3.1.3.1 Water supply situation—the drought breaks and dams fill

In 2010, the Millennium Drought broke due to a strong La Niña event that developed during the spring. The ACT (Canberra Airport) recorded 960 millimetres of rainfall, more than double that recorded in 2009, and well above the historical average of 617 millimetres. Dam inflows in 2010 were estimated at 404 GL, well above the long-term average of 235 GL/a. This, together with per capita demand remaining at low levels, resulted in combined dam levels rising from 52% at the end of 2009 to 100% by December 2010. In response, Stage 3 temporary water restrictions were reduced to Stage 2 in August 2010, and further reduced directly to PWCM in November 2010. As of April 2012 combined dam levels remain at 100%.

3.1.3.2 Key policy initiatives and investment decisions

The ACT Government commenced a review of TWAW in 2009–10.[47] The Commission understands that the review is progressing, and a revised strategy is expected to be released during 2012. ACTEW commenced construction of the M2G project in early 2011 with an expected completion date in mid-2012. ACTEW expects to complete the ECD project in the first quarter of 2013.[48]

3.1.4 Conclusion

It is evident from the above history that the ACT in 2012 has a very different water security outlook than in 2009.

On the supply side, ACT dams are full as a result of drought-breaking rains. The soon-to-be-completed ECD project will increase the ACT's overall dam capacity by 36% from 208 GL to 282 GL. The completion of the M2G project later this year will provide extra supply for storage in Googong Dam with water pumped from the Murrumbidgee River. In the longer term, the Tantangara Transfer Project will provide an additional primary water source that is independent of rain falling in ACT catchments.

On the demand side, annual average per capita water consumption in the ACT and Queanbeyan has fallen substantially since the period before the Millennium Drought. As expected, demand fell particularly sharply during the period when the more severe Stage 2 and Stage 3 temporary water restrictions were in place over the period 2006 to 2010. However, per capita consumption has not risen since the removal of restrictions in 2010.[49]

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[46] Corbell (2009), p. 1.

[47] ACT Government (2011a), p. 3.

[48] ACTEW (2012c).

[49] Appendix G provides more detail about the reasons for this per capita consumption decline and the Commission's view on the likelihood of the lower consumption patterns continuing into the future.

The magnitude of these changes in water supply and consumption suggests that a reassessment of the ACT's water security outlook is necessary.

3.2 Secondary water supply options

This section describes current public and private ACT secondary water initiatives that have emerged over the last decade. The initiatives described in this section are broadly differentiated into publicly provided schemes and private initiatives, either individual or corporate.

3.2.1 Public options

3.2.1.1 ACTEW secondary water projects

ActewAGL currently operates two treated sewage effluent secondary water projects in the ACT on behalf of ACTEW: the North Canberra Water Reuse Scheme (NCWRS) and the Lower Molonglo Water Quality Control Centre (LMWQCC) Effluent Reuse Project. Until it was decommissioned, ActewAGL also operated the Southwell Park Sewer Mining Scheme. Over the 2002 to 2009 period the three schemes supplied an average of 0.46 GL/a of secondary water to external customers. Table 3.1 provides more detail on the volumes supplied by each scheme.

Table 3.1: ACTEW secondary water schemes—annual average supply, 2002–2009

Scheme	Supply of secondary water ML
NCWRS	190
Southwell Park	20
LMWQCC Effluent Reuse Scheme	250
Total	460

Source: ACTEW and ActewAGL (2011), table 12.2, p. 12–7.

The Southwell Park Sewer Mining Project was commissioned in 1995 as a demonstration plant that extracted wastewater from a sewer in North Lyneham, treated it and then supplied secondary water for irrigation of about nine hectares of local sports fields and parks.[50] A 2008 review of the project found that for a number of reasons associated with being a small demonstration plant, Southwell Park was only meeting 50% of local irrigation demand at a significantly higher cost than the NCWRS. The project was subsequently decommissioned in 2010.[51]

The NCWRS is supplied with treated sewage effluent from the Fyshwick Sewage Treatment Plant. The effluent is further treated at the North Canberra Water Re-use Facility before being pumped up to the Lower Russell Hill water reservoir. The secondary water is then used to irrigate about 64 hectares of sports fields in North Canberra.[52]

The LMWQCC Effluent Reuse Scheme is the largest secondary water scheme in the ACT, supplying about 250 ML/a of secondary water through a former gas pipeline to nearby vineyards and golf course, and tanker trucks.[53]

[50] ACTEW and ActewAGL (2011), pp. 12–8.

[51] ACTEW and ActewAGL (2011), pp. 2–37; AECOM (2011), p. 24.

[52] ACTEW (2008a), p. 14.

[53] ACTEW and ActewAGL (2011), p. 12.8.

3.2.1.2 The Canberra Integrated Urban Waterways Project

In March 2007, the ACT Government signed a funding deed with the Australian Government under the Water Smart Australia program in relation to the Canberra Integrated Urban Waterways Project (CIUWP). The aim of the CIUWP is to develop integrated waterway management master plans for several Canberra catchments and to retrofit identified stormwater systems with infrastructure such as detention ponds and wetlands, stormwater reuse, water quality management, drainage and flood management, wetland landscaping and aquifer storage and recovery.[54]

The funding deed envisaged a three-year project period finishing in June 2010 and specified a two-stage feasibility study:[55]

- the first to test system function, thresholds and options in relation to the stormwater substitution target, including considering triple bottom line outcomes
- the second to develop a workplan for the remainder of the project that identifies opportunities for stormwater harvesting and a timeline for implementing the opportunities.

The funding deed required the workplan to include plans to 'reuse up to 1.5 (GL/a) by 2010 and reuse up to 3 (GL/a) of water stored and collected in wetlands or associated storage structures constructed during the project by 2015'.[56]

The funding deed envisaged a total project budget of $17 million (see table 3.2) to meet the stormwater reuse targets. The Australian Government provided $10.2 million (60%) towards this total and the ACT Government provided 3.5 million (21%), with the remaining $3.3 million (19%) intended to be raised through ACT developer contributions.

Table 3.2: CIUWP—Funding deed budget

$'000	Australian Government	ACT Government	Developers	Total cost
Project management team	525	787.5	–	1,312.5
Feasibility study phase 1	395	–	–	395
Feasibility study phase 2	800	–	–	800
Detailed design	680	205	260	1,145
Construction	7,800	2,357.5	3,040	13,197.5
Monitoring and evaluation	–	150	–	150
Total	10,200	3,500	3,300	17,000
Percentage contribution	60%	21%	19%	

Source: Australian Government and ACT Government (2007), p. 37.

The major policy drivers for the CIUWP are:[57]

- the funding deed between the ACT and Australian governments
- the parliamentary agreement between the ACT Labor Party and the ACT Greens[58]

[54] Sullivans Creek, Yarralumla Creek, Weston Creek and Ginninderra Creek catchments.

[55] The three-year timeframe was later extended to four years, with the project period ending June 2011.

[56] Australian Government and ACT Government (2007), p. 32.

[57] ACT Government (2011a), p. 5.

[58] Initiative 4.3 in Appendix 2: Accelerating the program of replacing stormwater drains with urban creek and wetland systems, beginning with the completion of the Sullivans Creek wetland network (ACT Labor & Greens 2008).

- the TWAW mains water reduction, recycled water and water quality targets
- the 2007 *Where will we play?* strategy in which the ACT Government had a vision that no ACT sportsground will be solely reliant on mains water by 2013[59]
- the WSUD Code water quality requirements.

In April 2007, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) was commissioned to undertake the first-stage feasibility study to identify stormwater harvesting opportunities in the ACT with the potential to achieve the up to 3 GL/a substitution target by 2015. The study also aimed to assess the financial cost of preferred harvesting options and identify social acceptance, ecological impacts, stakeholder views and potential risks of stormwater harvesting.

The CSIRO report produced a number of master plans for the preferred stormwater harvesting schemes. The master plans were based on least-cost planning considerations and included consideration of a range of social and environmental factors.[60]

Using information from the CSIRO report, the second stage of the ACT Government feasibility study involved the development of a workplan and detailed design for capital works to implement pilot stormwater reticulation networks to meet the reuse targets. The workplan identified three pilot stormwater reticulation networks: Inner North Canberra, Weston Creek and Tuggeranong.

Stage 1 of the **Inner North pilot network** (see figure 3.4) in the Sullivans Creek catchment consists of a number of constructed stormwater detention ponds—Flemington Road Ponds and Dickson and Lyneham Ponds—and a reticulation network intended to provide about 0.46 GL/a of stormwater to private and public customers to irrigate recreational facilities. The pilot includes a transfer pipe from Lyneham Pond to Flemington Pond and an aquifer storage and recovery trial.[61]

Expected private customers include Thoroughbred Park Race Course, Yowani Country Club and private schools. Public customers are expected to include Exhibition Park and public schools. ACT Government Sport and Recreation Services is expected to irrigate Southwell Park, Dickson District Playing Fields and Hackett and Downer neighbourhood ovals.[62]

The Inner North pilot is expected to be constructed and commencing preparation for operation by November 2012. Construction progress up to May 2012 is as follows:

- The two Flemington Road Ponds were constructed by 2009.
- The Dickson Pond and associated pumping system to provide water to Dickson District Playing Fields was completed in December 2011.
- The Lyneham Pond and pumping system to the Flemington Road Pond was completed in May 2012.
- A contract has been let for the installation of the pipes for the reticulation network, including the main transfer between Lyneham Pond and Flemington Road Pond 2.

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[59] The *Where will we play strategy?* has subsequently been amended.

[60] CSIRO (2009).

[61] The trial involves stormwater being injected into a borehole, stored and retrieved when required during peak irrigation demand periods.

[62] ACT Government (2011d), p. 20.

Stage 1 of the **Weston Creek pilot network** (see figure 3.5) in the Weston Creek catchment consists of the Coombs Pond (in the new Molonglo estate) and a reticulation network intended to provide up to 0.355 GL/a of stormwater to irrigate up to 45 hectares of high-priority Sport and Recreation Services sportsgrounds and a number of school playing fields.

The Weston Creek pilot is currently in the design stage and construction is scheduled to commence in March 2013. The network is expected to be operational by March 2014.

Stage 1 of the **Tuggeranong pilot network** (see figure 3.6) involves pumping water from Lake Tuggeranong through a reticulation network intended to provide up to 0.13 GL/a of stormwater to irrigate up to 26 hectares of high-priority Sport and Recreation Services sportsgrounds such as the Kambah and Wanniassa District Playing Fields.

Construction of the pipe network is expected to commence in August 2012, and the network is expected to be in operation by September 2013.

Figure 3.4: Inner North pilot stormwater reticulation project Stage 1

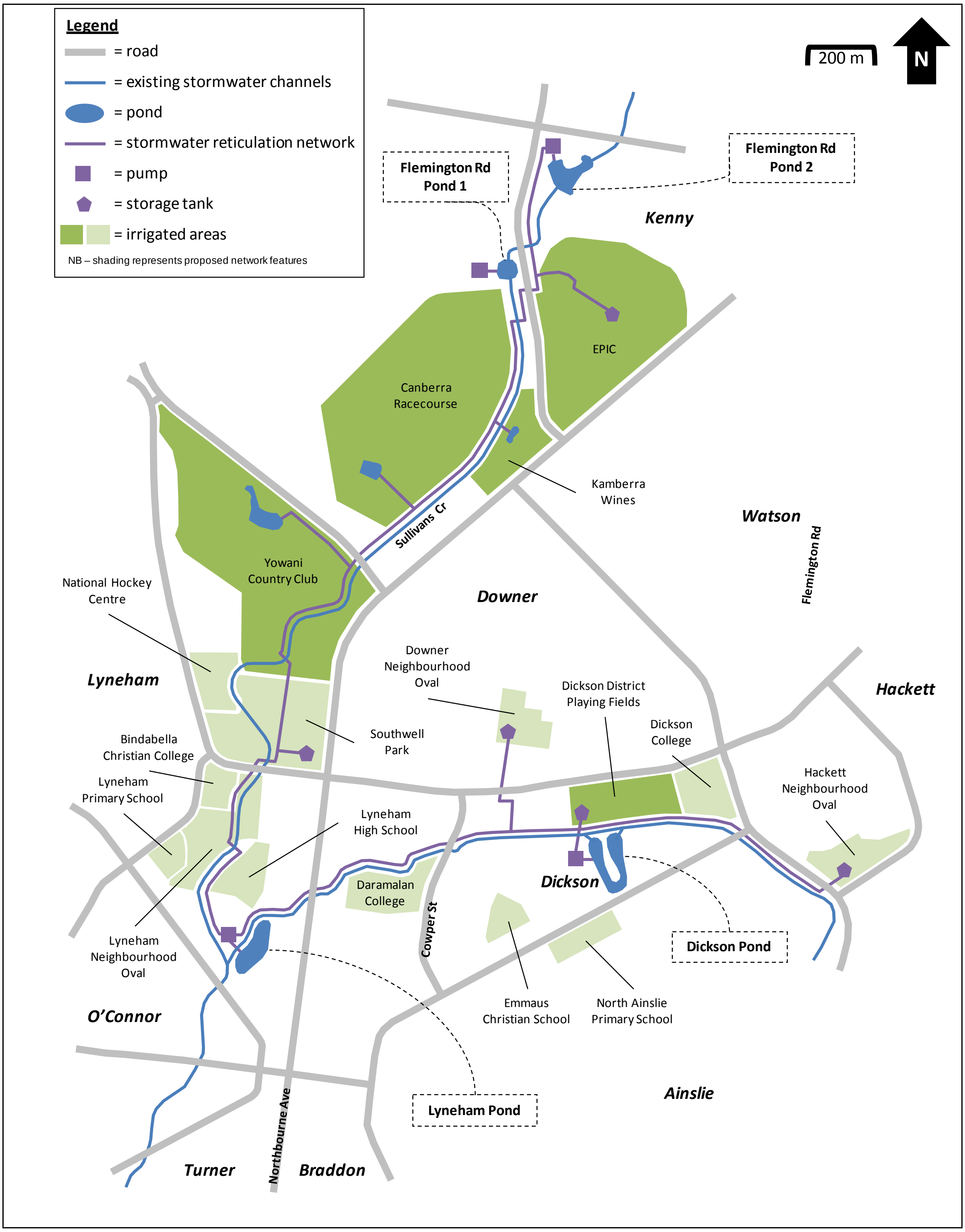


Figure 3.5: Weston Creek pilot stormwater reticulation project Stage 1

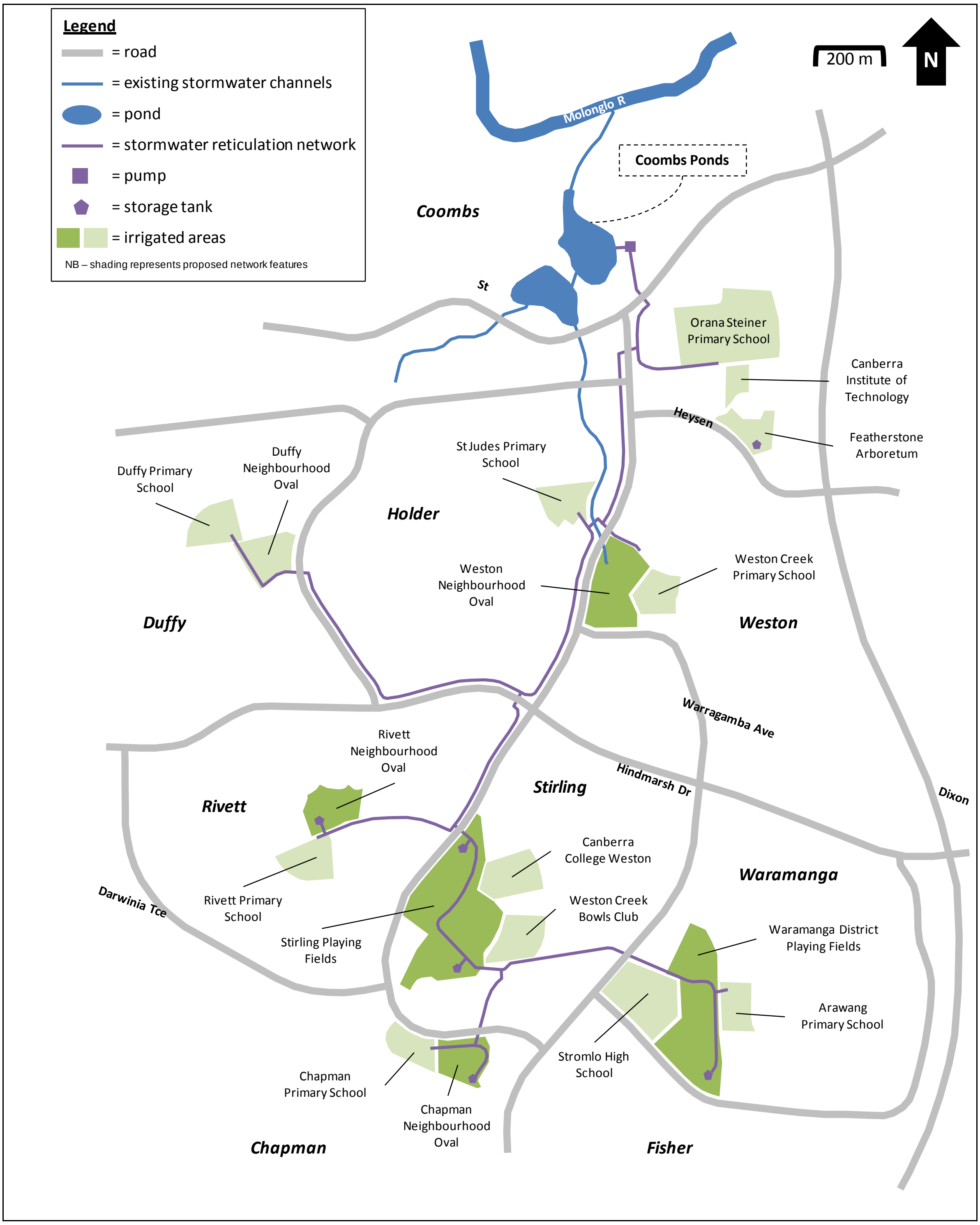
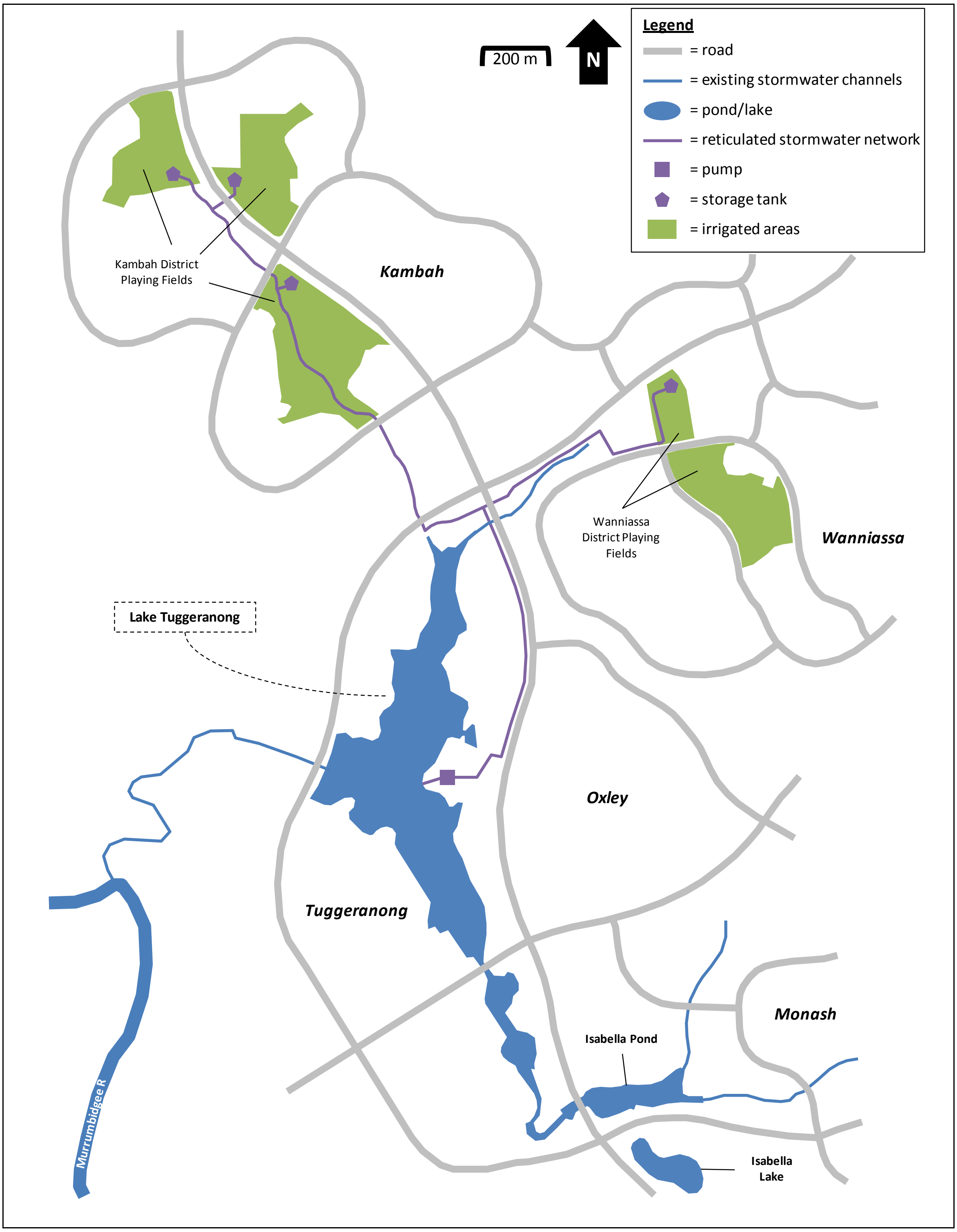


Figure 3.6: Tuggeranong pilot stormwater reticulation project Stage 1



An updated budget for the CIUWP is detailed in table 3.3. The total estimated budget through to completion of the three pilot reticulation networks in June 2014 is $61 million. This includes the Dickson and Lyneham and Flemington Road Ponds, pipes, pumps and other works. Of this total, about $22.5 million is allocated towards the cost of the reticulation network for the three pilot networks. The ACT Government's contribution is estimated at about $51 million (83%), with the Australian Government contributing about $10 million (17%). The contribution from ACT developers foreshadowed in the funding deed has not materialised due to administrative costs.[63]

Table 3.3: CIUWP—2007 to 2012 budget

$'000	Australian Government	ACT Government	Total cost
Project management team	900	500	1,400
Feasibility study phase 1	400	–	400
Feasibility study phase 2 design	1500	3,680	5,180
Construction	7,400	46,690[a]	54,090
Total	10,200	50,870	61,070
Percentage contribution	17%	83%	

a This line item includes an additional estimated $1 million for pump and pipe works for the Weston Creek pilot network that is included in the Coombs Pond budget.

Source: ACT Government (2011e), p. 2.

The funding deed between the ACT and Australian governments envisaged a trial period for monitoring and evaluation purposes for the CIUWP to run from the end of the project period (1 July 2010 extended to 1 July 2011) until 30 June 2015.[64] In relation to the trial stage, the ACT Government has stated:

> It is intended that the pilot reticulation projects be evaluated after a two year period of operation to comprehensively assess the costs and benefits of broad scale stormwater harvesting in the ACT. If the pilot evaluation concludes that the projects have been successful further infrastructure will be identified to meet the longer term 3 GL target of substituted potable water by 2015, pending successful ACT Government budget bids and additional Water for the Future grants.[65]

The Commission understands that with an expected completion date of June 2014 for the three pilot reticulation networks, the trial period will run from then until June 2016.

Looking beyond the CIUWP, the Environment and Sustainable Development Directorate (ESDD) commissioned AECOM to prepare a non-potable water master plan for the use of non-potable water across Canberra—primarily for irrigation purposes. The AECOM master plan is intended to provide a framework to guide the future provision of infrastructure for non-potable water supply in the ACT.

AECOM provided its master plan report to ESDD in December 2011.[66] The report proposes a mix of initiatives (treated sewage effluent and stormwater) to provide 13.7 GL/a of secondary water by 2035 at an estimated present cost of $726 million ($452 million capital costs and $275 million

[63] ACT Government (2011e), p. 26.

[64] Australian Government and ACT Government (2007), p. 29.

[65] ACT Government (2011d), p. 4.

[66] AECOM (2011).

annual operating costs).[67] The master plan uses a computer-based decision support model that assesses the volumetric and economic performance of various recycled water supply scenarios.

3.2.1.3 Other stormwater harvesting initiatives

There are a number of other smaller-scale publicly funded stormwater initiatives in the ACT including:

- Point Hut Pond—the Territory and Municipal Services Directorate (TAMSD) has upgraded a pump and pipeline to irrigate the Gordon District Playing Fields and Point Hut Park with stormwater from the Point Hut Pond[68]
- Australian National Botanic Gardens—the Botanic Gardens is irrigated with about 170 ML/a of filtered water pumped from Lake Burley Griffin.[69]

3.2.2 Private secondary water initiatives

3.2.2.1 Greywater recycling

Greywater is typically used to replace or complement primary water for outdoor garden use at the household level. Greywater systems available in the ACT broadly consist of two types:

- diversion devices that direct greywater to the garden for immediate use without making changes to its quality. The untreated greywater is not stored due to the presence of bacteria and chemical contaminants
- treatment systems that improve the quality of the greywater by filtering, disinfecting and treatment.

Greywater hoses are a simple diversion device and can be used to transfer greywater from bathrooms and laundries directly outdoors for garden use. For example, a greywater hose can be attached to a washing machine discharge pipe for this purpose. In the ACT, greywater hoses are readily available from a range of hardware and gardening stores.

More expensive diversion devices that enable short-term storage and pressurised garden watering are also available in the ACT. One particular product available in the ACT is the greywater wheelie bin. Greywater is piped from a washing machine, for example, into the wheelie bin. A submersible pump in the wheelie bin is then used to pump the greywater to irrigate the garden.

More complex filtering and pumping systems requiring installation by a licensed plumber are also available the ACT. For example, the Gator Pro is a system that filters gross pollutants (lint, for example) out of the greywater and enables the treated greywater to be pumped under pressure.

The use of greywater in the residential sector has been encouraged by the ACT Government over recent years through initiatives such as:

- introducing greywater use guidelines for the safe use of greywater in residential properties in the ACT[70]
- advertising campaigns encouraging household greywater use

[67] AECOM (2011), p. 39.

[68] ACT Government (2011f), p. 3.

[69] Farrell and Lundy (2011).

[70] ACT Government (2007).

- a greywater hose scheme in 2007–08 during which 10,000 free greywater hoses were distributed to the ACT community[71]
- the inclusion of greywater systems for irrigation and toilet flushing on individual dwellings as an acceptable solution in the Waterways Water Sensitive Urban Design General Code (WSUD Code) to reduce primary water consumption.[72]

3.2.2.2 Rainwater harvesting

Rainwater tanks collect roof run-off from residential or commercial buildings and can be installed in a number of different ways. Installation options range from the simple—placing the tank on a stand and having a tap outlet on the tank—to the more complex, with the rainwater tank connected to toilets and washing machines inside the home. Rainwater tanks and pumps of various sizes, types and prices are available in the ACT from a number of retail suppliers.

The ACT Government promotes the installation of rainwater tanks by ACT households by providing rebates, developing guidelines for the use and installation of residential rainwater tanks and through the WSUD Code requirements.[73]

The ACT Government has been offering rainwater tank rebates to eligible ACT residential property owners since August 1997. The rebate scheme has gone through various iterations, with the current scheme requiring the tank to be connected inside the home (for example, to the toilet or washing machine). A rebate of $750 to $1,000 depending on tank size is available for the installation and connection of new tanks. A rebate of $600 is available for connecting an existing rainwater tank to inside the home.[74] Up to June 2010 about 2,532 ACT residents had participated in the rebate scheme.[75]

The WSUD Code requires new building developments and redevelopments in the ACT to comply with a primary water use reduction target of 40% on 2003 levels. The installation of rainwater tanks (of various sizes depending on block size) connected to the toilet, laundry and external taps is listed in the code as an acceptable solution to meet the 40% target on single residential blocks.[76]

The Australian Government's National Rainwater and Greywater Initiative, which ceased in November 2011, provided ACT residents with rebates of up to $500 towards the purchase and installation of a new rainwater tank connected to the toilet and/or laundry by a licensed plumber.

3.2.2.3 Stormwater harvesting

There are a number of private stormwater initiatives in the ACT, including:

- Yowani Country Club—the 2010–11 ACT Budget provided funding for Yowani Country Club to construct a pipe and dam to harvest stormwater from Sullivans Creek to irrigate the golf course and bowling greens[77]

[71] ACT Government (2011a), p. 9.

[72] ACT Government (2009b), p. 23. See section 3.3.2 for more information on the WSUD Code.

[73] ACT Government (2010b).

[74] ACT Government (2012b).

[75] Fyfe et al. (2011), Table 4.3, p. 35.

[76] ACT Government (2009b), p. 23.

[77] Barr (2010).

- Royal Canberra Golf Club—the golf course is irrigated with water drawn from Lake Burley Griffin.

3.3 Institutional and regulatory arrangements

3.3.1 Institutional arrangements

Figure 3.7 provides an overview of the institutional arrangements applying to the ACT water sector.

Within the ACT Government the primary responsibility for water policy, with respect to the development and implementation of policy, planning, regulation and the delivery of some services and infrastructure relating to secondary water, rests with ESDD. The role of ESDD is to develop and coordinate water policy matters in the ACT consistent with *Think water, act water*, the ACT's water resources strategy.

The *Water Resources Act 2007* provides the framework for management of ACT water resources. Under the Act, control of all water use in the ACT, including from dams, streams and groundwater, is vested in the ACT Government. Persons wishing to use ACT water resources are required to hold a water access entitlement. In addition, a licence to take water is required to extract the water specified by a water access entitlement.

ESDD also provides the administration, regulation and enforcement of secondary water activities to ensure they are compliant with water resource management and environmental protection standards. The use of secondary water must be compliant with the *Environment Protection Act 1997*. ESDD has also developed the ACT Non-potable Water Master Plan, which is intended to provide a framework for the systematic assessment and future development of secondary water sources.[78]

The ACT Planning and Land Authority (ACTPLA) is part of ESDD. Among other functions, ACTPLA is responsible for WSUD planning requirements set out in the WSUD Code, and technical regulation of water utilities.

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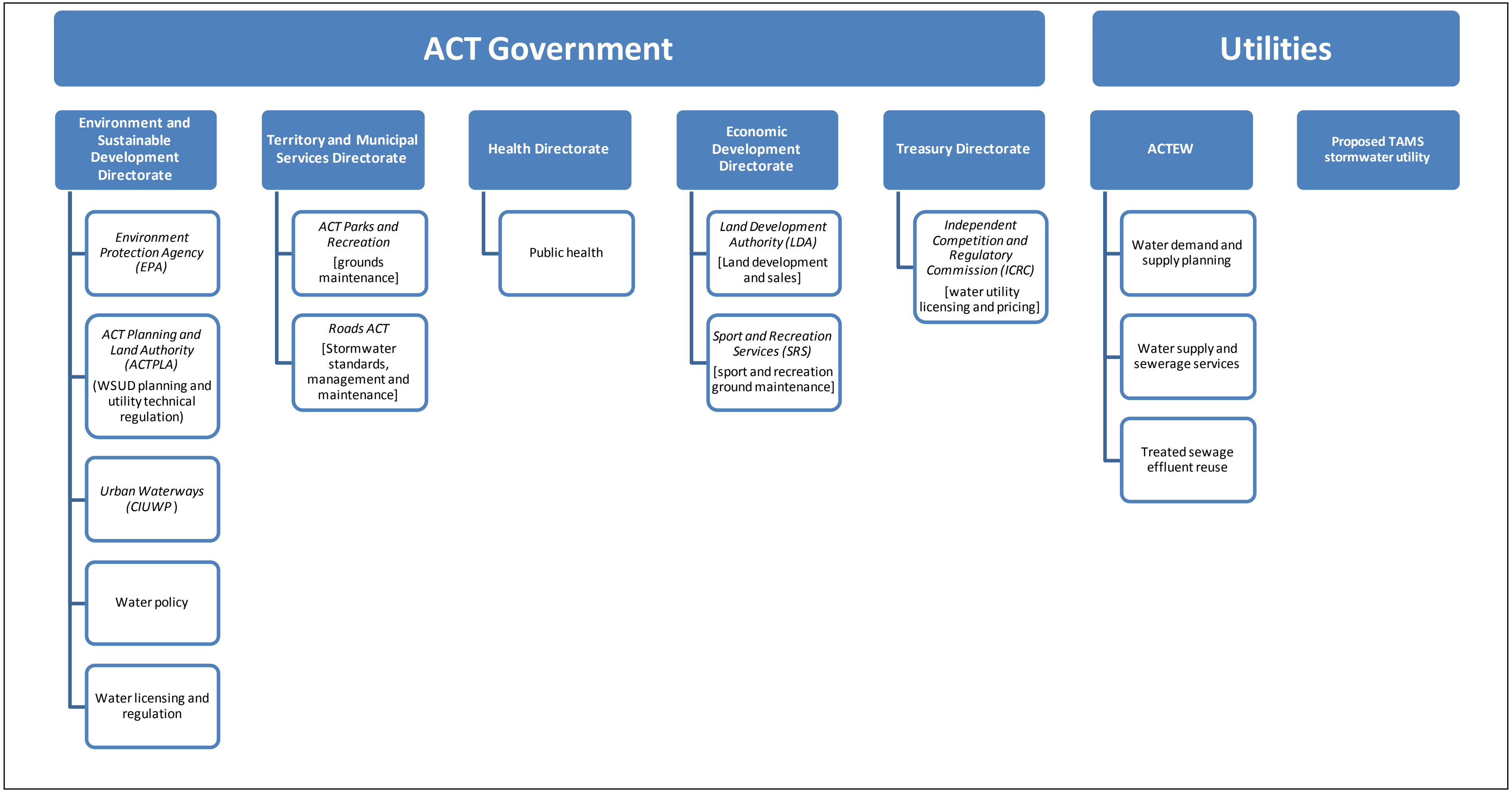
[78] AECOM (2011).

Figure 3.7: ACT institutional water arrangements



Water activities are also required to be compliant with the *Public Health Act 1997*, administered by ACT Health. The Health Protection Service manages risks and implements strategies regarding the prevention of, and timely response to, public health events. This includes the licensing, monitoring and enforcement of public health regulations, including safety of recreation and drinking water.

The ACT's water utility, ACTEW, in addition to providing water and sewerage services, provides input into policy development in the form of information on infrastructure costs, demand forecasts, the need for supply augmentation, and health and environmental issues. ACTEW is also responsible for implementing the ACT's temporary water restrictions and PWCM schemes.

The Territory and Municipal Services Directorate (TAMSD) is responsible for maintaining and operating the stormwater network in the ACT and for the maintenance, including irrigating, of various parklands around Canberra. TAMSD has also been proposed as the utility provider for the CIUWP stormwater reticulation network.[79] TAMSD is also often the recipient of stormwater and irrigation infrastructure constructed by ACT developers in response to WSUD planning requirements.

Sport and Recreation Services, part of the Economic Development Directorate, is responsible for the management, including irrigation, of ACT sports and recreation grounds. The Land Development Agency, also part of the Economic Development Directorate, is responsible for developing and selling land on behalf of the ACT Government. In this role the Land Development Agency is required to comply with WSUD Code requirements.[80]

3.3.2 Regulatory arrangements

The main purposes of water regulation in the ACT are:

- public health risk management
- achievement of planning outcomes
- environmental protection
- achievement of economic outcomes.

These objectives are closely interrelated and are generally concerned with the quality and quantity of water and flows of water through the system.

3.3.2.1 Public health

The Public Health Regulation 2000 provides for the protection of Canberra's water supply quality. Under these regulations it is an offence to contaminate the water supply. In addition, the ACT *Public Health Act 1997* empowers ACT Health to make a person rectify a condition that is a public health risk or offensive to community health.

ACT Health, through the Health Protection Service, usually participates and provides health advice in relation to secondary water proposals through the ACT planning process. The Commission understands that in relation to onsite sewage treatment systems that are not connected to the ACTEW sewerage network, ACT Health has a formal approval role in addition to providing advice.

[79] TAMSD (2012), Attachment D.

[80] See section 3.3.2 for more information on WSUD planning requirements.

The ACT Government has issued guidelines for greywater use in residential properties which cover health and environmental requirements.[81] The guidelines recommend levels of treatment for greywater stored for more than 24 hours. Untreated greywater that is stored for more than 24 hours is to be discharged only into the sewer. This requires written approval from ActewAGL. The guidelines recommend that householders ensure that greywater treatment systems are able to meet the required treatment standards.

As a further measure to ensure the protection of public health, plumbing work on greywater systems must be carried out by licensed plumbers. This work may involve changing or modifying existing plumbing and drainage associated with the installation of a greywater diversion valve or a treatment system.

ACTPLA regulates plumbing in the ACT. The legislation governing the plumbing industry is the *Construction Occupations (Licensing) Act 2004* (COLA). The *Water and Sewerage Act 2000* and the *Water and Sewerage Regulations 2001* are operational legislation within the COLA. The plumbing legislation (Water and Sewerage Act and Regulations) requires that any work conducted on the water supply, sanitary plumbing or drainage system is to be carried out by licensed plumber.

There are no specific guidelines facilitating multi-dwelling greywater or blackwater schemes in the ACT.

The ACT Government has issued guidelines for the installation and use of rainwater tanks for residential properties in Canberra.[82] There is no licence requirement in the ACT for harvesting and storing rainwater. While the use of rainwater for drinking and food preparation is not prohibited in the ACT, it is not recommended where primary water supply is available.[83]

The use of treated effluent is permitted in the ACT. However, it is not permitted to be used for drinking purposes or direct human contact. Users of treated effluent need to ensure that they do not cause an insanitary condition, which is an offence under the *Public Health Act 1997*. The ACT Government has issued a guideline for the use of wastewater for irrigation purposes in the ACT.[84] The guideline is intended to protect the environment and minimise the risk to public health from secondary water schemes. The guideline includes information related to applying Environment Protection Act requirements and compliance with ACT Health requirements. The ACT Government has also issued a factsheet on the use of treated sewage effluent from the Lower Molonglo Water Quality Control Centre.[85]

3.3.2.2 Planning

At the broad level, planning is the responsibility of ACTPLA, having regard to the requirements of the National Capital Plan, the Territory Plan and the Canberra Spatial Plan. The principles of TWAW are embodied in the WSUD Code (see box 3.2) and the Water Use and Catchment General Code issued by ACTPLA.[86] These codes apply to land-use planning, estate development, development and building approvals, and capital works.

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[81] ACT Government (2007).

[82] ACT Government (2010b).

[83] ACT Government (2010b), p. 3.

[84] ACT Government (1999).

[85] ACT Government (2012d).

[86] ACT Government (2009a).

Box 3.2: Water sensitive urban design

In response to the TWAW commitment to facilitate the incorporation of WSUD principles into urban, commercial and industrial development, the ACT Government introduced the WSUD Code in July 2009. The code aims to integrate the management of the urban water cycle into the urban development process. It also seeks to contribute to the TWAW mains water reduction, recycled water and water quality targets. The code states that 'the application of WSUD in new developments and redevelopments will play a significant role in achieving these targets' (ACT Government (2009b), p. 17).

In relation to mains water reduction, the WSUD Code states that as there are 'more opportunities to reduce water consumption in new developments than in existing developed areas, these developments will need to bear a higher proportion of water use reduction'. To this end the code requires a mandatory 40% reduction in mains water usage—more than the 25% TWAW target—in all new dwellings (single residential, multi-unit residential, estate, commercial, industrial or institutional) compared to 2003 levels.

The WSUD Code recommends a range of measures to reduce mains water usage, which include, in order of preference, water-efficient appliances, landscaping and fixtures, stormwater and rainwater harvesting, and greywater and treated effluent recycling.

Permitted uses and protected environmental values for the waterways in the ACT are contained in the Territory Plan, within the Water Use and Catchment General Code. The code identifies three types of catchments: drainage and open space; water supply; and conservation. Uses such as maintenance of ecosystems, recreation and water supply are designated for streams, lakes and rivers within each of these types of catchments. Within each catchment type there will be a designated primary value and a range of other permitted uses which are generally compatible with, but secondary to, the primary value. These uses establish the water quality standards to apply to a particular waterbody.

The Water Use and Catchment General Code also sets out the objectives and policies relating to ACT water resources. It sets out the prescribed use of or environmental values of the various water sources. The implementation of these policies is achieved through appropriate land-use policies, issuance of licences and preparation of management plans. All of these need to be consistent with the Territory Plan. Other planning objectives associated with waterways include flood mitigation, and community amenity and recreation facilities.

TAMSD (through Roads ACT) is responsible for standards for infrastructure and management and maintenance relating to stormwater control and road drainage.

3.3.2.3 Environment protection

Environmental policies and standards are administered by the Environment Protection Authority. The *Water Resources Act 2007* establishes environmental flows set through ACTEW's licence to take water under the Environmental Flow Guidelines. The principles of the guidelines are applied through the Water Resources (Water available from areas) Determination 2007 (No. 1) by detailing the amount of surface water and groundwater that can be taken from each Water Management Area.

Water quality standards for various water uses in the ACT are identified in the Environment Protection Regulations 2005.[87] Schedule 3 lists the pollutants entering the waterways that are taken to cause environmental harm. Schedule 4 sets the water quality standards for the necessary water quality to support each of the water uses referred to in the Territory Plan.

[87] ACT Government (2005).

In addition, environmental protection policies regarding wastewater re-use for irrigation are established under the *Environment Protection Act 1997* and the Environment Protection Regulations 2005.[88]

3.3.2.4 Economic

The Commission is an ACT statutory body set up to regulate prices, access to infrastructure services and other matters in relation to regulated industries and to investigate competitive neutrality complaints and government-regulated activities.

In relation to the water sector, the Commission is responsible for:

- licensing ACTEW as a utility service under the *Utilities Act 2000* and ensuring ACTEW's compliance with its licence conditions[89]
- approving the prices that ACTEW can charge for its water and wastewater services under the *Independent Competition and Regulatory Commission Act 1997* (the ICRC Act)
- maintaining a register of third-party access agreements and, as required, playing an arbitration role in access disputes
- investigating any water-related competitive neutrality complaints.

Secondary water initiatives may come under the purview of the Commission if they are provided through a utility service for the purposes of the Utility Act. If so, the utility will require a licence, with specific licence conditions, issued by the Commission in order to provide the service. The Commission may also have a role in approving the prices a secondary water utility can charge for its services, should the utility be referred by the responsible minister to the Commission under the ICRC Act.

The ACT does not have any institutional or legislative restrictions on seeking third-party access to existing water and sewerage networks. At the same time, the ACT does not have third-party access arrangements in place. A secondary water initiative proponent, seeking access to ACTEW's sewerage infrastructure for a sewer mining scheme, for example, can negotiate directly with ACTEW. Failing this, the proponent may resort to the existing national access regimes administered by the Australian Competition and Consumer Commission under Part IIIA of the *Competition and Consumer Act 2010*.

ACT competitive neutrality requirements are set out in the Competitive Neutrality Statement published by the ACT Treasury Directorate[90] in keeping with the ACT's commitments under the COAG Competition Principles Agreement.[91] The statement sets out the basis for the application of competitive neutrality to government business activities in the ACT. This includes full cost attribution, tax equivalent payments, debt guarantees and consistent application of regulations. Should an ACT Government secondary water scheme of sufficient scale be developed, such as a stormwater reticulation network, it will be necessary to ensure that competitive neutrality requirements are taken into account.

[88] ACT Government (1997).

[89] Section 7.2.1 provides more information on utility licensing.

[90] ACT Government (2010a).

[91] COAG (1995).

4 ACT water security outlook in 2012

This chapter provides an analysis of the performance of the ACT water supply system under various assumptions about population growth and per capita water use, with and without the take-up of various secondary water options, against the objective of providing the level of water security nominated by the ACT Government. It concludes by assessing the current likely water security benefits of secondary water options.

4.1 Modelling water supply and demand

4.1.1 ACT water security objective

Modelling water supply and demand requires understanding the level of water security that the ACT Government wishes to attain. The Commission has previously commented on the lack of specificity in the ACT Government's water security objective. In the final report on the Enlarged Cotter Dam Water Security Project, the Commission noted that the one year in 20 statement was a broad expression of the water security objective, with no clarity around:

> what climate assumptions this '1 year in 20' requirement should apply, or whether the requirement related to an accumulation of days across a 20-year period, or extended periods of time (for example, to be applied only when the restriction continued for more than one month).[92]

The lack of a clear statement of the required level of water security makes it difficult to plan to meet that level of security. It also makes it hard to assess whether supply or demand proposals will meet the required level of water security.

For the purposes of the inquiry, the Commission adopted ACTEW's interpretation of the objective, which is that for any year over the modelled period, there should be less than a 5% probability of any level of temporary water restrictions. This matter is discussed further in chapter 8.

4.1.2 The ActewAGL model

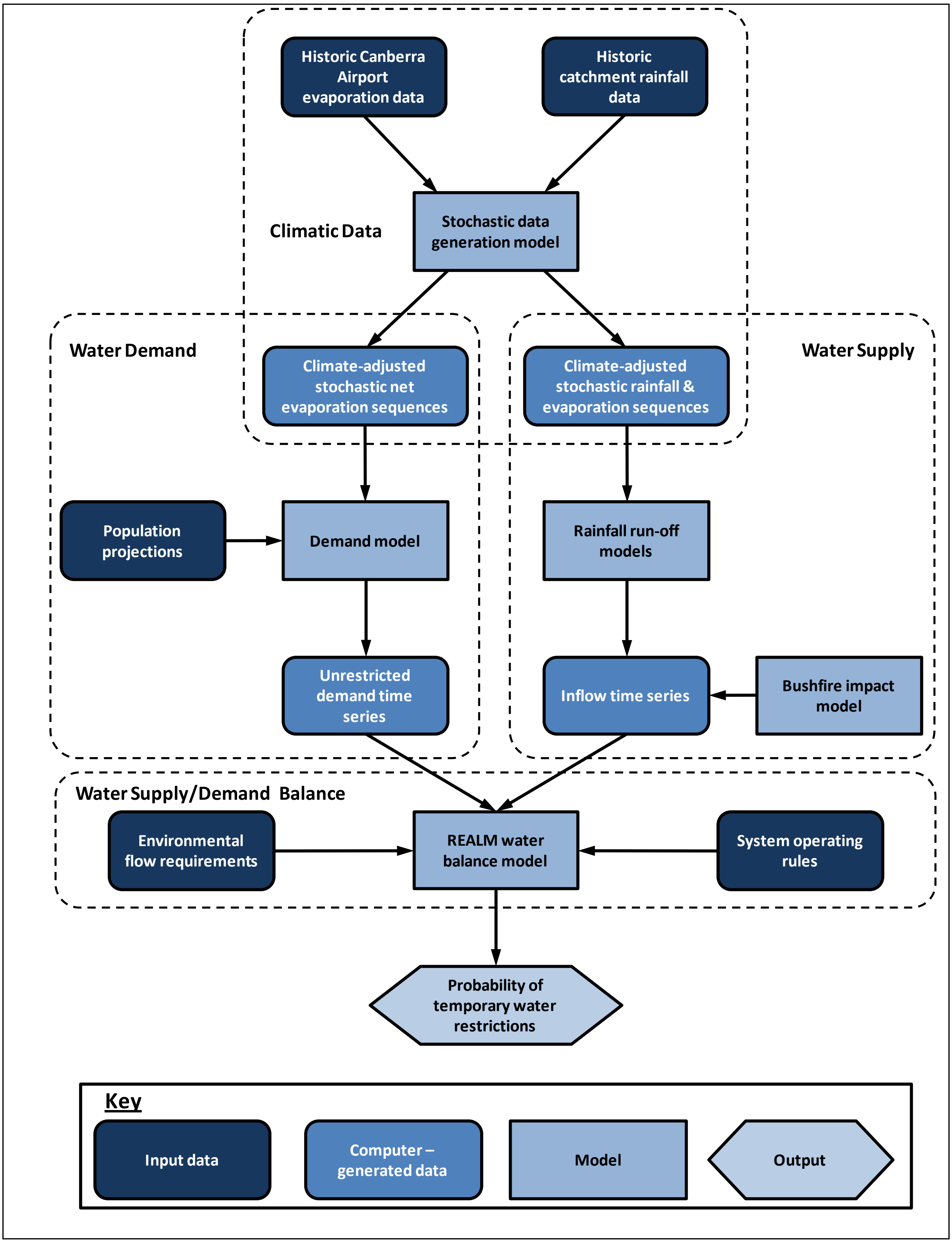
The Commission has utilised the ActewAGL water supply and demand model for the purposes of the inquiry. The Commission thanks ACTEW and ActewAGL for running the model on the Commission's behalf. While the model is not ideally suited to the purposes to which the Commission has put it, the results from the model have, nevertheless, made a valuable contribution to the inquiry. The model is illustrated in figure 4.1 and summarised in Appendix D.

As a simplification, the bucket analogy of the ACT water supply system introduced in chapter 2 can be used to describe the water supply and demand modelling process undertaken in this chapter.

To recap, the ACT primary water supply system is analogous to a bucket of water. Water flows into the bucket via precipitation falling in ACT catchments. Water is removed from the bucket for urban use and environmental flows. The bucket is required because of a timing mismatch between when water is available to flow into the bucket and when it is required for use. The challenge is to ensure that there is sufficient water in the bucket (water supply) to provide the amount of water required for urban use and environmental flows (water demand) over time. Ensuring that the water supply and demand are in balance is known as providing water security.

[92] ICRC (2010), p. 10.

Figure 4.1: ActewAGL water supply and demand model representation



Source: Adapted from ACTEW (2011), p. 2.

The desired level of water security can be expressed in several ways. A common approach is for a government to set a level of service, such as supplying a minimum volume of water per household each year, that a water provider is required to meet over a future period of time. As discussed earlier, the ACT Government has adopted an alternative approach, announcing an objective that temporary water restrictions occur no more than one year in 20, or 5% of the time. The level and duration of water restrictions depends on the level of water in the bucket. The lower the level, the more severe and the longer the restrictions will be in place.

In this chapter, the current level of ACT water security is estimated by starting with the existing full bucket, and then modelling the projected flows of water into and out of the bucket every year over the next 45 years—over the modelling period from 2012 to 2056.

There is a great deal of uncertainty about future climatic conditions. For example, we do not know the timing, extent or duration of a future dry spell that may require temporary water restrictions to be imposed. Modelling this uncertainty requires assessing the relative frequency of the future range of climatic conditions—wet, dry and average—based on historical climate experience, with allowance made for future impact of climate change. Given these relative frequencies, the model generates a set of 200 climate paths, each of which specifies the climate in each of the years of the modelling period.

As discussed earlier, future water inflow volumes are dependent on climatic conditions and the state of the ACT water catchments. Accordingly, for each of the generated future climate paths, the model generates a corresponding path of future dam inflows, allowing for bushfire effects on water catchments. Future outflows from the bucket are largely determined by the demand for water by the ACT community. This in turn is influenced by a number of factors, including population growth, weather conditions (including climate change), efficiency of water use and the price of water. Again, for each generated climate path, future water demand for each year is modelled by estimating per capita water demand based on previous experience, and multiplying this number by the projected population for that year to give total demand in that year.

Each pair of supply and demand paths is input to the water balance module of the model, REALM, in turn. REALM models the management of the dam system and is able to indicate, month by month, whether the level of water in the bucket has fallen enough to require the imposition of water restrictions. For each year of the modelling period, the proportion of the paths in which water restrictions needed to be imposed gives us an estimate of the probability of being in water restrictions in that year.[93]

This estimated probability of being in water restrictions can be compared to the 5% ACT Government water security objective. If the probability starts trending above the 5% level, this indicates that augmentation of the bucket may need to be delivered around this time if water security is to be maintained at the set objective.

It is important to note that meeting the ACT Government's water security objective does not imply that the ACT will never be in water restrictions over the modelling period. Rather it implies that the probability of being in water restrictions in any given year over this period is no more than 5%. Thus, the statement that the ACT is water secure means that water restrictions may be imposed but only rarely.

[93] The technique described here is often referred to as Monte Carlo simulation.

4.2 ACTEW baseline model run

4.2.1 ACTEW baseline assumptions

This section provides a summary of the key variables that ACTEW has adopted for its baseline model run and how they are applied in the model. This section draws heavily on ActewAGL (2011), which reviews the key assumptions and variables used in the ActewAGL model.[94]

4.2.1.1 Water supply infrastructure

ACTEW's baseline water supply infrastructure assumptions include:

- current primary water infrastructure—such as the Corin, Bendora and Googong Dams, upgraded Mt Stromlo and Googong Water Treatment Plants and the Murrumbidgee Pump Station
- a 78 GL Enlarged Cotter Dam to start filling from September 2012
- a 100 ML/day capacity M2G pipeline from July 2012
- the ability to release up to 11 GL/a of water from Tantangara Dam and transfer it to Googong Dam via the M2G pipeline from May 2014.[95]

4.2.1.2 Climate variability and climate change

In 2003 CSIRO produced climate change projections for the ACT for 2030 and 2070 relative to the 1990 climate (CSIRO 2003). Table 4.1 shows the range of projections for temperature, rainfall and evaporation.

Table 4.1: CSIRO climate projections for the ACT

	Change relative to 1990	
Climate variable	2030	2070
Average annual temperature (ºC)	+0.4 to +1.6	+1.0 to +4.8
Average annual rainfall (%)	–9 to +2	–29 to +7
Average annual evaporation (%)	+1.4 to +9.1	+3.8 to +28.0

Source: CSIRO (2003), pp. 9–10.

For baseline modelling purposes, ACTEW assumes climate change has already occurred in the ACT, and adopts the worst-case (the dry case) 2030 climate projections—a 9% decrease in annual average rainfall and a 9.1% increase in annual average evaporation, scaled over the seasons. ACTEW makes this assumption on the basis that water inflows experienced over the last 17 years (1994 to 2010) align closely with average inflows produced by the 2030 water resources model climate scenario. The climate change assumptions are applied in the model by adjusting the generated rainfall and evaporation path.

4.2.1.3 Environmental flows

Environmental flows are the flows of water in ACT streams and rivers that are necessary to maintain aquatic ecosystems. The ACT *Water Resources Act 2007* gives first priority to

[94] Available at www.actew.com.au.

[95] There is some uncertainty about the timing of the Tantangara option as the necessary water trade and transfer arrangements between the ACT and NSW governments are yet to be completed.

environmental flows with specific flow requirements set out in the 2006 Environmental Flow Guidelines.[96] The environmental flows are made either by releases or spills from ACT dams, or by putting restrictions on the volume of water that can be abstracted from a catchment. ACTEW's licence to take water under the Act requires ACTEW to ensure that environmental flows are given first priority in accordance with the guidelines. ACTEW's environmental flow requirements in relation to dam releases and water abstraction limitations are applied as constraints in REALM.

4.2.1.4 Bushfire impact

ACTEW assumes that the impact of the 2003 Canberra bushfires is reducing streamflow in ACT catchments due to increased evapotranspiration as vegetation recovers. Based on reports from environmental consultants, ACTEW assumes a maximum streamflow reduction of 15% about 17 years after the fires, with reduced inflows continuing for more than 50 years.

ACTEW applies the bushfire assumptions by using a bushfire impacts model to reduce the inflow levels on the paths generated by the rainfall run-off models. The potential for future bushfires to reduce streamflows over the future is also factored into the bushfire impacts model.

4.2.1.5 Population growth

The future population of Canberra and Queanbeyan is a key driver of future water demand. In 2008 the Australian Bureau of Statistics (ABS) released high, medium and low population growth projections for the ACT for the period June 2006 to June 2056.

ACTEW has adopted the ABS high series for baseline modelling purposes on the basis that observed population growth has tracked above the high series since its release and it is prudent to plan for high population growth given the long lead times to construct water supply infrastructure.[97]

The high series population numbers are listed in table E.1 in Appendix E with a summary in table 4.2. The population projections also include a Queanbeyan population projection series and an allowance for additional cross-border water supply to other nearby NSW areas (such as Murrumbateman and Yass).[98] Based on these assumptions, the high series serviced population is projected to reach 500,000 by 2024 and rise to about 772,000 by 2056.

Table 4.2: ACTEW population projection assumptions

Year	ACT	Queanbeyan	Other areas of NSW	Total population serviced
2012	368,100	41,740	0	409,840
2016	393,700	44,643	6,575	444,918
2026	462,500	52,445	7,724	522,669
2036	533,000	60,439	8,902	602,341
2046	605,300	68,638	10,109	684,047
2056	683,200	77,471	11,410	772,081

Source: ActewAGL (2012a), p. 8.

[96] ACT Government (2006). The 2006 Environmental Flow Guidelines are currently under review. The draft 2011 Environmental Flow Guidelines are currently open for comment on the Environment and Sustainable Development Directorate website at www.environment.act.gov.au/water/act_water_resources/environmental_flows.

[97] ActewAGL (2011), p. 7.

[98] The Queanbeyan population is expected to grow at the same rate as the ACT population.

4.2.1.6 Water conservation and restriction measures

The ACT has recourse to two administrative schemes, administered by ACTEW and approved under the Utilities (Water Conservation) Regulation 2006, to reduce water use by ACT and Queanbeyan residents, and therefore extend supply: permanent water conservation measures (PWCM) and a temporary water restrictions scheme.[99]

In practice, PWCM and temporary water restrictions can be considered as one extended suite of administrative demand-reduction measures. PWCM always apply, with Stages 1 through 4 temporary water restrictions progressively imposing more stringent water reduction measures over and above the PWCM requirements.[100] ACTEW has responsibility for the decision to implement temporary water restrictions. ACTEW takes a number of factors into account in making the decision to introduce and lift the various restriction stages. These include dam storage levels, climate outlook and community considerations. For modelling purposes, REALM has dam storage level triggers that introduce and remove restrictions which vary seasonally and increase with time as demand increases. To minimise continual restriction level changes, the removal trigger levels for each stage are 10% to 20% higher than the introduction trigger.

4.2.1.7 Demand

For baseline modelling purposes, ACTEW purposively factors in a 25% reduction in per capita primary water use by 2023 compared to 2003 consumption levels in line with the TWAW target. The reduction is applied linearly from 8% in 2005 to 25% by 2023. ACTEW assumes that enhanced PWCM, which have been in place since November 2010, will remain in place and contribute to the 25% reduction target.

4.2.1.8 Water security objective

In order to analyse its modelling results against the ACT Government's water security objective, ACTEW has interpreted the objective to mean that for any year over the modelled period there should be less than a 5% probability of any level of temporary water restrictions.

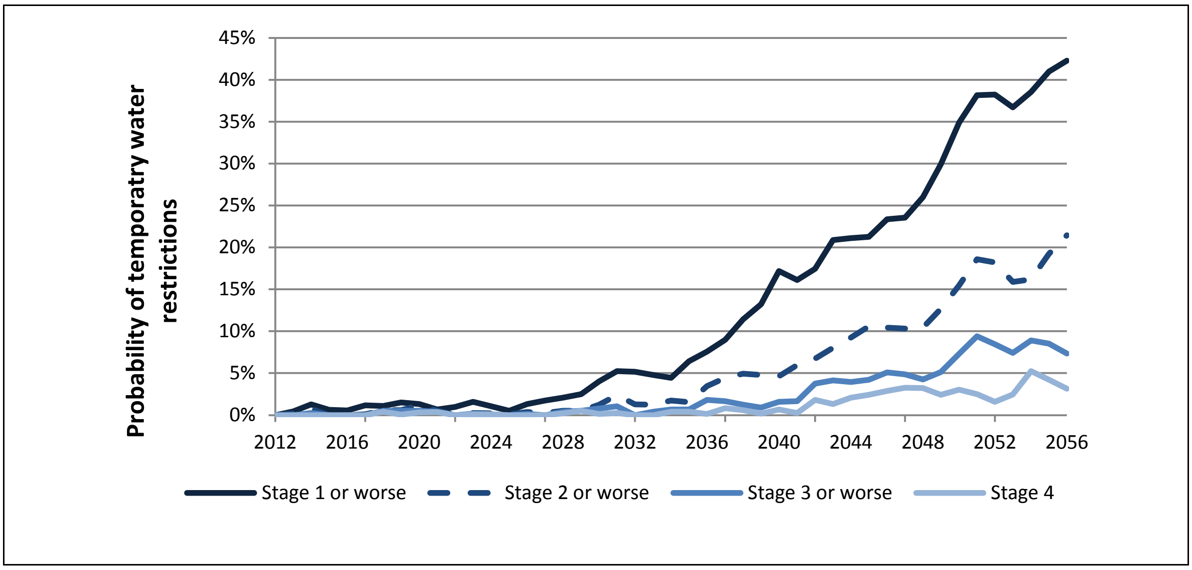
4.2.2 ACTEW baseline results

The probability of temporary water restrictions under the ACTEW baseline is illustrated in figure 4.2. This shows that the probability of experiencing Stage 1 or worse restrictions is likely to meet the ACT Government's 5% target for about the next 20 years, up to about 2031. Beyond this period the probability is likely to rise, suggesting that additional augmentation or demand reduction would be required to meet the target.

[99] Made under the *Utilities Act 2000*.

[100] More detail on PWCM and temporary water restrictions is provided in Appendix F and on the ACTEW website: www.actew.com.au.

Figure 4.2: ACTEW baseline—probability of temporary water restrictions



Note: The fluctuations in the probabilities of being in various stages of water restrictions towards the end of the modelling period are a product of the sampling variability associated with the limited number of stochastic paths (200). If the number of paths were much larger (say 10,000), the curves of the probability of being in water restrictions would be smoother.

Source: ActewAGL (2012a), p. 14.

4.3 Commission baseline model run

For the purposes of the inquiry, the Commission has established a baseline model run using the ActewAGL water resources model. To test sensitivity, the Commission baseline is run with medium and high population growth assumptions. Other scenarios, discussed in section 4.3.2.2, are also run to examine the effect on water security, in comparison to the Commission baseline, of adding a secondary supply source under different population growth assumptions. The Commission baseline and scenarios are listed in table 4.3.

Table 4.3: Commission modelling scenarios

1 Commission baseline (with medium series population growth)
2 High series population growth
3 Baseline with 1.2 GL stormwater
4 High growth with 1.2 GL stormwater
5 Baseline with 2.9 GL stormwater
6 High growth with 2.9 GL stormwater

4.3.1 Commission baseline assumptions

For its inquiry baseline the Commission has adopted the ACTEW baseline assumptions set out in section 4.2.1 in respect of water supply infrastructure, climate change, environmental flows, bushfire impact and the ACT Government’s water security objective. The Commission also assumes that PWCM remain in place. The Commission’s baseline assumptions differ from ACTEW’s in respect of population growth rate and water demand assumptions.

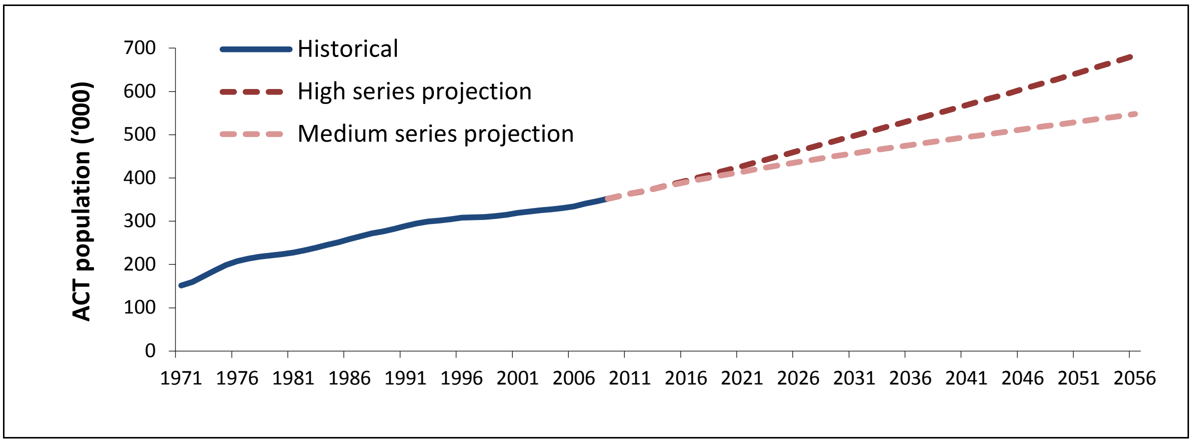
4.3.1.1 Population

ACTEW adopts the high ACT ABS population growth series for its baseline case. It applies the high series growth rate to the Queanbeyan population and includes an allowance for other nearby

NSW residents. This projects a total ACT and Queanbeyan serviced population of about 772,000 by 2056, with the ACT component comprising about 683,200.

In 2011 the ACT Government released 2009 to 2059 population projections for the ACT. These projections were based on the ABS medium series growth projections, and project an ACT population of about 547,000 by 2056. The scale of difference between the two series, which increases substantially in the outer years, is illustrated in figure 4.3. The difference between the two series is further illustrated in figure 4.4 by reference to the respective ten-year average growth rates.

Figure 4.3: ACT historical and projected population—high versus medium growth



Source: ACT Government (2011c); table E.1.

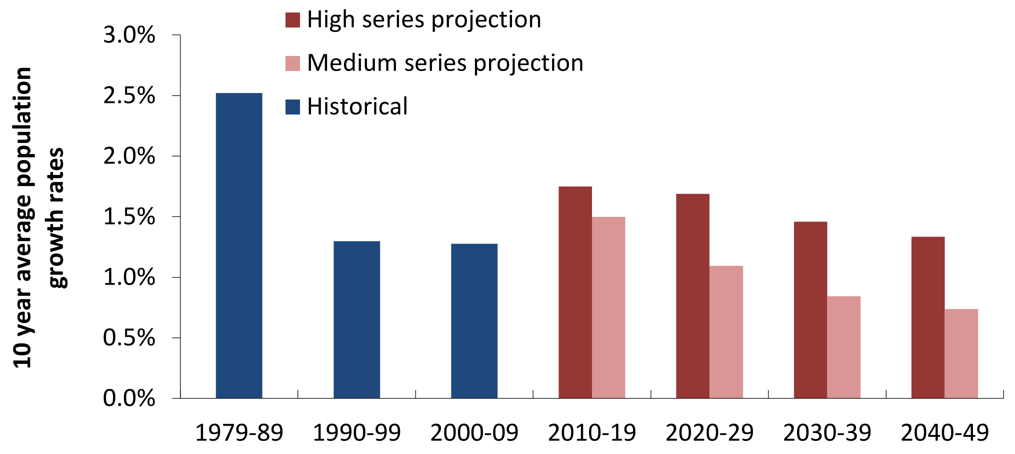
The Commission notes that ACTEW has adopted the ABS high series on the basis that observed population growth has tracked above the high series over the 2007 to 2010 period and that ACTEW considers it is prudent to plan for high population growth given the long lead times to build water supply infrastructure.

While recent population growth may have tracked the high series, it is evident from figure 4.4 that the high series assumes growth rates into the future well above historical growth rates over the last 20 years. The Commission's view is that assuming that a high growth rate will continue unabated into the future may be overly conservative from a planning perspective and result in augmentation or demand-management decisions being made prematurely.

On this basis, and consistent with the ACT Treasury's approach, the Commission has adopted the ABS medium growth series for its baseline. To test sensitivity and provide insight into the effect of population growth on water security, the Commission has run modelling scenarios with the high population series. The medium and high population growth series areas used in this analysis are listed in tables E.2 and E.3 in Appendix E with a summary in table 4.4.

In addition, the Commission has not included a population allowance for additional cross-border supply given the uncertainty of ACTEW supplying additional water to areas such as Yass or Murrumbateman in the future.

Figure 4.4: ACT historical and projected population ten-year average growth rates



Source: ACT Government (2011c); table E.1.

Table 4.4: Commission population projection assumptions

	Medium growth			High growth		
Year	ACT	Queanbeyan	Total population serviced	ACT	Queanbeyan	Total population serviced
2012	360,400	41,633	402,033	368,100	42,522	410,622
2016	377,000	43,550	420,550	393,700	45,480	439,180
2026	416,500	48,113	464,613	462,500	53,427	515,927
2036	450,800	52,076	502,876	533,000	61,571	594,571
2046	480,600	55,518	536,118	605,300	69,923	675,223
2056	509,300	58,834	568,134	683,200	78,922	762,122

Source: ActewAGL (2012b), p. 5.

4.3.1.2 Demand

The Commission baseline water demand assumptions differ from the ACTEW baseline in two respects.

The first difference relates to ActewAGL's demand model. The Commission's view is that the ActewAGL demand model overestimates per capita demand. This is because it is calibrated to the 1993–2002 period and does not reflect the reduced per capita demand patterns evident in this decade. Per capita consumption has fallen substantially from the 1993–2003 period and has not risen since the removal of restrictions in 2010.

ActewAGL recognises this issue, stating that 'it may no longer be best practice to scale 1993–2002 demand behaviour to estimate current and future demand',[101] and has indicated that it is currently investigating options to improve its demand modelling.

To remedy this, for the purposes of the inquiry, the Commission has adjusted the model to better reflect more recent per capita demand patterns. The Commission's adjusted demand model on

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[101] ActewAGL (2012a), pp. 4–5.

average generates per capita demand volumes approximately 25% less than the ActewAGL demand model.

Second, it is the Commission's view that the TWAW 25% target reduction in per capita water consumption by 2023 is likely to be achieved by 2012–13, with reduced consumption levels expected to be maintained into the future. In its submission to the inquiry, ACTEW supports this conclusion, stating that:

> Recent modelling by ActewAGL has indicated that the ACT has already exceeded a 25 per cent reduction with current changed behaviours.[102]

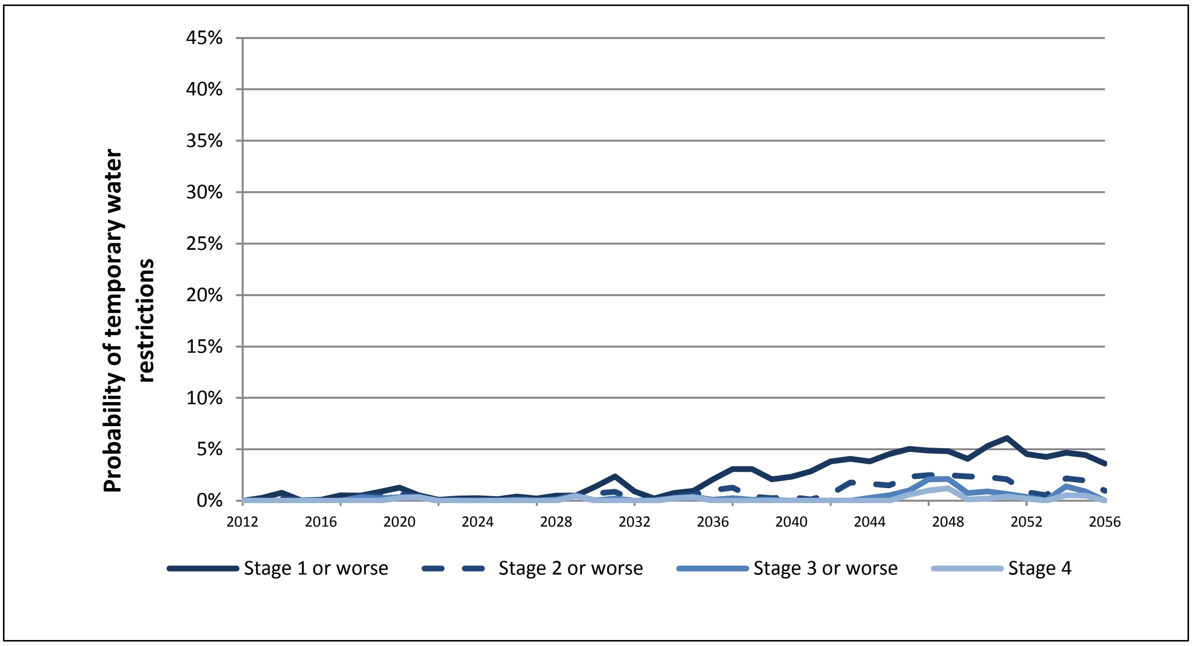
In the Commission baseline, ACTEW's linear reduction in per capita primary water use over the 2005 to 2023 period is redundant and is not included. Appendix G provides more detail demonstrating how the TWAW target has been met, and discusses the reasons why it is unlikely that per capita water consumption will increase in the future.

For modelling purposes, the per capita demand is calculated using the Commission's adjusted demand model which is then multiplied by the serviced ACT and Queanbeyan population to calculate the total water demand.

The net effect of the two changes described above is that the Commission's baseline per capita consumption is lower than the ACTEW baseline until 2023, which is the date by which ACTEW has factored in the full 25% TWAW reduction. From this date onwards the per capita figures are similar.

4.3.2 Commission baseline results

Figure 4.5: Commission baseline—probability of restrictions



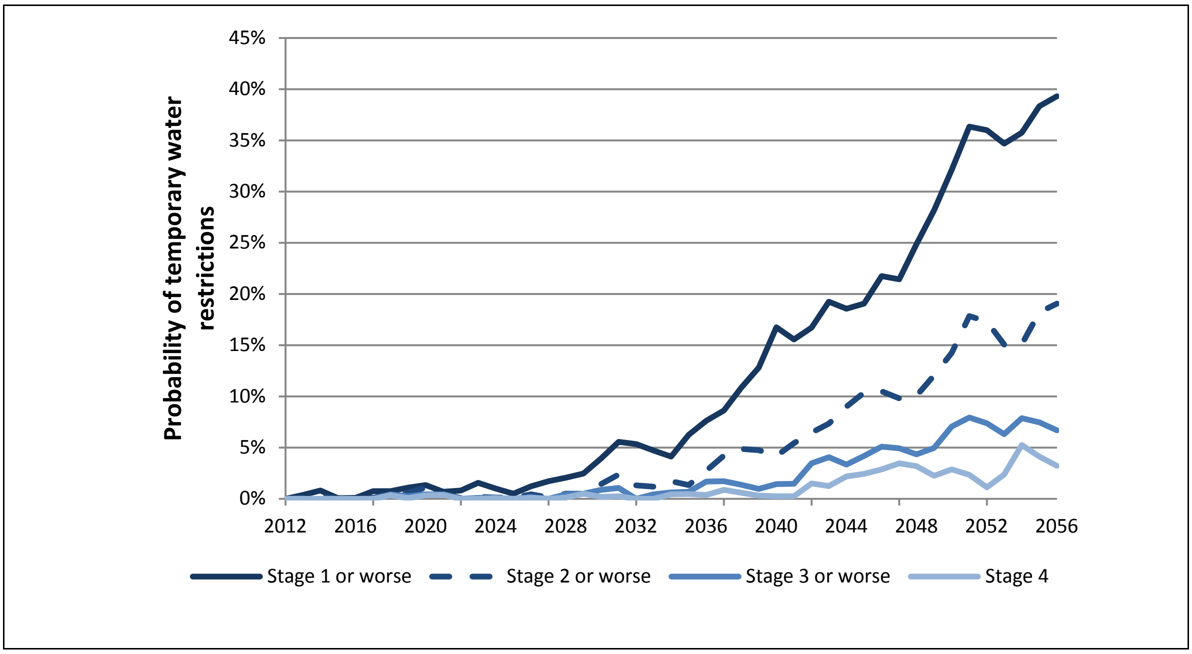
Source: ActewAGL (2012b) figure 4, p13.

The probability of temporary water restrictions under the Commission baseline is illustrated in figure 4.5. The results show that the probability of Stage 1 or worse restrictions is likely to meet

[102] ACTEW (2012b) p6.

the 5% target for more than the next 30 years, up to about 2045. To show sensitivity, figure 4.6 illustrates the probability of restrictions with the more conservative (from a planning perspective) high rather than medium growth assumption. This assumption reduces the period under which the ACT water security target is likely to be met to about the next 20 years, in line with the ACTEW baseline result.

Figure 4.6: Commission high growth—probability of restrictions



Source: ActewAGL (2012b), figure 4, p. 13.

4.3.2.1 Main conclusion

In summary, when measured against the ACT Government's water security target, and based on the ActewAGL model assumptions, the ACT is likely to be water secure for at least the next 20 years in the most conservative case, and for the next 35 to 40 years under a medium population growth assumption. This suggests that, even taking into account long lead times for water supply augmentation planning, the ACT does not need to consider undertaking further primary water supply augmentation investments now.

ACTEW supports this conclusion in its submission to the inquiry issues paper stating that with the 'current investments in water security almost completed, it is not necessary from a water security perspective to pursue additional investment'.[103]

Draft finding 4.1

The ACT is likely to be water secure for at least the next 20 years with existing primary water infrastructure when measured against the ACT Government's water security objective.

It is important to note that the above conclusion derives from a 2012 assessment of the capacity of the ACT water system to meet future ACT community water needs. Future assessments may arrive at a different conclusion, depending on the circumstances and information available at that time. This highlights the need for an integrated and adaptive water supply and demand planning

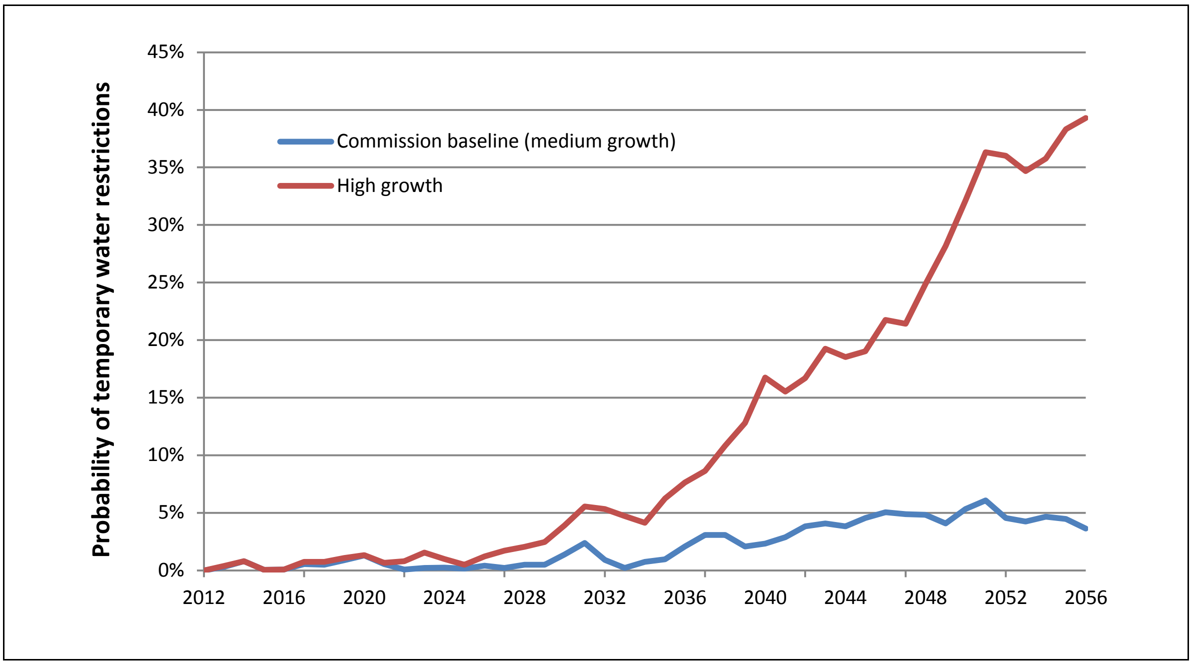
[103] ACTEW (2012b), p. 12.

approach that undertakes a rolling assessment of the capacity of the ACT water supply system to meet future community needs. This concept is developed further in chapter 8.

4.3.2.2 Impact of population growth assumptions

Figure 4.7 illustrates the comparative difference in the probability of Stage 1 or worse restrictions between the Commission baseline and the high population scenario. It is clear that the population growth rate assumption is a key water security driver. Assuming a medium rather than high population growth rate is likely to delay the need for additional supply augmentation or demand-management measures by a further 20 years.

Figure 4.7: Commission baseline versus high population growth—probability of Stage 1 or worse restrictions



Source: ActewAGL (2012b), figure 6, p. 14.

4.4 Valuing the contribution of public secondary water schemes to ACT water security

From a water supply and demand planning perspective, public and private secondary water options contribute to water security in different ways. Public schemes, from any secondary water source, which are under the control of the ACT Government or ACTEW, can be viewed as supply-side measures that add supply to the primary dam system.

Private household and corporate local-scale initiatives, on the other hand, are better considered as a reduction in demand on the public supply. This is because it is difficult to assess the potential water yield from such initiatives as there is limited information on how the systems are used, whether they are properly maintained, and whether an initiative is substituting or supplementing primary water use.

For the purposes of the inquiry, this section assesses the water security benefits to the ACT community of public secondary water initiatives. Further to the discussion in section 2.4, this assessment is made from two perspectives: long-term and short-term.

The former approach models the potential benefits of public secondary water initiatives in postponing the need to make further investments in augmenting the primary water system. The latter discusses the potential benefits of secondary water as part of a short-term strategy to respond to periods of unusual climate, like a prolonged drought.

This long-term and short-term water supply and demand planning dichotomy is further developed in chapter 8.

4.4.1 Long-term perspective

For the purposes of the long-term assessment, the Commission asked ACTEW and ActewAGL to model two secondary water supply scenarios based on the CIUWP stormwater harvesting scheme. Time and information constraints did not permit more extensive modelling.

4.4.1.1 Assumptions

Two stormwater harvesting scenarios were modelled:

- a 1.2 GL/a network notionally consisting of the Inner North, Weston Creek and Tuggeranong pilot networks discussed in section 3.2.1.2
- a larger 2.9 GL/a stormwater network notionally consisting of the pilot plus Lake Ginnindera.

The two stormwater scenarios are modelled on a ‘twin-tap’ basis. That is, all end-users have access to the primary water supply when stormwater is not available to meet modelled irrigation demands. The Commission understands that this is how the stormwater network is intended to work in practice. Further detail on the underlying modelling assumptions is provided in Appendix H.

4.4.1.2 Stormwater results

Under the climate paths generated by the model described above, the stormwater ponds delivered an average of 87% and 85% of their demand, for the pilot and expanded pilot, respectively. This ratio is sometimes referred to as the volumetric reliability. More detail is provided in table 4.5.

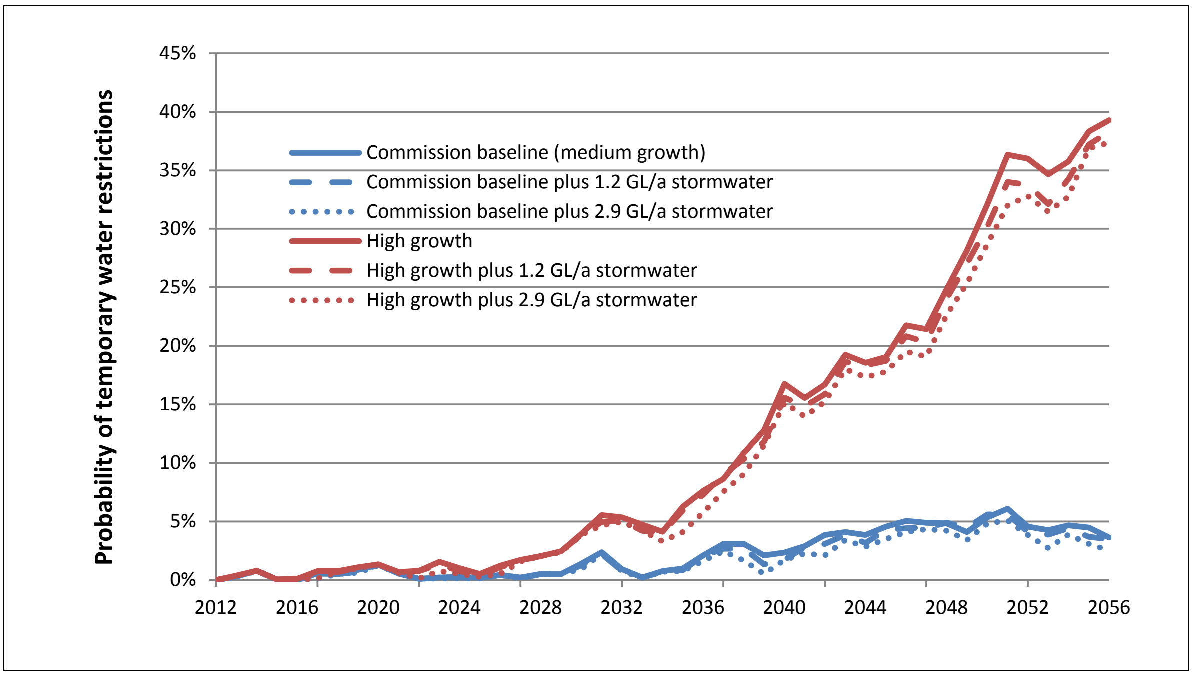
Table 4.5: Modelled reliability of stormwater scenarios

	Pilot	Expanded pilot
Mean supply (GL/a)	1.04	2.46
Mean demand (GL/a)	1.19	2.88
Volumetric reliability	87%	85%

Source: ActewAGL (2012b), p. 9.

Figure 4.8 illustrates the comparative difference in the probability of Stage 1 or worse restrictions between the Commission baseline and high population growth and additional stormwater scenarios.

Figure 4.8: Commission baseline versus stormwater scenarios—probability of Stage 1 or worse restrictions



Source: ActewAGL (2012b), figure 6, p. 14.

The stormwater scenarios effectively add extra supply to the Commission baseline and high growth scenarios over the modelling period by leaving more water in the primary dams that is available for future use. This is likely to marginally extend the probability of exceeding the 5% water security target in the high population growth case, and by about four years in the Commission baseline medium growth case.

From a long-term water security perspective, the water left in the primary water supply dams by the stormwater schemes is of limited value now, for two reasons.

First, the primary water bucket is full, which means any extra water provided by the stormwater scheme is likely to result in more water flowing over the dam spillways. As discussed in section 2.4, the only saving from providing an extra kilolitre of stormwater under these circumstances is the cost of treating primary water and reticulating it to end-users, known as the marginal cost. This cost saving is very small, about $0.30/kL, and would need to be considered against the cost of providing the secondary water.[104]

Second, the value of the stormwater in postponing the next investment in the primary water supply system is low, as the time at which such an investment is due is far distant, given the ACT's current water security outlook demonstrated in section 4.3.2.1.

The above argument applies equally to any proposed public secondary water initiative, irrespective of the source of the secondary water.

The foregoing implies that there is little immediate value to the ACT community from a water security perspective in the ACT Government pursuing additional secondary water initiatives,

[104] See section 5.2 for more information.

including broadscale secondary water proposals such as those proposed in the ACT Non-potable Water Master Plan Study.[105]

Draft recommendation 4.1
Given the current water security outlook, the ACT Government should not undertake further secondary water investments now. However, the Inner North pilot stormwater reticulation trial needs to be fully evaluated.

It is important to note two further points. First, the value of a kilolitre of secondary water will vary over time depending on how full the primary bucket is and how close we are to the next investment in augmenting the bucket. The recommendation above derives from a 2012 assessment of the capacity of the ACT water system to meet future ACT community water needs. Future assessments may arrive at a different conclusion, depending on the prevailing situation and the value of a kilolitre of secondary water then.

Secondly, it is also important to draw attention to the question of the reliability of stormwater harvesting, which is yet to be operationally tested in the ACT. As discussed in chapter 2, stormwater draws its supply from the same source as the primary water system, which is natural precipitation. It follows that low precipitation will mean low inflows to both systems. It is for this reason that stormwater schemes require primary water backup, that is a ‘twin-tap’.

If primary water backup is required when stormwater ponds fail, which is more likely during extended hot and dry periods, the question that arises is whether stormwater schemes provide any benefit in postponing primary water augmentation decisions. In its submission to the inquiry issues paper, ACTEW stated that:

> ACTEW must design its network to meet peak demand and security during summer and the worst predicted drought. If stormwater users start to use potable water during summer and/or droughts when stormwater supply is jeopardised, there would be no savings in ACTEW infrastructure costs.[106]

The reliability of stormwater harvesting is discussed in more detail in section 7.2.2.

4.4.2 Short-term response

As discussed in section 2.4, secondary water initiatives may have a potential role to play as part of a short-term strategy to respond to periods of unusual climate, like a prolonged drought. While the likelihood of such an event may be assessed as low, should the event occur the severity of its consequences make it desirable to have a strategy to limit those consequences.

The Commission’s view is that the role secondary water initiatives may play as a short-term response measure depends on two key characteristics. The first is that the initiative must be capable of being implemented quickly. This will rule out any new secondary water initiative that requires large-scale construction.

The second is that the supply of water for the initiative should be reliable, and in particular the source of that water should not be correlated with that of the primary water supply system it is intended to augment. For the reasons discussed earlier, subject to further operational testing, this

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[105] AECOM (2011). Discussed further in section 3.2.1.2.

[106] ACTEW (2012b), p. 10.

may rule out stormwater harvesting. In contrast, options relying on treated sewage effluent as a secondary water source are likely to more reliable.

4.4.3 A cautionary note

A final note of caution should be applied in relation to the uncertainty inherent in the modelling undertaken in this chapter and therefore the conclusions drawn from the modelling results.

As noted by ActewAGL, water supply planning involves a great deal of uncertainty around many of the key assumptions.[107] This includes future population growth, per capita demand patterns, and future ACT climate patterns in the face of climate change. While the ActewAGL water resources model attempts to deal with uncertainty through stochastic modelling processes, conservative assumptions and sensitivity analysis, the fact remains that the model is not intended to predict, for example, the likelihood of a multi-year drought (or a long string of very wet years) starting from next year.

Because the ActewAGL water resources model was developed with a major focus on managing the system of dams in the ACT, it is not well adapted to provide the kind of modelling that will be required to underpin the strategic approach to managing water security in the ACT recommended in chapter 8. Therefore, developing a more appropriate model, built on the foundations provided by the ActewAGL modelling work but with richer and more flexible modelling of climate, should be a priority. Such a model would be capable of giving a more complete and accurate representation of the performance of the various secondary water options under various climate scenarios.

Nevertheless, should the ACT face another drought, with full storages (even with the ECD still under construction), operational improvements such as the upgraded Mt Stromlo Water Treatment Plant, the ability to pump water directly from the Murrumbidgee River, the Tantangara Transfer Project, and lower per capita demand patterns, the ACT is in a much better position to deal with it.

[107] ActewAGL (2011).

5 Public secondary water options assessment

The analysis in chapter 4 demonstrated that there is no need for the ACT Government to pursue additional water supply investments given the current level of security of supply. It follows that there is no current need to undertake a comprehensive assessment of additional secondary water supply options.

Nonetheless, there is value in considering the economic, environmental and social costs and benefits of the various current and committed ACT water initiatives now to gain an insight into the likely trade-offs associated with potential future water options. This consideration also addresses the terms of reference requirement for the Commission to include consideration of the 'economic, environmental and social costs and benefits' of various secondary water options.

Moreover, as discussed earlier, the value of water varies over time and an options assessment today will not necessarily result in the same conclusions as an assessment at a later date. As such, it is important to undertake such an assessment at the appropriate time in relation to when the next water supply investment is due, to ensure that options are valued on the basis of pertinent information. This further highlights the need for an integrated and adaptive water supply and demand planning approach, revisited regularly as circumstances evolve and new information becomes available, a concept developed further in chapter 8.

Based on the differentiation between public and private secondary water sources discussed earlier, this chapter focuses specifically on the public secondary water initiatives identified in section 3.2.1.

Given the ongoing role that ACTEW's primary water supply network will play in the future of the ACT's water supply, this chapter also assesses the costs and benefits of water from this source. Therefore, the options analysed in this chapter are those shown in table 5.1. The Commission has selected these options for more detailed analysis on the basis of their relevance and availability of information.

Table 5.1: Public water source options for cost and benefit consideration

Option	Source of supply	Description	Average volume
ACTEW's reticulated water supply	Primary water	ACTEW's existing primary water supply network	56 GL/a
Southwell Park Sewer Mining Project (now decommissioned)	Treated sewage	Sewer mining demonstration plant	0.20 GL/a
North Canberra Water Reuse Scheme (NCWRS)	Treated sewage	Treatment plant supply for irrigation	0.19 GL/a
LMWQCC Effluent Reuse Scheme	Treated sewage	Treatment plant supply for irrigation	0.25 GL/a
Inner North Stormwater Reticulation Pilot[a]	Stormwater	Inner North CIUWP	0.46 GL/a

Note: The Inner North was selected for analysis purposes on the basis of being more advanced, with more current cost information available, than the Weston Creek and Tuggeranong pilot networks.

5.1 Assessment approach

As discussed in section 2.5, the public water options shown in table 5.1 are assessed from a community benefit perspective. In a practical sense, this approach can be thought of as asking the following questions from a community perspective for each option:

- What is the cost to the ACT community of water supplied by the option?
- What is the contribution of the option to the ACT community's water security?
- What are the other economic costs and benefits to the ACT community?
- What are the environmental costs and benefits to the ACT community?
- What are the social costs and benefits to the ACT community?

As discussed earlier, the ACT community's primary water storages are full and the augmentation works underway currently are likely to provide the required level of water security for the next 20 years.

The Commission has adopted a two-stage approach to comparing public secondary water options. The first is a cost-effectiveness analysis. A broader range of economic factors than cost-effectiveness, as well as environmental and social factors, is then considered on a more qualitative basis.

The main benefit of a cost-effectiveness analysis is that it allows a quantitative comparison of options in terms of their contribution to meeting a specific common goal or objective. The overarching objective in this case is to improve the ACT's water security (by supplying water to the ACT community). As such, the ACT primary water supply system and public secondary water supply initiatives can be assessed in terms of meeting the ACT community's water security objective at least cost.

With specific reference to the CIUWP, the Commission understands from discussions with ESDD that the stormwater ponds associated with the CIUWP were primarily constructed for water quality improvement rather than secondary water supply purposes. On this basis, the Commission has excluded the ponds themselves from the options assessment in this chapter. For example, the cost of the ponds is excluded from the cost calculation in the cost-effectiveness analysis, as are any water quality or microclimate and biodiversity outcomes in the broader economic, environmental and social consideration.

5.2 Cost-effectiveness analysis

5.2.1 Basis for comparing costs

In considering the appropriate basis for comparing the costs of supplying water from various initiatives, the key consideration is whether to include the cost of capital together with the operating and maintenance costs in the comparison. This in turn depends on whether an initiative already exists, or is a proposed option that is yet to be constructed.

The capital investment in existing initiatives, such the ACTEW primary water supply system, has already been made and is therefore considered "sunk". Consequently expenditure on capital should not be included in a cost comparison. The average variable cost that ACTEW incurs in supplying water through the primary water system is a suitable proxy for its operating and maintenance costs.

In contrast, capital is yet to be expended on proposed options and should therefore be included in the cost comparison. The levelised unit cost (see below) of supplying water through a proposed option captures both the capital and operating and maintenance costs.

Therefore, with respect to the existing secondary water initiatives, the ACTEW primary water system, Southwell Park Sewer Mining Project, NCWRS and LMWQCC Effluent Reuse Scheme, average variable cost is the appropriate point of comparison given the 'sunk' nature of the infrastructure. While the Inner North stormwater reticulation pilot is largely complete, given its pilot nature it is considered as a proxy for possible future stormwater augmentations, and therefore the appropriate point of comparison is its levelised cost.

5.2.2 Calculating unit costs

Levelised unit cost is a common cost-effectiveness analysis tool used for least cost planning purposes. Levelised unit cost, usually calculated as the present value of the costs of an initiative divided by the present value of the water supplied (or saved in the case of demand-management measures), is widely used in the water industry. It enables a comparison of proposed water supply options on a unit cost basis where annual operating or maintenance costs are not constant, or water volumes supplied or saved vary over time.

Following Fane et al. (2003) and CSIRO (2009) the Commission has adopted the levelised unit cost formula set out below for the purposes of the inquiry.

$$LUC = \frac{PV(Costs\ in\ \$)}{PV(Water\ Supplied\ or\ Saved\ in\ kL)} = \frac{\sum_{t=0}^{n} \frac{C_t}{(1+r)^t}}{\sum_{t=0}^{n} \frac{Q_t}{(1+r)^t}}$$

Where LUC = levelised unit cost; PV = present value; C_t = costs in current dollars in year t; Q_t = volume of water supplied or conserved in kL in year t; t = year; r = discount rate.

This method is discussed further in Appendix I.

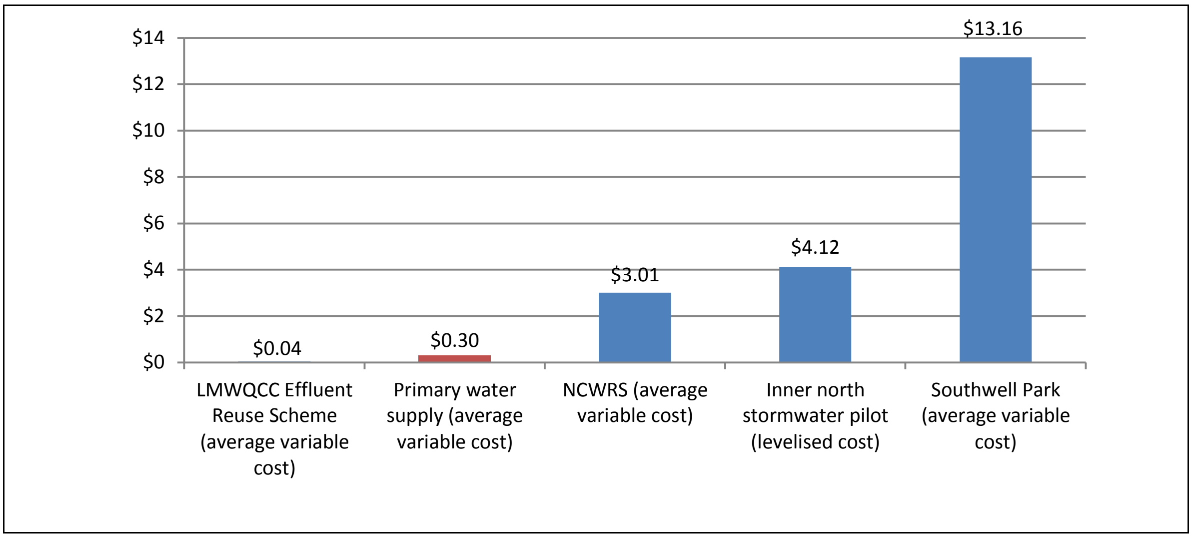
5.2.3 Cost-effectiveness results

For the purposes of the inquiry, the Commission engaged the Strategic Economics Consulting Group (SECG) to undertake an assessment of the costs of providing water through the primary water supply system and various public and private secondary water options. The SECG report is available on the Commission's website.[108]

Figure 5.2 summarises the current relative cost-effectiveness of the ACT primary water supply and current public secondary water initiatives. The estimated average variable cost of supplying water to the ACT community through ACTEW's primary water supply network is estimated at $0.30/kL. While higher than the cost of supplying water through the LMWQCC Effluent Reuse Scheme (which only supplies 250 ML/a to a small number of end-users), it is significantly lower than the costs of all other public secondary water options considered.

[108] SECG (2012), available at www.icrc.act.gov.au.

Figure 5.2: Cost effectiveness of current public water sources ($/kL)



Source: SECG (2012).

It is important to note three points with regard to the cost-effectiveness comparison made above.

First, as illustrated in table 5.1, the primary water system is the only current water supply source that can service the entire ACT community. All the current secondary water sources are small scale and can only supply a few customers.

Second, the comparison is made on the basis of existing ACT water supply sources. It is not a comparison of the costs that will apply when considering future water supply options to meet an impending supply gap. For example, the unit cost of any future expansion of the LMWQCC Effluent Reuse Scheme will be much higher to account for the cost of a pipeline network required to reach additional customers.

Third, the primary water supply system supplies potable water which can be used for potable and non-potable uses. This contrasts with the secondary water options which only supply water for non-potable purposes.

In conclusion, given the current water security outlook, the analysis above indicates that the ACT community's water supply can be most cost-effectively met through ACTEW's primary water supply network.

5.3 Broader economic, environmental and social considerations

Table 5.2 expands on the high-level questions set out in section 5.1 and details the specific criteria against which each option is considered. Each criterion is discussed in more detail below, before the range of options is considered in relation to each relevant criterion in section 5.4.

Table 5.2: Economic, environmental and social criteria

Factor	Criteria	Brief description
Economic	Water security	How and under what circumstances does the option contribute to water security of the ACT?
	Cost-effectiveness	What is the cost per kilolitre ($/kL) of water supplied by the option?
	ACT water sector impacts	Does the option have any impact on the efficiency of the ACT water sector?
	ACT wastewater sector impacts	Does the option have any knock-on impacts on the wastewater sector?
	ACT regulatory requirements	What are the implications of ACT regulatory arrangements for the option?
Environmental	Water quality impacts	Does the option have any impact on water quality?
	Environmental flows	Does the option draw water from the natural environment?
	Biodiversity and microclimate impacts	Does the option contribute to microclimate and biodiversity outcomes?
	Greenhouse gas emissions	Does the option lead to additional greenhouse gas emissions?
Social	Recreational and amenity value	Does the option contribute to recreational and amenity value?
	Community support and equity	Does the option have community support and contribute to equity across the ACT?
	Health and safety	Are there any health and safety concerns associated with the option?

5.3.1 Economic criteria

5.3.1.1 Water security

This criterion considers the potential contribution secondary water projects make to ACT water supply, water security and the efficiency of the primary water supply system. In the context of the ACT's current level of water security, as demonstrated in chapter 4, additional water sources currently provide limited value in terms of improved supply reliability or water security.

5.3.1.2 Cost effectiveness

This criterion is the cost-effectiveness comparison discussed in section 5.2.

5.3.1.3 ACT water sector impacts

The ACT community has an existing primary water supply system—the ACTEW water supply network—which supplies water to the ACT and Queanbeyan communities. The prices of water and wastewater services from the ACTEW network are set by the Commission using a building block methodology which assesses the efficient cost of service delivery and determines a pricing structure to allow ACTEW to recover its costs.

The introduction of alternative water supply providers has implications for the efficient operation of the primary water supply system and the price determination process administered by the Commission.

Where a secondary water provider is seeking to displace water that would otherwise have been supplied by ACTEW the efficiency of the ACTEW network will be reduced. Under the current regulatory arrangement this will result in water prices for ACTEW customers being higher than what they otherwise would have been.

In the event that a potential new water supply provider seeks to target delivery to a small number of high-volume water use customers and the regulatory regime allowed ACTEW to offer price discounts to prevent uneconomic bypass of its network, there would also be price impacts for all other customers.

These adverse efficiency and price effects would be mitigated where water is supplied to new customers whose demand had not been anticipated by ACTEW and where the provision of secondary water removes the need for ACTEW to undertake additional capital expenditure.

5.3.1.4 ACT wastewater sector impacts

As with water sector impacts, large-scale secondary water use can reduce the volume of water flowing through the sewerage network and lead to a range of knock-on economic impacts. These impacts include possible increases in unit costs of wastewater service provision as a result of reduced volumes.

In addition, impacts may include increases in the frequency of odours, associated blockages and therefore the need for additional investments to be undertaken due to reduced volumes of sewage. In its submission to the inquiry issues paper, ACTEW stated that due to 'low flows in the sewerage network due to water conservation, there has been an increase in the frequency of odour complaints, associated blockages and maintenance', which 'results in unplanned investments being initiated to address the odour' in the 'order of $1M per site and up to $3M if it is in a sensitive area'.[109]

ACTEW has also indicated that less water through the sewerage system can increase treated sewage effluent concentration levels—total dissolved solids—being discharged from the LMWQCC and Fyshwick Sewage Treatment Plant. ACTEW is required to meet certain environmental standards in relation to total dissolved solids and is currently close to licence limits.

A further consideration relates to the potential impacts on return flows from LMWQCC, Fyshwick Sewage Treatment Plant or Queanbeyan Sewage Treatment Plant that are available for use by downstream users. If the secondary water use replaces primary water use there will be no net impact on diversions by the ACT. However, if a secondary water initiative results in more water overall being used, there may be lower return flows.

5.3.1.5 ACT regulatory requirements

Proposed public secondary water initiatives will be required to be compliant with relevant ACT regulatory arrangements. For example:

- the initiative will need to meet ACT public health and environment protection regulations
- if the initiative provides a utility service for the purposes of the Utility Act, it will require a utility licence, with specific licence conditions, issued by the Commission
- secondary water initiatives that are government business activities will need to meet competitive neutrality requirements.

The costs and benefits of meeting these requirements need to be fully considered when developing secondary water initiatives.

5.3.2 Environmental criteria

5.3.2.1 Water quality impacts

This criterion relates to whether the option has any impact on water quality. Water quality is considered within the context of the water quality of the actual secondary water as well as any

[109] ACTEW (2012b), p. 11.

knock-on impacts on the quality of other water sources, such as reduced flows of sewage leading to increased levels of total dissolved solids.

5.3.2.2 Environmental flows

It is sometimes argued that secondary water sources and water recycling should be pursued on the basis that they reduce the draw on water from the natural environment compared to the primary water system.

Consideration of this issue involves a range of factors. First, as discussed in section 4.2.1.3, ACTEW is subject to detailed environmental flow requirements administered by the ACT Environment Protection Authority. These requirements ensure that water is only taken for consumptive purposes once adequate flows for the environment are secured. Environmental flows are designed to mimic the natural flows of the river systems and hence ensure minimal disturbance to the natural environment.

Second, the overall system-wide impacts of any recycling activities must be considered. For example, the ACT is part of the Murray–Darling Basin and as such water discharged from the ACT is available for use downstream. Chapter 3 illustrated that the ACT returns on average about 60% of the water it extracts for urban use.

Finally, there is a risk that the availability of secondary water may result in an overall increase in water consumption. That is, the opportunity to use secondary water may lead to consumption that would not have otherwise occurred.

As such, there are a number of factors that contribute to any analysis of the costs and benefits which may be ascribed to secondary water use and its impact in reducing the draw on water from the environment. This requires a thorough analysis of all costs and benefits on a case-by-case basis.

5.3.2.3 Biodiversity and microclimate impacts

The development of secondary water storages in the urban area has the potential to support increased biodiversity and to produce microclimate effects which are beneficial for the community. Biodiversity impacts may include increased species diversity due to additional suitable habitat. Microclimate impacts are generally the result of additional green spaces which result in benefits such as reduced summer temperatures. These outcomes, however, can be developed using secondary and/or primary water and their cost-effectiveness needs to be assessed on a case-by-case basis.

5.3.2.4 Greenhouse gas emissions

Greenhouse gas emissions are created through the use of electricity for pumping and treating water. All options are therefore likely to result in emissions. For the purposes of the inquiry, the Commission has not undertaken a detailed analysis of the emissions intensity of each option but notes that additional emissions are likely to be generated the higher the level of treatment and the further the distance the water must be transported. This must be considered against any benefits from greater efficiencies due to economies of scale from larger source options.

5.3.3 Social criteria

The cost-effective provision of an assured supply of water provides a social benefit to the entire ACT community.

5.3.3.1 Recreational and amenity value

When assessing the contribution of public secondary water sources to recreational and amenity value it is important to note that green open spaces are not the sole preserve of secondary water. Primary water is the predominant source of water used to irrigate Canberra's green spaces. The potential advantage of secondary water over primary may relate to additional irrigation being permitted during periods when primary supply is under water restrictions and a reliable source of public secondary water is available. As such, this matter is closely aligned with the discussion regarding supply reliability and water security.

5.3.3.2 Community support and equity

The degree of support for or opposition against a secondary water initiative can have a direct bearing on the decision to implement the initiative in the first place, and on its utilisation should it be implemented. Certain proposals such as those related to using treated sewage effluent as drinking water can generate very strong public reaction. This was demonstrated by the rejection by Toowoomba residents in Queensland in a 2006 referendum on a plan to use wastewater for drinking supply.

In relation to the CIUWP, including the ponds and stormwater harvesting components, CSIRO undertook a community survey that found that overall the community assessment was positive and the criterion:

> of 'community support' received the highest positive assessment suggesting that support from community may be expected when implementing new supply–demand schemes or establishing new ponds.[110]

Equity considerations can relate to access to the secondary water supplied by the initiative, or access to the site. In the CIUWP context, for example, CSIRO found that equity considerations related to who would be using the water to irrigate during dry times. Concerns were raised about golf courses, with access limited to members, keeping fairways green during dry periods.

5.3.3.3 Health and safety

Health and safety are linked closely with the level of treatment the water has undergone—the higher the level of treatment, the lesser the opportunity for adverse health outcomes from using it. The risk of adverse health outcomes is also related to the final use of the water, with higher levels of treatment required for potable compared to non-potable uses.

ACT Health notes in its submission to the inquiry issues paper that the risk to public health is largely dependent on the final use of the treated water, stating that:

> the risk to the public from the irrigation of open spaces, is significantly less than when treated effluent is piped to individual households where young children will come into contact with, and potentially consume the water.[111]

[110] CSIRO (2009), p. 140.

[111] ACT Health (2012), p. 1.

ACT Health's submission to the inquiry issues paper also indicated that chemical contamination such as toxins and cyanobacteria can be a health risk. It also stated that 'the greatest risk to the public is from pathogens in the reuse water', which 'can cause outbreaks of illness that can affect a high proportion of the community and in extreme cases cause death'.[112]

5.4 Economic, environmental and social consideration

This section considers the broader economic, environmental and social benefits and costs with respect to the individual public water options identified. As discussed earlier, in making the comparison between public options, it is important to recognise that the primary water supply is the only one of sufficient scale to supply the entire ACT community, and is the only potable water supply source.

5.4.1 ACT primary water supply

The ACT primary water supply consists of the existing dams, treatment plants and water reticulation network as set out in section 4.2.1.1.

Table 5.3: ACT primary water supply

Factor	Cost/risk	Benefit	Other issues
Economic	• Cost effectiveness—$0.30/kL • Water sector—secondary water use may decrease ACTEW's water sales and increase the regulated price of primary water	• Water security—extremely high level of reliability and security of supply. Sufficient to meet existing 1 in 20 year probability of water restriction objective for short to medium term • Water sector—ACTEW may compete for customers to guard against economically inefficient bypass • Water sector—third-party access to existing network may increase supply options	• Institutional and regulatory—ACTEW network subject to and compliant with regulatory requirements
Environmental	• Environmental flows—draws water directly from the natural environment	• Wastewater sector—the primary network returns around 60% of the water it extracts from the natural environment • Biodiversity and microclimate—high reliability of the primary network supports biodiversity and microclimate	• Water quality—treated to potable standard
Social		• Recreation and amenity—high reliability of the primary network supports recreation and amenity • Health and safety—primary water treated to potable standard • Equity—primary water is available to all members of the ACT community	

[112] ACT Health (2012), p. 1.

5.4.2 Southwell Park Sewer Mining Project

While the Southwell Park project has been decommissioned, the discussion is taken from the perspective of its costs and benefits during its operation. This approach has been adopted to provide an indication of the issues that may arise from similar sewer mining proposals in the future.

Table 5.4: Southwell Park Sewer Mining Project

Factor	Cost/risk	Benefit	Other issues
Economic	• Cost effectiveness—$13.16/kL • Water sector—secondary water use may decrease ACTEW's primary water sales and increase the regulated price of primary water • Wastewater sector—sewer mining may reduce the volume of sewage and increase the unit cost of treatment and hence the price of existing wastewater treatment • Wastewater sector—sewer mining may reduce the volume of sewage, leading to odours, blockages and increased total dissolved solids in the sewerage system	• Water sector—ability to access existing sewerage network may increase supply options	• Water security—limited value due to existing state of primary water supply • Wastewater sector—if increase in overall water consumption, less water available for downstream users • Regulatory—pilot complied with regulatory requirements • Water quality—water treated to required standard for irrigation use (not treated to potable standard)
Environmental		• Environmental flows—reduces draw on natural environment	• Biodiversity and microclimate—limited value given the reliability of the primary network
Social		• Recreation and amenity—benefits from irrigation during water restrictions	• Recreation and amenity—limited value given the reliability of the primary network • Equity—pilot restricted to specific location • Health—water treated to required standard for irrigation use

5.4.3 North Canberra Water Reuse Scheme (NCWRS)

The NCWRS is operated by ACTEW and supplies about 190 ML/a of secondary water to end-users.

Table 5.5: North Canberra Water Reuse Scheme

Factor	Cost/risk	Benefit	Other issues
Economic	• Cost effectiveness—$3.01/kL • Water sector—secondary water use may decrease ACTEW's water sales and increase the regulated price of primary water • Wastewater sector—extractions may reduce the volume of sewage and increase the unit cost of treatment and hence the price of existing wastewater treatment • Wastewater sector—sewer mining may reduce the volume of sewage, leading to odours, blockages and increased total dissolved solids in the sewerage system	• Water sector—ability to access existing sewerage network may increase supply options	• Water security—limited value due to existing state of primary water supply • Wastewater sector—if increase in overall water consumption, less water available for downstream users • Regulatory—project complies with regulatory requirements • Water quality—water treated to required standard for irrigation use (not treated to potable standard)
Environmental		• Environmental flows—reduces draw on natural environment	• Biodiversity and microclimate—limited value given the reliability of the primary network
Social		• Recreation and amenity—benefits from irrigation during water restrictions	• Equity—project restricted to specific locations • Health—water treated to required standard for irrigation use

5.4.4 LMWQCC Effluent Reuse Scheme

The LMWQCC Effluent Reuse Scheme is operated by ACTEW.

Table 5.6: LMWQCC Effluent Reuse Scheme

Factor	Cost/risk	Benefit	Other issues
Economic	• Cost effectiveness—$0.04/kL	• Water sector—low cost source of non-potable water for small customer base	• Wastewater sector—if increase in overall water consumption, less water available for downstream users • Regulatory—ACTEW network subject to and compliant with regulatory requirements
Environmental		• Environmental flows—reduces draw on natural environment	• Water quality—water treated to required standard for discharge into river ways (higher treatment than other secondary water options)
Social		• Recreation and amenity—benefits from irrigation during water restrictions	• Health—water treated to required standard for discharge into river ways

5.4.5 Inner North stormwater reticulation pilot

The Inner North Stormwater pilot project, to be operated by the ACT Government, is currently under construction. It is expected to provide about 460 ML/a of secondary water to end-users when in full operation by 2013.

Table 5.7: Inner North Stormwater Pilot Project

Factor	Cost/risk	Benefit	Other
Economic	• **Cost effectiveness**—$4.12/kL • **Water sector**—secondary water use may decrease ACTEW's water sales and increase the unit price of primary water • **Water sector**—ACTEW may compete for customers to guard against economically inefficient bypass • **Regulatory**—arrangements being made to comply with regulatory requirements	• **Water sector**—the trial period will provide data to inform future investment decisions	• **Water security**—limited value due to existing state of primary water supply; reliability concerns during hot and dry periods
Environmental		• **Environmental flows**—reduces draw on natural environment	• **Water quality**—water treatment via natural processes considered suitable for irrigation purposes (not treated to potable standard) • **Biodiversity and microclimate**—limited value given the reliability of the primary network
Social		• **Recreation and amenity**—benefits from irrigation during water restrictions • **Community support**—community survey indicated support (includes support for ponds)	• **Equity**—project restricted to specific locations • **Health**—water considered suitable for irrigation use

5.5 Conclusion

Given the ACT's current storage situation and water security outlook, the ACT community's demand for water can be most cost-effectively met by water supplied through the existing ACT primary water system.

Draft finding 5.1

The ACT community's current water needs can most cost-effectively be met through the ACTEW primary water supply network.

The foregoing discussion of broader economic, environmental and social factors has identified a number of important trade-offs that require careful consideration when a future options analysis is undertaken at the appropriate time in relation to when the next primary water supply investment is due. For example, from a community benefit perspective, the potential trade-off between increased secondary water use and cost of living impacts from higher primary water prices are particularly important to evaluate.

Chapter 8 provides more discussion on the options analysis approach, including consideration of economic, environmental and social factors, that the Commission recommends should be adopted in an integrated and adaptive water supply and demand planning framework.

6 Private secondary water investment decisions

In this chapter the Commission considers the decisions of households and developers to install secondary water systems. As noted in chapter 4, while household and business secondary water systems can be considered as a reduction in demand rather than an increase in supply, nonetheless they can affect water security at the margin when water storages are under pressure.

The motivations of the private sector to install these systems varies from commercial considerations about reducing the cost of water and improving security through to more altruistic considerations relating to environmental and social considerations.

Government actions such as education or the provision of subsidies can influence the community's willingness to install secondary water systems. The principal issue therefore is the value for money achieved by these measures.

6.1 Assessment approach

The Commission has adopted a two-part approach in this chapter to compare private secondary water options.

The first is a financial analysis using the unit cost methodology described in chapter 5. This analysis focuses on the direct financial costs facing individual households or businesses in choosing among a range of secondary water systems as an alternative to the primary water supply. This is not to suggest that other factors are not important to these decisions, rather that they are specific to the individual decision-maker and therefore do not lend themselves to direct comparison.[113]

The second part examines the impact of government intervention, or absence of intervention, on the decision by individual households and businesses or estate developers to invest in secondary water systems.

6.2 Financial analysis

Table 6.1 sets out potential secondary water options that an individual ACT household or business might choose, and for which a financial analysis has been undertaken.

Table 6.1: Individual private secondary water options

Option	Type of supply
Greywater diversion and pumping device	Greywater
Greywater in-house treatment and pumping device	Greywater
Rainwater tank—plumbed in to the premise	Rainfall run-off
Rainwater tank—not plumbed in (outdoor use only)	Rainfall run-off

For the purposes of the financial analysis, it is assumed that the private decision-maker is only concerned with the direct costs and benefits they face. This is different to the community perspective adopted in the previous chapter. At the simplest level, an individual will compare the

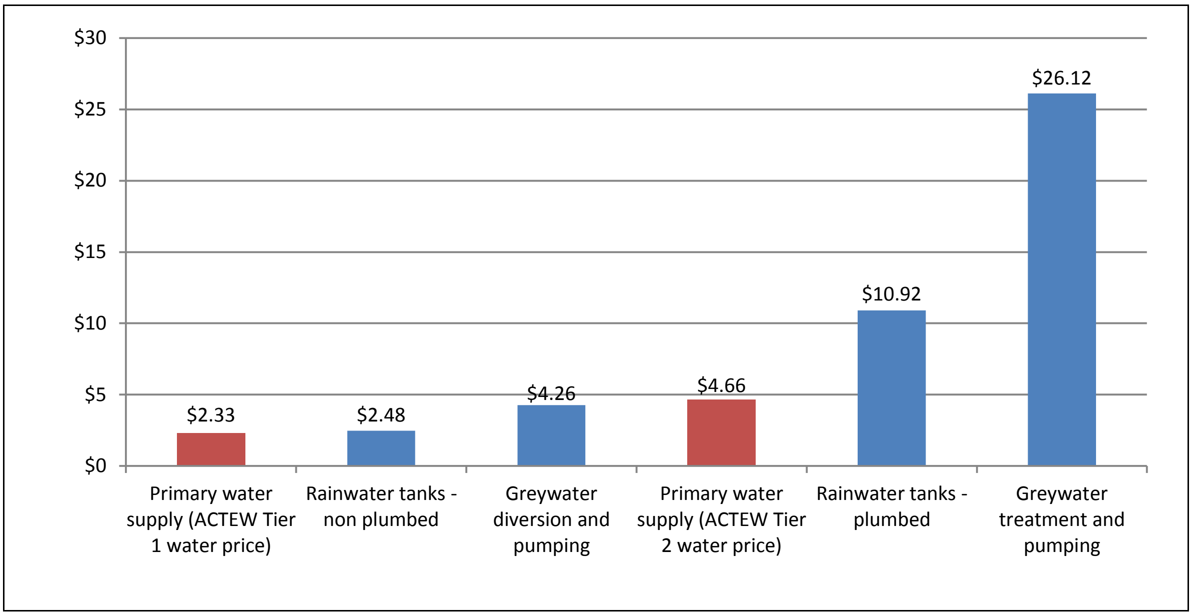
[113] For example, an individual may place a high value on the potential benefits of being able to irrigate their garden from a rainwater tank when temporary primary water restrictions are in force.

average cost of a kilolitre of water supplied from a secondary water system with the price of a kilolitre of water purchased from the primary water supplier. For example, an individual would compare the average per kilolitre cost of installing and operating (taking into account any government rebates) a rainwater tank with the volumetric prices charged by ACTEW.

For the purposes of the inquiry, the Commission engaged the Strategic Economics Consulting Group (SECG) to undertake an assessment of the unit costs of water provided through the primary water supply system and various public and private secondary water options.

Figure 6.1 summarises the estimated costs of the private secondary water options listed in table 6.1, compared to the 2011–12 ACTEW Tier 1 (2.33/kL) and Tier 2 (4.66/kL) volumetric prices. More information on each secondary water option is contained in the SECG report, which is available on the Commission's website.[114]

Figure 6.1: Cost of private water options ($/kL)



Source: SECG (2012).

From an individual perspective, non-plumbed-in rainwater tanks and greywater diversions and pumping systems provide a cheaper source of water than the Tier 2 primary water supply. Plumbed-in rainwater tanks and greywater treatment and pumping systems supply significantly more expensive water than can be purchased from ACTEW. All of the secondary options are more expensive than the primary water Tier 1 price.

The maximum ACT Government rainwater tank rebate of $1,000, which only applies to tanks plumbed in to the house, will only reduce the average cost of supplying rainwater to about $9.76/kL, which is still well above the cost of primary supply. This matter is discussed further below in relation to government intervention.

[114] SECG (2012), available at www.icrc.act.gov.au.

6.3 Impact of government intervention on private decision-making

This section examines the impact of government intervention, or absence of intervention, on the decision by individual households and businesses or estate developers to invest in secondary water systems.

6.3.1 Individual secondary water initiatives

6.3.1.1 Direct ACT Government market intervention

The ACT Government intervenes directly in the ACT water market largely through the administration of programs and the provision of rebates and subsidies aimed at reducing water consumption. Table 6.3 summarises the key initiatives that currently fall under the ACTSmart initiative administered by ESDD.[115]

The involvement of the ACT Government in these activities, and particularly the provision of rebates and subsidies, is likely to influence an individual's decision to invest in a secondary water initiative. The rainwater tank rebate, for example, may result in more households investing in rainwater tanks than would otherwise have occurred. In so doing the rebate may have shifted consumer spending from greywater diversion and pumping systems, for example, which offer a cheaper source of secondary water than plumbed-in rainwater tanks but are not subject to a government rebate.

The Commission considers that ACT Government water efficiency rebates and subsidies should be considered within the integrated and adaptive water supply and demand planning framework developed in chapter 8. Such an analysis would indicate the optimal combination of water supply and demand-management options, including the appropriate level of subsidies and rebates to meet the desired level of security. Should this analysis demonstrate that the current subsidies and rebates do not provide value for money when compared with other options, they should be withdrawn.

Draft recommendation 6.1

The Commission recommends that the ACT Government consider the provision of water use efficiency rebates and subsidies within the context of an integrated and adaptive planning framework to better assess which options are likely to deliver value to the ACT community.

[115] More information on ACTSmart is available at www.actsmart.act.gov.au.

Table 6.3: Recent and current ACT Government water efficiency initiatives

Program	Commenced	Program description	Subsidies
WaterSmart Homes	1 December 2004 – 31 July 2007	A home audit and retrofit to ACT homeowners involving a subsidised home visit by a trained plumber; the audit checks for leaks and advises on water-efficient practices in the home. The retrofit includes installation of one 3-star showerhead, 2 tap aerators, minor leak repairs and cistern weights for toilets	Participants paid $30 toward total cost of audit, advice and retrofit, including minor leak repairs, one 3-star showerhead, and two tap aerators
GardenSmart	11 January 2005 – ongoing	A rebate for a horticulturist to visit and provide advice on making gardens more water efficient and sustainable through plant choice and garden design, and practical maintenance and watering advice	Participant receives a free audit and is eligible for $50 rebate on purchased garden water efficiency products.
Rainwater Tanks Rebate	20 August 1997 – ongoing	Rebates towards the cost of installing rainwater tanks and pumps connected to indoor end uses	Current rebates available are: $750 for 2,000–3,999 L tanks; $900 for 4,000–8,999 L tanks, $1000 for tanks ≥ 9,000 L for connection to indoor uses; and $600 for connecting existing tanks to indoor end uses
Dual Flush Toilet Rebate	1 December 2004 – 31 July 2007	Replaced by the ToiletSmart program in 2008 after the WaterSmart Homes program was discontinued	WaterSmart Homes customers qualified for a $100 subsidy on the supply and installation an existing single-flush toilet with a 6/3 L or 4.5/3 L dual flush toilet
ToiletSmart and ToiletSmart Plus	5 May 2008 – ongoing	Replaces a single dual-flush toilet with a 4-star water-efficient toilet; participants also eligible for a free home water audit and additional low-cost water saving fixtures and repairs, provided these are taken up at the time of the toilet installation	$100 subsidy on the supply and installation of a 4.5/3 L dual-flush toilet to replace an existing 11 L single-flush toilet; pensioners are eligible for a subsidy on the full cost of a base standard toilet
IrrigationSmart Service	Ongoing	Provides a free visit by an irrigation specialist to assist ACT residents to improve the performance of their automated irrigation systems, and a rebate for improvements	$100 subsidy for improvements to the irrigation system

Source: Adapted from Fyfe et al. (2011), table 2.1, p. 27; ACT Government (2012a).

6.3.1.2 Regulation of residential greywater systems

As discussed in section 3.3, the current ACT framework for regulating residential greywater systems, set out in the document *Greywater use: Guidelines for residential properties in Canberra*, puts the onus on ACT homeowners to ensure that greywater treatment systems meet relevant, and from a lay perspective, somewhat complex, NSW Health treatment standards (see box 6.1).

Box 6.1: Extract from the ACT greywater water use guidelines

'The technical performance objectives of systems designed for the treatment and storage of greywater are outlined below in Table 1. Achieving these objectives reduces the risks to public health and the potential for creating nuisance odours.

When selecting a greywater treatment system ensure that the manufacturer can demonstrate that they meet the values in Table 1.'

Table 1 – Greywater treatment objectives and applications for greywater stored for more than 24 hours

Treatment	Greywater use application
Treated greywater to a quality of 20mg/L BOD5, 30mg/L SS.	• Sub-surface irrigation (100-300mm below ground level) • Sub-soil irrigation (>300mm below ground level)
Treated and disinfected greywater to a quality of 20mg/L BOD5, 30mg/L SS and 10 cfu thermotolerant coliforms/100mL	• Covered surface drip irrigation • Surface irrigation • Toilet flushing • Laundry use • Car washing

***Source:* NSW Health 2000**

Note: BOD5 – Biochemical Oxygen Demand (5 Day)
SS – Suspended Solids CFU – Colony Forming Unit

Source:ACT Government (2007), pp. 6–7.

The current ACT approach, which places the compliance burden on the homeowner, may be a barrier to the take-up of greywater systems. At a minimum, the homeowner faces extra costs in terms of time and resources, to understand the treatment requirements and then establish that the manufacturer has met them. At the other extreme, the homeowner may simply decide that it is too burdensome and risky to proceed with the investment.

The ACT approach contrasts with that of other jurisdictions where the compliance burden is largely met by the relevant government health agency via the accreditation of greywater treatment systems. In New South Wales, for example, NSW Health maintains a register of accredited systems for use in single domestic premises.[116] Similarly, the Environment Protection Authority in Victoria, the Queensland Department of Local Government and Planning and the Western Australia Department of Health all approve greywater treatment systems and maintain registers.[117]

The Commission understands that the ACT Government has adopted its current regulatory approach on the basis of the expected limited scale of greywater treatment systems adoption in the

[116] NSW Government (2012).

[117] Queensland Government (2012).

ACT, and consequently the low risk of any wide-scale community health impacts, as compared to the cost of establishing a formal accreditation process.

However, it is the Commission's view that it is appropriate for the relevant ACT Government agency, with its subject-matter expertise and the resources available to it, to accept a greater portion of the compliance burden. The Commission considers that an accreditation approach, such as that operating in New South Wales, would achieve this objective and, by removing a potential barrier, support the commercial market for these systems.

In developing and maintaining an accreditation approach, the costs and benefits would need to be considered. The Commission believes that an approach that would minimise the costs would be to recognise those schemes that have been deemed compliant by NSW Health. This can be viewed as an extension of the current ACT arrangements, which already base the health requirements set out in the ACT's *Greywater use: Guidelines for residential properties in Canberra* on those developed by NSW Health.

Moreover, such an approach is consistent with that adopted by other elements of the ACT Government. For example, the ACT Gambling and Racing Commission recognises those gaming machines that are compliant with similar regulations in other Australian jurisdictions.

Draft recommendation 6.2

The Commission recommends that the ACT Government develop and maintain a residential greywater treatment system accreditation approach, such as that operating in New South Wales.

6.3.2 Estate-level decisions

This section discusses three issues that are relevant to estate-level development decisions: the WSUD Code, approval pathways and third-party access.

6.3.2.1 Implications of the WSUD Code

As discussed in section 3.3, the WSUD Code imposes obligations on developers to undertake certain activities to improve water efficiency and stormwater quality when developing estates.

The Commission has identified two issues that require further discussion in relation to the ACT Government's intervention in the secondary water market through the WSUD Code's mandatory requirements. The first relates to the impact of the code on decisions made by estate developers to invest in secondary water infrastructure. The second relates to the ongoing ownership, operation and maintenance of the secondary water infrastructure installed by developers.

Market impact of mandatory WSUD requirements

The Commission received a submission from the Village Building Company (VBC) on the inquiry issues paper that identified three potential issues related to the WSUD Code.[118]

First, the VBC submitted that deemed-to-comply activities were stifling innovation in terms of achieving the required mains water reduction target.[119] The submission noted examples of where it

[118] Village Building Company (2012).

[119] As an example, the WSUD Code contains a list of water efficiency options for single residential blocks in new developments, such as a certain size rainwater tank, which, if installed by the developer, is accepted as 'deemed to comply' with the code's 40% primary water reduction target.

had proposed alternative solutions to those specifically contained in the WSUD Code. The VBC claimed that the alternative measures achieved the required water reduction target, but that these were not accepted by the ACT Pla7nning Authority (ACTPLA). The VBC submission stated that:

> we do not believe the current deemed to comply solutions offer a valid way of reducing water usage in the community. Rather they simply transfer the cost of some water collection to purchasers of new dwellings.[120]

Second, the VBC submission provided information on the increased housing costs due to the WSUD Code water efficiency requirements. The submission stated that the cost of installing a rainwater tank increased the cost of the property to the house purchaser by an average of $1,637.

Third, the VBC submission noted that one approach it took with respect to the WSUD Code was to size blocks at less than 300 m^2 such that the dwelling is exempt from the 40% water reduction target. The Commission notes that the WSUD Code's primary water reduction requirements stemmed from the 2004 *Think water, act water* (TWAW) water efficiency targets. Imposing mandatory water efficiency requirements for new developments presupposes that, without intervention, a suboptimal level of water efficiency measures would be installed by developers. That is, there is a market failure that requires government to intervene.

As discussed earlier, the ACT's water security outlook has substantially improved since then, with current per capita water consumption substantially below pre-2003 levels. Moreover, as demonstrated in Appendix G, the TWAW water efficiency targets have already been met. In this context it is not evident that the costs of intervention are outweighed by the benefits.

The Commission, however, recognises that in certain circumstances there may be benefits associated with incurring upfront costs in cases where retrofitting may be prohibitively expensive. This matter requires an assessment of the whole-of-life costs of an initiative and the trade-offs between installing infrastructure upfront and perhaps never using it, compared to not installing it at the start and requiring it later when it is expensive to retrofit.

As discussed in relation to subsidies and rebates, the Commission considers that government intervention through the WSUD Code should be considered within the integrated and adaptive water supply and demand planning framework developed in chapter 8, and in particular a real options approach. This analysis would assess the overall value of this policy initiative, including the costs and benefits of retrofitting versus upfront installation, in comparison with other supply and demand options. Should this analysis demonstrate that this policy does not provide net benefits, it should be amended.

Draft recommendation 6.3

The Commission recommends that the ACT Government undertake a detailed analysis of its Waterways Water Sensitive Urban Design General Code (WSUD Code) planning requirements. The analysis should include the merit of the code's mandatory water efficiency requirements within the context of an integrated and adaptive planning framework, including flow-on impacts on the ACT housing market.

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[120] The Village Building Company (2012), p. 2.

WSUD Code infrastructure ownership and operation implications

In relation to acceptable solutions for stormwater quality management for residential land development in particular, the WSUD Code expects 'that the requirements for stormwater quality will be met at the estate development scale through the use of ponds, wetlands and other measures'.[121]

The constructed ponds and wetlands will generally have a gross pollutant trap installed to treat catchment run-off by removing litter, debris and coarse sediment before it enters the pond or wetland. In some cases the stormwater harvested from the ponds will be used to replace primary water for public area irrigation purposes to help meet the WSUD Code primary water reduction target for the development.

The Commission understands that once complete, the estate developer hands over the ownership and management responsibility for the stormwater ponds, wetlands and public space irrigation infrastructure to the Territory and Municipal Services Directorate (TAMSD) or to a private-sector entity, such as a body corporate.

TAMSD has raised concerns that no additional funding has been provided for ongoing maintenance of the assets (see box 6.2). The ongoing maintenance and operation of these water assets is critical to ensure that the benefit stream from the assets is realised. Should, in the worst case scenario, a public-space irrigation network be switched off after handover to TAMSD due to lack of operational funding, all of the capital costs would have been incurred by the developer, and passed on to the property owners, with no irrigation benefits.

Box 6.2: Extract from Submission 9 (2 February 2012) TAMSD

> 'The change from hard storm water infrastructure to soft landscaping for ponds/wetlands/lakes and natural water channels has transferred some of the management and maintenance responsibility from Roads ACT to Parks and City Services. The introduction of Water Sensitive Urban Design has significantly increased the number of gross pollutant traps (GPT's) in the stormwater network and increased the maintenance cost of maintaining GPT's and trash racks adjacent to ponds/wetlands/lakes. New proprietary GPT products require increased cleaning frequencies and increased maintenance costs due to the specialised equipment required to clean the GPT's. No additional funding has been provided for ongoing maintenance of these assets. This includes weed control, maintaining water clarity, litter management, landscape maintenance, safety concerns (including signage) removal of debris and removal of silt/sediment to maintain a functional "stormwater asset".'

Source: TAMSD (2012), Attachment D.

The operation and maintenance of water infrastructure handed over by developers is not confined to the ACT Government. Box 6.3 provides a private-sector case study.

Box 6.3: Urban redevelopment WSUD Code case study

> Section 27 Barton: Sydney Place Park
>
> Sydney Place Park is part of the redevelopment of the former Macquarie Hostel site in Barton. The redevelopment is a staged development. Construction of the first stage was completed in September 2007. Construction on the Macquarie Street side of the block is pending. Redevelopments in Barton need to comply with WSUD requirement as set out in Element 6 of Part A of CZ5 Mixed Use Zone Development Code.
>
> The stormwater hydraulic system under Sydney Park, a public open space in the development, was

[121] ACT Government (2009b), p. 36.

constructed in 2009 following construction of the first stage of the development—the Hotel Realm. Subsequent stages of the development were still being finalised.

The Commission reviewed the hydraulic services plan for the Sydney Place Park noting the stormwater collection and filtration system and arrangements for the retention and reuse of the secondary water. From the documentation available to the owners corporation of Realm Park that became responsible for the park in September 2011, it is not possible to determine which of the assets in the hydraulic plan are required to meet the stormwater retention and discharge requirements of the development code and which assets if any that were installed to meet water efficiency requirements for new buildings.

The staged development of the site involving incremental transfers of parts of the initial lease raises issues in relation to the efficient and effective operation of the stormwater assets. The removal of the planned greywater storage facility under the park appears in part to have been a result of the decision to transfer the area of the park to the lease associated with the residential development on the eastern side of the park. The former Macquarie Hostel site now has a multitude of lease holders and this will limit the capacity of the park's retained stormwater system to be used to irrigate other parts of the site.

The Commission notes that there does not appear to any ACTPLA-oversighted mechanism to ensure that stormwater assets are effectively managed when urban redevelopment occurs on a staged basis or mechanisms to ensure that secondary water can be transferred within an integrated development where parts of the development are ultimately held by different lease holders.

Source: Owners Strata Plan, 3658, D-Group/THCS Building Hydraulic Services.

Should an assessment of the WSUD Code within an integrated and adaptive framework, as recommended earlier, demonstrate that there is value in retaining mandatory water efficiency obligations on developers, consideration should be given to ensuring effective use of the infrastructure after handover by the developer. As illustrated above, failure to do so has the potential to result in water infrastructure being installed at increased cost to the ACT community with limited or no benefits.

In relation to TAMSD, the ACT Government should give explicit consideration to how to ensure funding for the ongoing maintenance and operational costs of the infrastructure owned and operated by TAMSD.

In the private-sector case, consideration should be given to reviewing the operation of planning approval processes to ensure that water assets can be operated in an efficient and effective manner. This requires ensuring that water efficiency targets and WSUD principles are explicitly provided for in the development approval process and that this documentation is provided when new leases are established in an integrated development.

Draft recommendation 6.4

The Commission recommends that, if the ACT Government determines that there is value in retaining mandatory water efficiency obligations on developers in the WSUD Code, the government should:

- ensure that TAMSD is explicitly funded for the ongoing maintenance and operational costs of the infrastructure for which it becomes responsible as a result of the code
- review the operation of planning approval processes to ensure that code requirements are explicitly provided for in the development approval process and that this documentation is provided when new leases are established in an integrated development, to ensure that water assets can be operated in an efficient and effective manner.

6.3.2.2 Approval pathway for estate-level secondary water initiatives

During the inquiry it became clear that the ACT does not have a clearly articulated and identified overarching ACT Government pathway for approving and regulating estate-level multi-dwelling secondary water initiatives such as stormwater harvesting, greywater or treated sewage effluent schemes.

Several ACT Government agencies have an interest in secondary water proposals from a variety of perspectives, including planning, land development, public health, environment protection and ongoing operation and maintenance of schemes. However, the ACT Government does not have a clearly defined approval or regulatory pathway for proponents of such schemes to follow.

This contrasts with approaches taken in other jurisdictions, such as NSW. For multi-dwelling secondary water schemes using greywater or treated sewage effluent, the NSW Government has published interim guidelines for the installation, approval and management of private recycled water schemes.[122] The interim guidelines are intended to ensure that the regulatory system for water recycling manages environmental and health risks and at the same time encourages secondary water initiatives. The interim guidelines are based around separate approval by local government authorities for installation and operation of schemes. Approval for installation requires an application to have:

- outlined the proposed scheme
- undertaken appropriate community and stakeholder consultation, including with the relevant New South Wales Government authorities
- completed a financial assessment of the long-term viability and sustainability of the scheme, particularly where the scheme proposes to provide essential services to end-users.

In his submission to the inquiry issues paper, Mr Shane Rattenbury MLA identified a lack of coordinated regulation in the ACT as a significant barrier to private-sector development of alternative schemes (see box 6.4). Mr Shane Rattenbury MLA recommended better coordination between ACT Government agencies as a solution to this problem.

Box 6.4: Extract from Submission 5 (22 December 2011), Mr Shane Rattenbury MLA

‘The Village Building Company (VBC) have also had problems, which they were unable to overcome. VBC wanted to use non-potable water in West Macgregor, but they had difficulties getting agreement from the ACT Government agencies. I understand that ACTPLA had agreed, but the negotiations between TAMS and ACT Health become complicated with the end result being that nothing could be agreed to. This was frustrating given that VBC have planned a third pipeline for Tralee, and CIC will be using recycled non-potable water with purple pipes for gardens and toilets at Googong, which is expected to contribute to a 60% reduction in urban water usage.

Ensuring better and greater coordination between the ACT Government bodies on this issue (for example ACT Health, ACTEW, ACTPLA, ESD and TAMS) is one way to facilitate greater use of grey water.

We need to make it easier for companies, such as developers and industrial companies to be innovative in their water reduction, conservation and re-use efforts. It is always a shame when bureaucratic rules become an obstacle to sustainable innovation, when similar practices are in place in other jurisdictions, especially just over the border, in Googong and Tralee.’

Source: Rattenbury (2011), pp. 2–3.

[122] NSW Government (2008).

In his submission to the inquiry issues paper, Mr Ian Lawrence raised similar concerns with respect to the WSUD Code (see box 6.5).

Box 6.5: Extract from Submission 4 (20 December 2011), Mr Ian Lawrence

> 'My experience is that most developers are keen to incorporate a range of WSUD measures and recycling facilities into their developments, as part of the marketing of "green and sustainable" housing. It has been Government agencies that time and time again reject the Draft Structural Plans incorporating WSUD measures and recycling facilities. This is a reflection of concerns regarding "lack of control" in the case of resource limited maintenance agencies, and "lack of adequate pricing signals" in the case of agencies such as the LDA [Land Development Agency] and Treasury.'

Source: Lawrence (2011), p. 10.

In the Commission's view, uncertainty about the steps a proponent is required to undertake, and conditions they are required to meet, in order to install and operate a particular secondary water scheme is potentially an information-related market failure that requires government intervention. The Commission takes this view for a number of reasons.

At the minimum, such uncertainty may result in additional costs as more time and resources than necessary are expended by the proponent on understanding and then meeting regulatory requirements. These costs are likely to be passed on to the house purchaser.

Regulatory uncertainty may also result in estate developers not investing in more innovative secondary water initiatives beyond the minimum required to meet the WSUD Code requirements. Alternatively, there are benefits in identifying any secondary water schemes or technologies that are unlikely to be approved in the ACT, due to their potential health or environmental risks, for example. In its submission to the inquiry issues paper, ACT Health differentiates the health risks associated with using treated sewage effluent on the basis of its final use, stating that the:

> risk to the public from the irrigation of public spaces, is significantly less than when treated sewage effluent is piped to individual households where young children will come into contact with, and potentially consume, the water.[123]

To avoid proponents unnecessarily investigating options and expending resources in developing secondary water initiatives that may be too far along the risk continuum to be approved in the ACT, it is important that such information is clearly stipulated and made publicly available.

The Commission's view is that innovative estate-level multi-dwelling secondary water schemes, particularly in new developments, may be better fostered by the development of a clear approval pathway, such as that set out in New South Wales interim guidelines for the management of private water recycled schemes.[124] A clear pathway would provide certainty for commercial proponents about the steps they are required to undertake, and conditions they are required to meet, in order to install and operate a particular secondary water scheme.

Draft recommendation 6.5

The Commission recommends that the ACT Government develop a clear approval pathway for private sector multi-dwelling secondary water schemes, such as third pipe, stormwater harvesting and greywater schemes.

[123] ACT Health (2012), p. 1.

[124] NSW Government (2008).

6.3.2.3 *Third-party access*

Third-party access arrangements provide another means to facilitate private participation in service provision in the water sector. Third-party access involves a party other than the owner of an infrastructure network gaining access to and using the network to deliver services to end-users. A third-party access regime sets out the terms and conditions of use and outlines prices (or pricing principles) that may be charged by the infrastructure owner for access.

If the access regime is well defined, parties seeking access will face prices that ensure that only economically efficient access is sought and granted. Further, the regime will limit the ability of owners of infrastructure to prohibit access to the infrastructure in order to preclude competition that promotes efficiency in downstream markets. Third-party access arrangements can therefore deliver benefits to end-users through the provision of alternative and more competitively priced services by allowing alternative service providers to compete with infrastructure owners in downstream markets.

In the case of the ACT, third parties may wish to access ACTEW's water and sewerage network, and potentially the Canberra Integrated Urban Waterways Project stormwater reticulation network, or third pipe networks, once completed. For example, if a commercial market participant with an alternative source of secondary water wished to use an existing secondary water network to transport the water to end-users, a third-party access regime would determine the conditions under which access could be achieved and at what price. Similarly, an access regime would facilitate a proponent competing with ACTEW in providing water services using ACTEW's existing infrastructure.

The ACT has no third-party access arrangements in place. Parties seeking access can either negotiate directly with the infrastructure owner or, failing that, use the existing national access regimes administered by the Australian Competition and Consumer Commission under Part IIIA of the *Competition and Consumer Act 2010*. The latter approach can be a long and expensive process.[125]

As an alternative, the COAG Competition Agreement Principles[126] provide for a jurisdiction-based third-party access regime. While it is unclear whether the ACT market is capable of efficiently supporting competition in water and sewerage services, it is likely that the absence of an ACT third-party access arrangement is a disincentive for potential alternative service providers. However, as costs of establishing such arrangements are likely to be small, the potential benefits do not need to be large to make it worthwhile.

The real benefit of designing access laws and regulations that are specific to the ACT is that these instruments will provide certainty to potential market participants who may wish to provide water-related services within the ACT. Establishing an access regime with technical conditions for connection to existing and future networks as well as pricing rules in advance will provide some degree of certainty to potential market participants that are considering commercial opportunities in the ACT water market. It is also likely to reduce the time taken and cost incurred in gaining access.

The establishment of jurisdiction-based access arrangements has been considered in other Australian jurisdictions. The most well developed framework exists in New South Wales, where

[125] ERA (2008), p. 67.

[126] COAG (1995).

the government has established the *Water Industry Competition Act 2006*. The Act provides a comprehensive framework that intends to:

> encourage competition in relation to the supply of water and the provision of sewerage services and to facilitate the development of infrastructure for the production and reticulation of recycled water.[127]

In simple terms, the Act contains two main elements:

- a licensing regime aimed at ensuring that appropriate public standards are maintained such as public health
- an access regime component aimed at establishing a framework to promote the economically efficient use and operation of, and investment in, significant water industry infrastructure, thereby promoting effective competition in upstream or downstream markets.

While other jurisdictions have considered the development of third-party access regimes, none have yet formally established a regime such as that in New South Wales. In South Australia, the Water Industry Bill provides for a single piece of legislation to replace the *Waterworks Act 1932, Water Conservation Act 1936* and *Sewerage Act 1929*.[128] It provides for the Essential Services Commission of South Australia to be the independent regulator for urban and regional water and sewerage services with the power to regulate prices and standards of service. The bill does not provide a formal access regime for water; however, it does propose the development of a state-based third-party access regime with a final report to Parliament within 12 sitting days of 1 August 2012. The bill is yet to be enacted.

The Victorian Essential Services Commission undertook an inquiry into an access regime for water and sewerage infrastructure services and found that an effective state-based access regime would promote innovation, efficiency and reliability in water resource management, and in the delivery of water and sewerage services.[129] It proposed that an access regime would ideally include access to large storage facilities, such as dams and reservoirs, and water and sewerage transport services. However, supply of and treatment of water or sewage would not be part of an access regime. Importantly, the access regime would not extend to the actual resources—the water, recycled water, sewage and other wastewater. To date the recommendations have not been implemented by the Victorian Government.

Under the Victorian Constitution, where the delivery of a water service (which includes sewerage services and sewage treatment) is the responsibility of a public authority, that authority or another public authority must continue to have responsibility.[130] In other words, it is not possible to transfer the responsibility from a public authority to the private sector. This, however, does not prevent outsourcing to an independent contractor, provided the public authority remains the responsible entity.

Part 5 of the *Queensland Competition Authority Act 1997* provides the legislative basis for third-party access in that state. Water and sewerage infrastructure, including treatment and distribution infrastructure, is included in the list of services that may be declared.[131] Declaration of a service

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127 IPART (2008), p. 1.

128 SA Government (2010).

129 ESC (2009).

130 *Constitution Act 1975*, Part VII—Delivery of Water Services.

131 Queensland Government (1997).

under the Act requires the owner/operator of the service to negotiate with a party seeking access to the service. Currently, there have been no requests for water or sewerage services to be declared under the Act.

While it may be premature to establish a fully operational scheme along the lines of that in New South Wales, it is possible that the lack of clarity around third-party access arrangements in the ACT may be creating a barrier to entry for a commercial proponent considering entry into the ACT water market.

Draft recommendation 6.6

The Commission recommends that the ACT Government begin the development of a clearly defined third-party water infrastructure access regime.

7 Remaining matters arising from the terms of reference

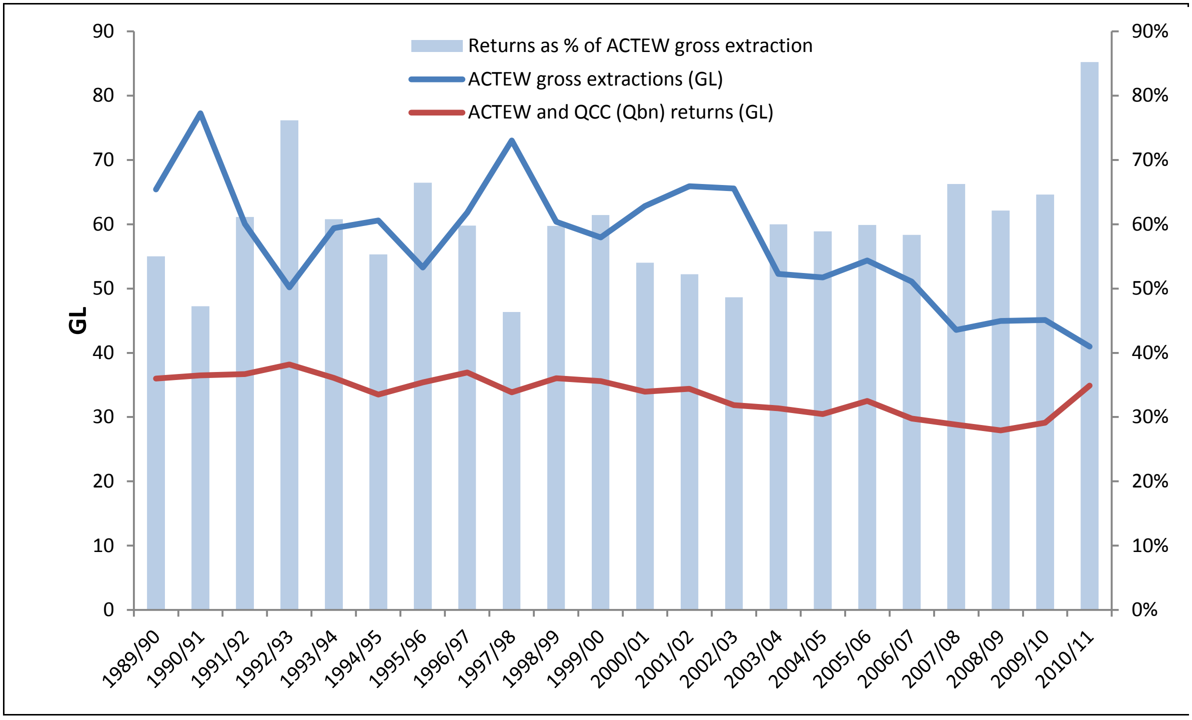
This chapter discusses a number of outstanding matters arising directly from the foregoing discussion and the terms of reference. These relate to the implications of the Murray–Darling Basin Plan (Basin Plan) for secondary water use in the ACT and a number of regulatory, governance and technical issues associated with the Canberra Integrated Urban Waterways Project (CIUWP).

7.1 Implications of the Basin Plan for ACT secondary water use

Paragraph 2(a) of the terms of reference requires the Commission to consider the implications of the Basin Plan for secondary water use in the ACT. This section discusses current water arrangements in the Murray—Darling Basin (the Basin), before assessing the potential impact of the draft Basin Plan, released by the Murray–Darling Basin Authority (MDBA) in November 2011.

At the outset, it is useful to put the ACT's secondary water use in the context of the Basin. The ACT returns on average about 60% of the water it extracts for urban consumptive use to the Basin river system as treated sewage effluent (see figure 7.1). Over the last two decades, the ACT and Queanbeyan have returned an average of 34 GL/a of the 62 GL/a they have extracted for consumptive purposes, as treated sewage effluent to the Basin river system.[132] In the Basin context, the ACT is a substantial source of secondary water for use by downstream Basin water users.

Figure 7.1: ACT water extractions and returns to the river system



Source: ActewAGL.

[132] The treated sewage effluent is returned to the river system from the Lower Molonglo Water Quality Control Centre and the Queanbeyan Sewage Treatment Plant.

7.1.1 Current arrangements under the Murray–Darling Basin Agreement

7.1.1.1 Surface water

The ACT is a signatory to the Murray–Darling Basin Agreement (MDB Agreement), an intergovernmental agreement between Basin jurisdictions. The MDB Agreement, among other things, sets a long-term cap—or upper limit—on surface water diversions.[133] The purpose of the cap is to limit Basin water diversions to the 1993–94 level:

> 1. to maintain and, where appropriate, improve existing flow regimes in the waterways of the Murray–Darling Basin to protect and enhance the riverine environment
>
> 2. to achieve sustainable consumptive use by developing and managing Basin water resources to meet ecological, commercial and social needs.[134]

Section 9 of Schedule E to the MDB Agreement defines the ACT cap (see box 7.1). The ACT cap allows the ACT to take out of the ACT watercourses (dams and rivers) a long-term average net[135] of 40 GL of water per year (GL/a) for consumptive use.

The cap is allowed to grow as the population increases by applying a growth factor. In any particular year the cap is also subject to adjustment based on the prevailing climate and whether any temporary water restrictions are in force. The ACT cap is calculated each year and compared to actual net water diversions. Annual cap debits or credits are accrued depending on whether actual water extractions are below or above the calculated cap for the year in question.

Basin jurisdictions are responsible for adhering to the cap within their jurisdictions. The MDBA is responsible for auditing and reporting compliance with the cap, which it does through its annual water audit monitoring report.

ACT total surface water diversions have been trending down in recent years, as illustrated in figure 7.1, reaching a low of about 42 GL in 2010–11. This is due to a number of factors affecting demand, such as permanent water conservation measures, mandatory temporary water restrictions, water price increases and greater consumer awareness of opportunities for reduced consumption. Consequently, net ACT diversions have generally been lower than the long-term cap of net 40 GL, with an average net diversion over the last 20 years of about 28 GL/a. This has resulted in the ACT accumulating 130 GL of cap credit (up to 2008–09) under the cap arrangements.[136]

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[133] The cap does not limit groundwater diversions.

[134] MDBC (2000), p. 9.

[135] A net cap means gross water extractions minus water returned to the river system after use.

[136] MDBA (2011), Appendix H, p. 94.

Box 7.1: ACT cap on surface water diversions

9 Long-term diversion cap for the Australian Capital Territory

(1) The Government of the Australian Capital Territory must ensure that diversions from the designated river valley in the Australian Capital Territory do not exceed 40 GL per annum (being 42 GL minus 2 GL saving allocated to the Living Murray), varied as required by sub-clause (2).

(2) The long-term diversion cap referred to in sub-clause (1) is to be annually adjusted:

(a) for the prevailing climate during the water year by reference to the model developed under sub-clause 11(4); and

(b) to account for growth in population, in accordance with the following formula:

0.75 multiplied by:

2006/07 per capita consumption of the population of Canberra and Queanbeyan, multiplied by:

the difference between the population of Canberra and Queanbeyan in 2006/07 and the population of Canberra and Queanbeyan for each year in consideration.

(3) The Government of the Australian Capital Territory must ensure that no water or water entitlement that is used for urban purposes will be transferred for use outside the Australian Capital Territory unless that water or water entitlement has been transferred for use within the Australian Capital Territory from another State.

(4) If demand for water for industrial uses or uses by the Commonwealth grows beyond the level of demand in 2006/07, that growth in demand will be met by transferring water or water entitlements from another State.

The Authority must, for the purposes of maintaining the Cap Register referred to in sub-clauses 13(7) and 13(8), take into account 107 GL of cumulative Cap credit existing at the end of 2006/07.

Source: Schedule E to the MDB Agreement.

7.1.1.2 Groundwater

The Water Resources (Water available from areas) Determination 2007 (No. 1) made under the *Water Resources Act 2007* (ACT) sets a sustainable upper limit on ACT groundwater abstraction of 7.25 GL/a. A total of about 1.7 GL of groundwater water access entitlements have been issued, which is well below the upper limit.

7.1.2 The Basin Plan

The MDBA is developing a Basin Plan under the Commonwealth *Water Act 2007*. This is a strategic plan for the integrated and sustainable management of water resources across the whole Basin.

The Basin Plan, among other things, will set mandatory long-term average sustainable diversion limits (SDLs) on the amount of water that can be taken from Basin water resources. The SDLs are limits on the volumes of water that can be taken for human uses (such as domestic, urban and agricultural) and are set at both a catchment and Basin scale. SDLs will be set for both surface water and groundwater diversions. The Basin Plan will replace the existing ACT cap under the MDB Agreement with an ACT SDL.

Under the *Water Act 2007* the MDBA is required to prepare a draft Basin Plan—also known as the proposed Basin Plan—for public consultation, before a final Basin Plan can be presented to the Commonwealth Water Minister for approval. The MDBA released the draft Basin Plan on

28 November 2011 for a 20-week public consultation period. The consultation period ended on 16 April 2012.[137]

For the purposes of comparing the potential implications of the Basin Plan for recycled water use in the ACT compared to current arrangements under the MDB Agreement, the Commission has had regard to the proposals for the ACT set out in the chapter 6 of the draft Basin Plan.

7.1.2.1 Proposed ACT sustainable diversion limits

Chapter 6 of the draft Basin Plan, in conjunction with schedules 2, 3 and 4, presents the proposed surface water and groundwater SDLs for all Basin catchments, including the ACT. The proposed ACT SDLs are summarised in table 7.1, and more detail is provided in Appendix J. The draft Basin Plan proposes that the SDLs come into effect from 1 July 2019,[138] with current MDB Agreement cap arrangements remaining in place until then.

Table 7.1: Proposed ACT sustainable diversion limits

Current diversion limit	Proposed Basin Plan SDLs
Surface water (MDB Agreement cap)	Surface water
Watercourse diversions: net 40 GL/a (with growth factor)	Total: 52.5 GL/a diversions comprising: • watercourse diversion: net 40.5 GL/a (includes adjustment for population growth to 30 June 2009 but no ongoing growth factor) • run-off dams diversion: 1 GL/a • commercial forestry plantations diversion: net 11 GL/a
Groundwater (Water Resources Act 2007)	Groundwater
7.25 GL/a	7.25 GL/a

Source: Draft Basin Plan, *Water Resources Act 2007*; MDB Agreement.

The draft Basin Plan proposes an ACT surface water SDL of 52.5 GL/a. This comprises watercourse diversions (net 40.5 GL/a); diversions by run-off (farm) dams (1 GL/a); and diversions from commercial forestry plantations (net 11 GL/a). The draft Basin Plan makes no provision for the SDL to increase as the ACT population grows beyond 2019.

The current surface water cap under the MDB Agreement does not capture run-off dams or commercial plantations and should therefore be compared to the watercourse diversion component of the proposed ACT surface water SDL. While the proposed SDL watercourse diversion provides for the current net 40 GL/a (with an additional 0.5 GL/a adjustment for population growth to 30 June 2009), it does not provide for an ongoing population growth factor, which the MDB Agreement permits.

7.1.2.2 Implications for secondary water use in the ACT

The current MDB Agreement cap is set on a net basis. That is, the measured volume of treated sewage effluent from LMWQCC, Fyshwick Sewage Treatment Plant and Queanbeyan Sewage Treatment Plant returned to the river system after use is subtracted from the gross volume of water extracted from ACT water resources. The watercourse diversion component of the proposed ACT SDL will also be set on a net basis and will therefore have no additional implications for secondary water use in the ACT compared to the current arrangements.

[137] The draft Basin Plan is available on the MDBA website at www.mdba.gov.au/draft-basin-plan.

[138] Section 9.13(2) of the draft Basin Plan.

That is not to say that the net cap or net SDL has no implications for secondary water use. Any large-scale secondary water initiative in the ACT that reduces treated sewage effluent returns without reducing primary water use by the same amount will mean that the cap or SDL is reached more quickly. Turning this around, as long as a secondary water initiative directly substitutes for primary water use, it will not hasten the net cap or SDL being reached. ACTEW's submission to the inquiry issues paper supports this view, stating that 'if the re-use replaces the use of potable water it has a nil impact on the Cap'.[139]

The key difference between the current MDB Agreement and the ACT SDL proposal under the Basin Plan is that the latter will not provide an ongoing population growth factor. In response to the MDBA's *Guide to the Murray–Darling Basin Plan*, which preceded the release of the draft Basin Plan, the ACT Government stated that the ACT's future population growth needs to be recognised in the Basin Plan, while recognising 'that a population growth factor for the ACT, or any urban centre, without some mechanism for offsetting water diversions elsewhere in the Basin, would undermine the SDL concept'.[140]

The Commission agrees that at some stage in the future, the ACT and Queanbeyan population will require more water for consumptive use than is available under the proposed 40.5 GL/a watercourse component of the SDL. Nevertheless, given the declining trend in per capita water consumption since the Millennium Drought, as discussed in section 3.1, and with net diversions well below the 40 GL/a current cap, it may be some time before the proposed ACT SDL becomes a constraint due to population growth.

In any case, following the introduction of the Basin Plan, should the ACT be unable to use water stored in its dams because it has reached the SDL, water trading offers a relatively simple solution. The Commission understands that once all Basin Plan arrangements are in place, including the ability for the ACT to trade with downstream jurisdictions, the ACT will be able to increase its SDL by buying water access entitlements from other MDB jurisdictions for use in the ACT, subject to entitlements being available at a reasonable price. The Commission notes that ACTEW has already purchased about 16.6 GL of NSW water access entitlements (4.1 GL high security and 12.5 GL general security) for the Tantangara Transfer Project.[141] These entitlements could also be used to access water stored in ACT dams if required.

The ACT Government is pursuing the water trade option. In November 2011, the ACT Minister for the Environment and Sustainable Development, Simon Corbell MLA, announced that '[a]rrangements for growth in population are the subject of ongoing discussions with the Federal Government'.[142]

Minister Corbell was also quoted in the media stating that he was 'close to finalising agreements with the Federal Minister in this regard, which will allow us to purchase high security water entitlements into the future to meet that population growth'.[143]

[139] ACTEW (2012b), p. 3.

[140] ACT Government (2011b), p. 14.

[141] ACTEW (2012d).

[142] Corbell (2011).

[143] CityNews.com.au (2011).

Draft finding 7.1

The Commission finds that:

- under a net Murray–Darling Basin (MDB) Agreement cap or net sustainable diversion limit (SDL), as long as a secondary water initiative directly substitutes for primary water use, it will not hasten the net cap or SDL being reached
- the key difference between the current MDB Agreement cap and ACT SDL proposal under the Basin Plan is that the latter will not provide an ongoing population growth factor
- given the ability to increase the ACT SDL by trading water, the absence of a provision for population growth in the draft Basin Plan will have limited implications for ACT primary or secondary water use.

7.2 The Canberra Integrated Urban Waterways Project

Paragraph 1(b) of the inquiry terms of reference requires the Commission to report on the ACT Government's urban waterways and stormwater harvesting programs and their associated built wetlands. Section 3.2.1.2 provides a description and background information on the CIUWP as it currently stands. The economic, social and environmental costs and benefits of the CIUWP in relation to other secondary water options in the context of the ACT's current water security situation are considered in chapter 5.

Four other issues have arisen during the course of the inquiry that require consideration:

- the regulatory and governance arrangements for the pilot stormwater reticulation network
- the reliability of the network in terms of meeting irrigation demands under different climatic conditions
- the value of the pilot stormwater network trial period
- the scale of the pilot.

7.2.1 Regulation and governance

7.2.1.1 Licensing

The *Utilities Act 2000* provides a regulatory framework for utilities in the ACT. It does this by establishing a licensing regime for utilities, and provides for specific industry and technical codes to apply to utilities operating in the ACT.

The Explanatory Memorandum to the *Utilities Bill 2000* states that it:

> sets out a robust, ownership-neutral regulatory regime, which applies equally to entities supplying regulated utility services in the ACT and protects and enhances the interests of the ACT community as consumers of utility services.[144]

The Utilities Act provides for the licensing of prescribed 'utility services'. Any person providing a utility service in the ACT must hold an appropriate operating licence or be exempted from the requirement.[145] Utility services include:

- the transmission, distribution, connection and supply of electricity

[144] ACT Legislative Assembly (2000), p. iv.

[145] Section 22 of the Utilities Act provides that the minister may, in writing, exempt a person from the requirement for a licence in relation to a utility service.

- the transmission, distribution, connection and supply of gas
- the collection and/or treatment of water for distribution through a water network and the distribution of water through the network
- the conveyance, collection, treatment and disposal of sewage and sewerage connection services
- the provision of water and sewerage networks for the supply of water and sewerage connection services.

The Commission is responsible for administering the licensing framework under the Utilities Act. The Commission's responsibilities include:

- licensing of utilities, including granting, varying, transferring and revoking licences
- determining and monitoring compliance with licence conditions
- granting exemptions from compliance with licence conditions
- determination of licence fees
- approval or determination of industry codes that sets out practices, standards and other matters related to the provision of a utility service.

ACTPLA is responsible for technical regulation of utilities under Part 5 of the Utilities Act.[146] This provides for technical codes that relate to:[147]

- the quality of the supplied services (such as pressure or quality of water supply, voltage fluctuations in electricity distribution)
- the standards to which the networks (and network infrastructure) are being constructed or maintained
- the conditions under which a utility provides a new or resized connection to its network including temporary connections
- who is authorised to work on connections to the network
- the preparedness for and handling of emergency situations.

The Commission understands that TAMSD is the proposed utility to own and operate the CIUWP pilot stormwater reticulation network assets and supply stormwater to customers. The Commission also understands that the ACT Government is proposing that TAMSD be licensed under the Utilities Act.

The Commission's view is that the CIUWP pilot stormwater reticulation network is a utility service for the purposes of Part 2 of the Utilities Act and that the utility service should be licensed under the Utilities Act. The alternative would be for the minister to exempt the utility service from the requirement for a utility service licence under section 22 of the Utilities Act. Such an exemption would require the service to instead be regulated under the *Water and Sewerage Act 2000*.

The Commission's view is that regulation under the Utilities Act best serves the interests of the ACT Government and the ACT community in this particular case rather than an exemption.

[146] ACTPLA is part of the Environment and Sustainable Development Directorate (ESDD).

[147] ACT Government (2012c).

Factors leading to this conclusion include:

- The licensing regime under the Utilities Act imposes a range of technical, safety, consumer protection and other responsibilities on utilities.
- It will provide greater clarity and certainty as to the role of the Commission and the Technical Regulator in the administration of the regulatory framework.
- It will avoid the potential for competitive neutrality issues to arise in the event that there are alternative stormwater harvesting providers.

Importantly, it will treat all water utility service providers under the same ACT Government regulatory framework.

> Draft recommendation 7.1
>
> The Commission recommends that the utility that will own and operate the CIUWP pilot stormwater reticulation networks be licensed under the Utilities Act.

7.2.1.2 Stormwater pricing for the trial period

In December 2009 the Commission provided confidential advice on the pricing of stormwater from the CIUWP pilot network. Due to data and forecasting constraints, the Commission was not able to determine a price for stormwater that would recover its capital and operating costs. Instead, the Commission provided an indicative price at which a user might be indifferent about using stormwater rather than potable water.

The stormwater pilot reticulation network is still being built three years later and data on actual capital and operating costs remains incomplete. The Commission retains its view that a full evaluation of the cost of stormwater provided by the trial needs to be completed. Moreover, the cost information collected over the proposed CIUWP trial period (see section 7.2.3) will better inform an assessment of future stormwater supply options.

7.2.2 Reliability of stormwater harvesting

A number of concerns have been raised in the inquiry about the reliability of stormwater harvesting in terms of its ability to contribute significantly to the ACT's water security, particularly during hot and dry periods. In its submission to the inquiry issues paper, ACTEW states that:

> It is important that secondary water use options are considered in the same context as investments in potable water infrastructure. For any water supply system, the critical factor is the ability to supply water during droughts. To enable this, reliability of supply and associated storage are essential in the ACT environment.[148]

CSIRO and AECOM both concluded that primary water backup would be required to improve the reliability of stormwater harvesting schemes in the ACT.[149] The stormwater scenarios assessed for the purposes of the inquiry were modelled on this 'twin-tap' basis. CSIRO also recommended investigating combining stormwater harvesting schemes with aquifer storage recharge.

[148] ACTEW (2012b), p. 12.

[149] CSIRO (2009); AECOM (2011).

There are grounds for concern about the technical reliability of ACT stormwater ponds constructed for the purposes of the CIUWP for two reasons.

First, the pilot reticulation networks are still under construction and are yet to supply water to any end-user. Until a stormwater network is operational and provides water to end-users under a range of climatic conditions, the reliability of the ponds will remain uncertain. The lack of information on reliability will make it difficult to assess future stormwater harvesting schemes in comparison to alternative water supply options.

This highlights the value of the CIUWP trial period in gathering the relevant information to more accurately assess reliability. As noted by the ACT Auditor-General, the 'intention of [the Inner North pilot stormwater reticulation network] was to test issues associated with the design and operation of an alternative supply of non-potable water for irrigation purposes'.[150]

The Commission's views on the CIUWP trial period are provided in section 7.2.3.

Second, the relationship between the different supply sources is a critical aspect of the overall security or reliability of an integrated water supply system with a diversity of supply sources. The fact that the ACT's primary water dams and urban ponds in Canberra are rainfall dependent means that their respective reliabilities are likely to be closely correlated with ACT rainfall patterns, particularly at the tail end of a long drought when ACT dam levels have fallen. The implication of this is that stormwater ponds are more likely to fail, and require primary water backup, under exactly the same hot and dry drought conditions that will place the primary water supply system under pressure.

The reliability of stormwater harvesting also carries potential risks for the financial viability of the network. The first risk relates to the single purpose of the water supplied by the pilot stormwater reticulation network, which is irrigation, particularly during the summer months. During extended wet and relatively cool periods, irrigation demand, and therefore sales revenue, is likely to be low. The second risk relates to the potential for ponds to fail during extended hot and dry periods, which will have similar financial risks for the utility from lower than expected sales revenue. Financial viability is another matter that the Commission considers can be further assessed during the CIUWP pilot evaluation period.

The Commission understands that the CIUWP is proposing to undertake an aquifer storage recharge (ASR) trial in the Flemington Road area to test whether recharge is feasible. Should it prove feasible, it would provide low-cost extra storage and thereby increase the volumetric reliability of the Inner North pilot project.[151] The funding deed between the ACT and Australian governments identified ASR as one of the options for the CIUWP to investigate.[152] The trial would involve injecting excess stormwater into an aquifer through a bore at EPIC, and then extracting it from the same bore to meet irrigation demands.

The Commission understands that the CIUWP commissioned a risk assessment project[153] for the proposed ASR trial. The project undertook a two-stage risk assessment:

- an entry-level risk assessment—this involved a desktop study of all available relevant data

[150] ACT Auditor-General's Office (2010) p77.

[151] ACT Government (2011d) p25.

[152] Australian Government and ACT Government (2007) p30.

[153] URS (2011).

- a maximal and pre-commissioning residual risk assessment—this involved collecting the necessary information, including geochemical modelling on water samples, to assess whether the ASR trial has low human health and environmental risks in the absence of any controls or preventive measures.

The final project report concluded that '[g]eochemical modelling was undertaken and revealed that no significant geochemical reactions should arrive from either injecting or extracting water', which 'allowed a pre-commissioning residual risk assessment to be completed as per the guideline requirements'.[154]

The final report has a cautionary note in relation to the geochemical modelling, stating that it is 'based on two water quality data samples only'. The report recommends that to 'verify the model, both water quality and potential for mineral saturation are monitored during the injection and extraction phase of the proposed trial.'[155]

The final project report is intended to allow the Environment and Sustainable Development Directorate (ESDD) to apply to the Environment Protection Authority (EPA) for approval to undertake a short-term ASR trial involving a 60-day injection test, followed by 60 days' storage and then a 60-day extraction test.

The Commission understands that once ESDD has identified a funding source for the construction of a water pump at the EPIC bore, it will apply to the EPA for approval for the trial. In response to an application, the EPA will assess the proposal based on the risk assessment and methods proposed with a view to assessing likely environmental impacts. The Commission understands that should the EPA approve the trial, it has the option of licensing ESDD to inject and then extract water, or it can exempt ESDD from licensing requirements on the basis that it is conducting a scientific trial.

7.2.3 Trial period

A key purpose of the CIUWP pilot network is to assess the costs and benefits of stormwater harvesting to better inform future decisions about broader-scale stormwater harvesting in the ACT. To this end, the ACT Government has proposed a trial period of two years for monitoring and evaluation purposes, stating that if 'the pilot evaluation concludes that the projects have been successful further infrastructure will be identified to meet the longer term 3 gigalitre target of substituted potable water by 2015'.[156]

As discussed earlier, the Commission's view is that while the ACT does not need to consider broader-scale stormwater harvesting initiatives given its current water security position, the trial period is a good opportunity to collect information that will assist future consideration of stormwater harvesting as an alternative water supply source. More specifically, a properly conducted monitoring and evaluation program will provide the necessary information about the technical and financial viability of the pilot network for the ACT Government to make a decision about whether the pilot should continue or cease operation after the trial. This decision should be made within the context of the integrated and adaptive water supply and demand planning approach discussed in chapter 8.

[154] URS (2011), p. vii.

[155] URS (2011), p. 72.

[156] ACT Government (2011d).

The key areas that require operational testing and data collection during the trial are:

- the volumetric reliability of stormwater harvesting ponds under different weather conditions—this is important for water security and financial viability
- the actual costs of operating and maintaining a stormwater network—this information is important for future pricing of stormwater beyond the trial period, should the stormwater network continue to operate, which in the Commission's view should be set consistently with the way in which the Commission approves ACTEW water prices.

The Commission's view is that a detailed workplan and budget is critical for the trial period monitoring and evaluation program to be successfully executed. Moreover, the program should have clear and measurable criteria on which to gauge the technical and financial viability of the pilot.

Draft recommendation 7.2

The Commission recommends that the ACT Government include an assessment of the following in the monitoring and evaluation trial phase of the Canberra Integrated Urban Waterways Project:

- technical—volumetric reliability of stormwater ponds under different weather and irrigation demand conditions, service reliability in relation to quality of water provided to end-users
- environmental—impact of stormwater harvesting on the pond environment and reducing nutrient loads downstream, filtrate management plan
- commercial—actual costs to operate and maintain the pilot network by the utility, including administration costs, water demand and supply volumes under different weather conditions
- compliance—compliance with utility licensing conditions.

The ACT Government should also prepare a detailed monitoring and evaluation program workplan and budget, and ensure that there are clear and measurable criteria by which to gauge the viability of the pilot.

7.2.4 Scale of the CIUWP pilot reticulation network

The CIUWP is in the process of constructing three separate pilot reticulation networks: the Inner North, Weston Creek and Tuggeranong. The Inner North pilot is the most advanced, and is expected to be operational by November 2012. The Weston Creek pilot is currently in the design stage and expected to be operational by March 2014. Construction is expected to start on the Tuggeranong pilot in June 2012, with a completion date in June 2013.

Under the funding deed between the ACT and Australian governments, the CIUWP originally intended to supply up to 1.5 GL/a of stormwater to end-users by June 2010. Following negotiations with the Commonwealth, this date was subsequently extended by a year to June 2011. As noted above, the ACT Government expects the first supply of stormwater to commence by November 2012.

At the same time, the ACT Government has appropriated substantially more towards the CIUWP than the initial commitment in the funding deed. The ACT Government's final report on the CIUWP to the Australian Government states that the:

> Commonwealth's seed funding resulted in the ACT appropriating over $49 million towards retrofitting infrastructure into the ACT's stormwater systems since 2007, significantly exceeding the initial funding commitment of $6.8 million.[157]

[157] ACT Government (2011d), p. 3.

The Commission's view is that CIUWP should be limited to the more advanced Inner North pilot reticulation network. This would maximise the chances of an operational stormwater pilot network being in place in a timely fashion for trial purposes, while minimising the need for any further budget appropriations.

A key consideration in relation to this decision is whether the Inner North pilot alone will provide sufficient information on which to make an informed decision after the trial period about the technical and financial viability of broader-scale stormwater harvesting. The Inner North pilot is likely to be the more complex and costly of the three pilot networks, because it comprises a network of constructed ponds and a wider range of potential public and private end-users. As such, it may provide adequate scope for testing the technical and financial viability of broader-scale stormwater schemes.

In the Commission's view, the CIUWP funding deed between the ACT and Australian governments should not be a barrier to concentrating on the Inner North pilot for two reasons. First, the Australian Government has indicated that it considers that the project is already complete.[158] Second, the Inner North is expected to provide up to about 0.43 GL/a of stormwater to end-users. This is line with the expected volumes referenced in the deed, which relate to the CIUWP providing 'up to' 1.5 GL/a or 3 GL/a.[159]

Moreover, in the Commission's view, focusing exclusively on the Inner North pilot will not compromise the other key CIUWP policy drivers cited in section 3.2.1.2. These include:

- the Parliamentary Agreement between the ACT Labor Party and the ACT Greens—the Inner North represents an acceleration of the program of replacing stormwater drains with urban creek and wetland systems in Sullivans Creek
- the *Think water, act water* strategy's primary water reduction, recycled water and water quality targets—as discussed in section 5.3, the Commission is of the view that the strategy's mains water reduction target of 25% on 2003 levels by 2023 is likely to be met by 2012–13
- the 2007 *Where will we play?* strategy—this strategy had a vision that no ACT sportsground would be solely reliant on primary water by 2013. In response to the changed ACT water supply situation, it was revised in October 2011 to recommend a broader range of water supply and demand options, with a focus on the viability and cost-effectiveness of each option.[160]

Draft recommendation 7.3

The Commission recommends that the ACT Government limit the CIUWP to the Inner North pilot stormwater reticulation network.

[158] Australian Government (2012).

[159] Australian Government and ACT Government (2007), p. 32.

[160] ACT Government (2011f).

8 An adaptive and integrated urban water supply and demand planning framework

During the course of the inquiry into secondary water use in the ACT, it has been necessary for the Commission to examine the current ACT management planning framework for water supply and demand. In this chapter, the Commission draws lessons from this assessment in the interests of developing a more adaptive, integrated, and ultimately more effective approach to ensuring maintenance of the ACT's urban water supply and demand balance.

8.1 What is an adaptive and integrated approach?

During the course of the inquiry it has become clear that there are two essential features of the problem faced in making good decisions about water supply and demand in the ACT.

The first is the evolving pattern of uncertainty that is constantly changing over time. For example, there is a great deal of uncertainty about future rainfall patterns and their impact on water supply, both in the short and long term. On the demand side, there is uncertainty about future population growth.

The second is that there are many different options for supply augmentation and demand management that can play a role in providing water security. Each has its own set of costs and benefits and interacts with other options in different ways in relation to the water supply system as a whole.

The approach to dealing with these features of the supply and demand decision problem therefore needs to be both adaptive and integrated.

An adaptive approach responds to the continually evolving and changing nature of the problem. It does this through a rolling assessment of the capacity of the water system as a whole to provide the level of water security required.

An integrated approach properly considers all potential supply and demand options, and the interaction between them on the water system as a whole, on a like-with-like basis using the same set of assumptions.

Together, an adaptive and integrated approach to water supply and demand planning provides a single analytical framework under which good decisions can be made in an uncertain and complex environment. It is the Commission's view that a fully integrated and adaptive planning framework will provide the best outcomes for the ACT community.

8.2 The current ACT water supply and demand planning approach

In the Commission's view, a successful adaptive and integrated approach to water supply and demand planning requires:

- clearly defining the roles, responsibilities and accountabilities of the parties involved in the decision-making process
- defining a clear and measureable water security objective
- clearly mapping out an adaptive and integrated decision-making process to ensure that the water security objective can be met at least cost.

In the Commission’s view, the current approach to water supply and demand planning in the ACT does not meet the elements of an adaptive and integrated approach framework set out above.

First, the roles and responsibilities of relevant organisations involved in water security planning are not defined clearly. For example, the entity responsible for ensuring that the ACT water security objective is met is not clearly identified. Similarly, the lines of accountability and responsibility between ACTEW and the ACT Government regarding the investment in large infrastructure projects are blurred. With respect to other decisions, both ACTEW and the ACT Government have separately undertaken investments and activities aimed at ensuring water security. ACTEW has assumed responsibility for the primary water supply and community-wide demand-management measures (permanent water conservation measures and temporary water restrictions), while the ACT Government is responsible for a range of water-efficiency and secondary water initiatives.

Second, as discussed in section 4.1.1, the current ACT Government water security objective of no more than one year in 20 in water restrictions is not clearly defined and is therefore open to inconsistent interpretation. The lack of a clear statement of the required level of water security makes it difficult to plan to meet that level of security.

This contrasts with water security objectives set in other jurisdictions. In southeast Queensland and New South Wales, water security objectives are expressed more specifically in terms of the expected frequency, duration and severity of water restrictions (see box 8.1).[161]

Box 8.1: NSW Security of Supply basis for local government utilities

Under the NSW Security of Supply basis (commonly referred to as the ‘5/10/10 rule’), water supply headworks systems are normally sized so that:

a) duration of restrictions does not exceed 5% of the time
b) frequency of restrictions does not exceed 10% of years—that is, one year in 10 on average
c) severity of restrictions does not exceed 10%—that is, systems must be able to meet 90% of the unrestricted water demand through a repetition of the worst recorded drought commencing with storage drawn down to the level at which restrictions need to be imposed to satisfy a) and b) above.

Source: NSW Government (2010), p. 7.

Third, there is no clearly defined integrated and adaptive decision-making process. The ACT Government’s *Think water, act water* (TWAW) strategy sets the broad direction for ACT supply and demand planning decision-making.[162] While the strategy lists specific implementation actions and the organisation responsible for meeting the various objectives, this is not in the Commission’s view a substitute for a clearly specified decision-making process.

In the absence of such a process, investment decisions are not being made in an integrated manner on the basis of their implications for the ACT water supply system as a whole. For example, in recent years, ACTEW has made substantial investments in augmenting the primary water supply that is likely to provide the required level of water security for some time. At the same time, the ACT Government is investing in a stormwater network that, if expanded, has the potential to

[161] Queensland Government (2010), p. 3; NSW Government (2010), p. 7.

[162] It is important to note that, as a water resources management strategy, TWAW deals with a much broader range of water issues than water supply and demand planning, such as environmental flows and water quality.

undermine the efficiency of ACTEW's investment, with cost implications for the ACT community.

The ACT lacks a formal process for responding in a timely manner to changing circumstances that would allow decisions about water investments to be reviewed and adjusted as necessary based on new information. For example, TWAW has not been updated since its introduction in 2004, despite substantial developments in the ACT water sector. Investment decisions are currently being guided by targets set in this strategy that are, on the basis of new information, no longer relevant.

8.3 Water planning in Victoria

The current ACT approach contrasts with the more clearly defined, integrated and adaptive approach to water supply and demand planning adopted by Victoria.

In August 2011, the Victorian Government issued *Guidelines for the development of a water supply demand strategy* that urban water corporations in Victoria are required to follow. The guidelines are intended to assist Victorian water corporations to prepare, regularly update and implement water supply and demand strategies in order to identify the best mix of measures to maintain a balance between the demand for water and available supply for urban supply systems now and into the future. To achieve this, the guidelines require, among other things, that 'water planning is subject to a transparent and rigorous decision-making process, with clear roles and responsibilities and accountabilities, which can adapt to the changing environment'.[163]

The guidelines set out a decision-making process that corporations are required to follow, which is summarised below:

1. A water security objective (or level of service) the water corporation is required to meet under normal circumstances is determined following consultation with customers.
2. The water supply system performance is modelled over the long term (50 years) and short term (five years) using scenario-based supply and demand forecasts.
3. If the second step shows an impending supply and demand imbalance, a long list of supply and demand options are developed and then refined to create a short list of viable options.
4. The short list is subject to more detailed economic, social and environmental options analysis, including customer consultation.
5. The fourth step gives rise to a list of priority actions to be implemented over the short term (next five years) and long term (next 50 years) to ensure that supply and demand remain in balance.
6. The actions are then implemented.
7. Each year the short-term system performance is updated to reflect new information, with adjustments made to actions as necessary.
8. Every five years the entire water and supply demand strategy is reviewed and updated.

[163] Victorian Government (2011).

8.4 A new framework for the ACT

8.4.1 Overview

This section sets out an example of a new adaptive and integrated water supply and demand planning framework, based on the broad principles discussed above, which would ensure more effective ACT water investments in the future. The framework, adapted from the Victorian example described above, demonstrates just one possible method, based on existing ACT institutions. Any decision on the most suitable framework would require further detailed analysis. It is important that, should such an approach be adopted, sufficient time is taken to work through the details to ensure that the broad principles discussed earlier are given proper effect in the new framework. Figure 8.1 provides a simplified representation of the framework discussed in this chapter.

It is important to note that the framework described below is not a substitute for a broader water resources management strategy, such as TWAW, which sets directions for a wider range of water resources management issues. It is, however, important that the framework and the broader strategy are consistent. For example, should the broader strategy contain upfront targets for particular water supply initiatives, this would limit the flexibility inherent in the framework. This matter is discussed further in section 8.4.3.3.

A key element of the framework presented in this chapter is that it enables integration of long-term and short-term planning.

Long-term planning deals with more permanent long-term changes to the water supply system, such as building new primary dams or public third pipe networks. The purpose of long-term planning is to determine supply and demand measures needed to manage population growth and climate change over the next 50 years.

Short-term planning, often referred to as drought-response planning, deals with more flexible and immediate actions required to respond to water shortages over a five-year period, such as imposing water restrictions. The purpose of short-term planning is to ensure continuity of supply regardless of climatic conditions.

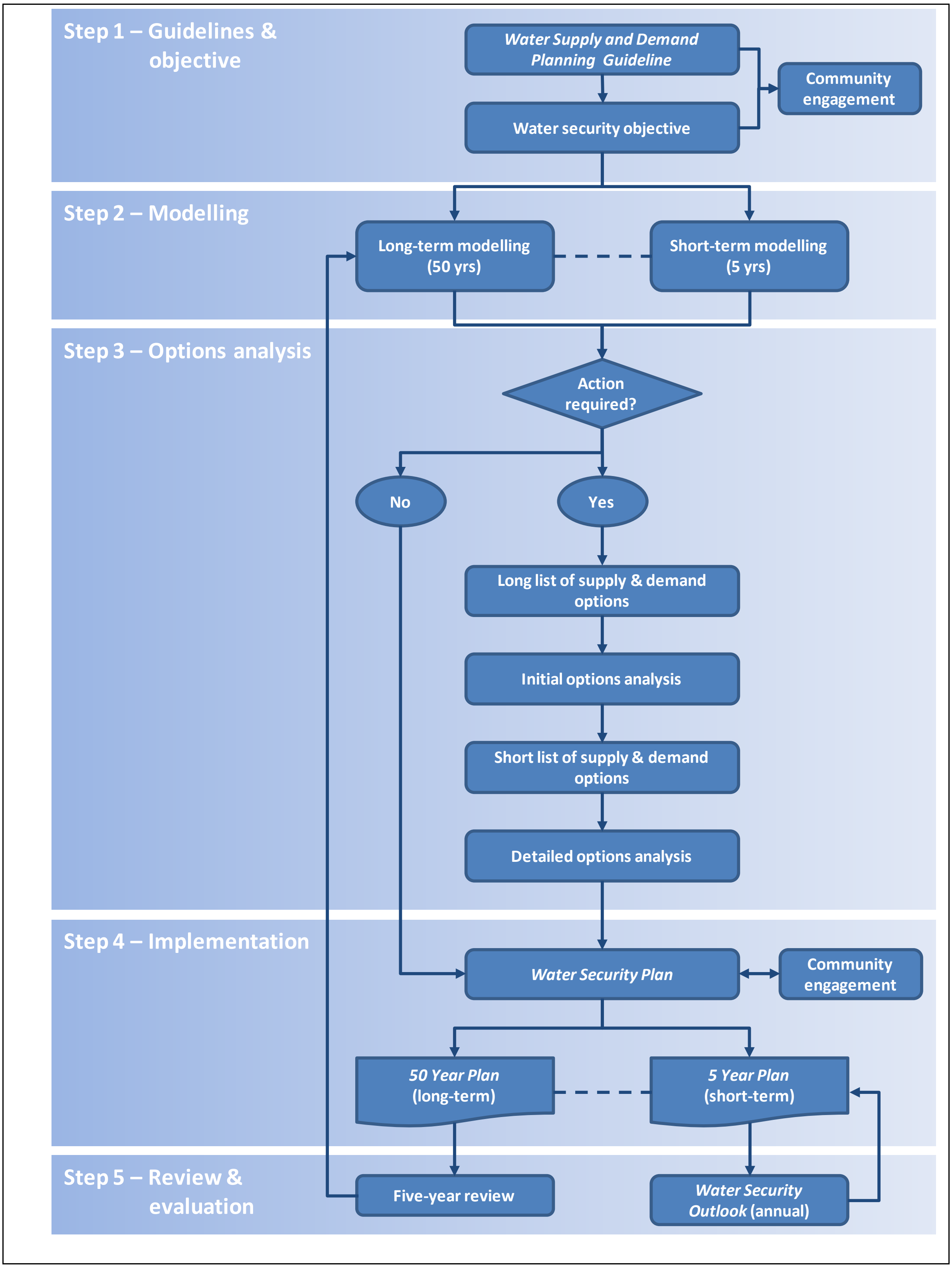
8.4.2 Roles and responsibilities

To improve decision-making, the framework discussed in this chapter requires clear delineation of the roles and responsibilities between the various entities involved. In the ACT, the key entities are the ACT Government and the directorate responsible for providing water policy advice, the Environment and Sustainable Development Directorate (ESDD), ACTEW and the Commission. The proposed role of each is described below.

8.4.2.1 ACT Government

ESDD would develop the details of the framework and water security objective, in consultation with the ACT community, and provide advice to the ACT Government. The government would approve the framework, set out in, say, the Water Supply and Demand Planning Guideline. The government would also approve and publish the ACT water security objective.

Figure 8.1: A new adaptive and integrated ACT water supply and demand planning framework



Source: Adapted from Victorian Government (2011), figure 1, p. 6.

8.4.2.2 ACTEW

As the ACT's water utility, ACTEW would be the sole entity responsible for public investment, primary and secondary, in the ACT water supply system. It would also be responsible for any public water conservation or demand-management initiatives.

Following the Water Supply and Demand Planning Guideline and informed by the water security objective, ACTEW would be responsible for developing the Water Security Plan, which would include actions required to meet the water security objective at least cost to the ACT community. This process would include the ACTEW Board approving actions, including investments, determined at the end of the process. For larger investments above a specified value, ACTEW would provide a business case to the ACT Government for approval. The business case and the advice of the Commission (see below) would be made public such that the community would be aware of the potential investments and their implications, and would therefore be able to provide input into the government's decision-making process.

Having a single entity responsible for water supply decisions and investments makes it easier to ensure that all potential supply and demand options are considered in a holistic manner so that the ACT's water requirements are met at least cost to the community.

8.4.2.3 The Commission

The Commission would have a number of roles. The first would be to undertake an independent assessment of the prudence of the business case developed by ACTEW for significant projects. The results of the assessment, along with the ACTEW business case, would be made public and would form an input into the ACT Government's decision-making process.

The second would be a continuation of the Commission's current regulatory pricing role. This would include, for example, assessing the efficiency of significant ACTEW investments after they have been implemented. There would be information synergies between the Commission's ex ante prudency and ex post efficiency assessment roles.

Third, the Commission would undertake an independent public assessment of the Water Security Plan and underpinning 50-year and five-year plans prepared by ACTEW under the framework.

If requested, the Commission would also have a role in assisting ESDD in developing the water supply and demand framework, or assisting ACTEW in its model development.

8.4.3 Decision-making process

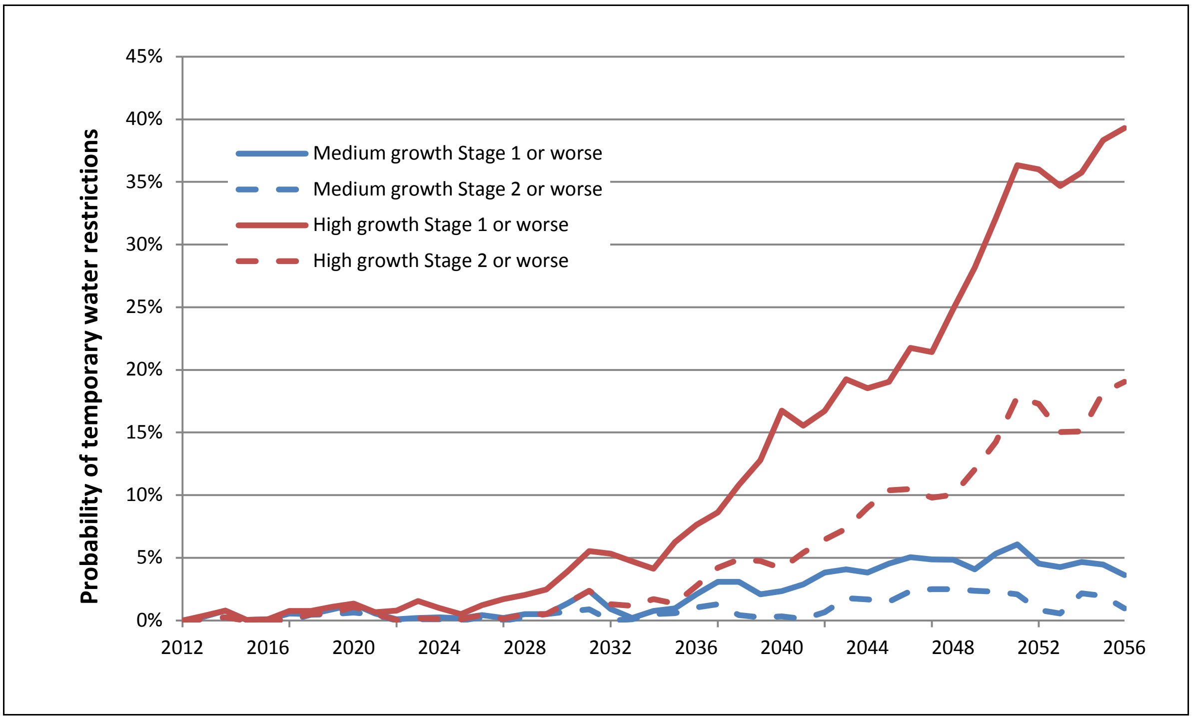
8.4.3.1 Step 1: Develop the guideline and set the water security objective

Following advice from ESDD, including community consultation, the ACT Government publishes the Water Supply and Demand Planning Guideline, which contains the detail of the new adaptive and integrated decision-making process.

The ACT Government announces a clearly defined and measureable water security objective, after community consultation. The objective should reflect the trade-off the community inherently makes between the level of water security it desires and the costs of providing that security. For example, the merits of adopting a more severe level of restrictions as the objective water security measure might be canvassed with the community. Avoiding Stage 2 or worse restrictions rather than Stage 1 or worse as is currently required is likely to substantially delay the next water supply augmentation.

As illustrated in figure 8.2, adopting a target of being in Stage 2 or worse restrictions no more than 5% of the time would delay the need for further augmentation beyond the 2056 forecast period in the medium growth case, and by about ten years in the high-growth scenario. The trade-off is the cost to the ACT community of the probability of being in Stage 2 rather than Stage 1 restrictions 5% of the time. The difference in ACTEW's target water use reduction for Stage 2 restrictions relative to Stage 1 is 15% (25% water reduction compared to 10%).

Figure 8.2: Stage 1 versus Stage 2 probability of restrictions



Source: ActewAGL (2012b), figure 4, p. 13.

The purpose of the security objective is to guide ACTEW's water supply and demand decision-making process.

8.4.3.2 Step 2: Model the performance of the existing water supply system

The next step is for ACTEW to model the performance of the existing ACT water supply system in relation to the water security objective set out in step 2 from two perspectives: long-term and short-term.

The long-term modelling looks 50 years ahead, while the short-term modelling assesses performance over a five-year period. The modelling will be based on forecasts of future water supply and demand under a range of climate and population growth scenarios, including a return to dry conditions scenario.

As discussed in section 4.4.3, because the ActewAGL water resources model was developed with a major focus on managing the system of dams in the ACT, it is not well adapted to underpin the strategic water supply and demand planning envisaged here. Therefore, developing a more appropriate model, built on the foundations of the ActewAGL modelling work but with richer and more flexible modelling of climate, is required. This model would be capable of giving a more complete and accurate representation of the performance of the various secondary water options under various climate scenarios.

The modelling undertaken in step 2 would show the extent to which the existing water supply system is likely to meet the desired level of water security over the long and short term.

8.4.3.3 Step 3: Carry out an options analysis if required

If the modelling described in step 2 suggests that there is a potential supply gap that requires action to be taken, the next step is to for ACTEW to carry out an options analysis. If there is no need for further additional action, this should be reflected in the Water Security Plan in step 4.

Long list

The options analysis commences with the development of a long list of all potential supply and demand options. This includes potential secondary water options. As discussed in section 4.4, public secondary water schemes should be viewed as supply-side measures that add supply to the primary dam system. Private household and estate-scale initiatives should be considered as demand-reduction measures on the basis that is difficult to assess their potential water yield.

Short list

A short list of viable options is then developed from the long list and tested with the ACT community. The short list is subject to a detailed options analysis that considers economic, social, and environmental costs and benefits, including the contribution of the initiative to meeting the water security objective. It is important, particularly for innovative secondary water options, that the institutional and regulatory requirements required for successful installation and operation are considered.

Real options analysis

As discussed above, there is a great deal of uncertainty about future water supply and demand. This includes uncertainty about how wet or dry the next few years will be, future climate patterns under climate change, future population growth and per capita demand patterns. As time passes, some uncertainties are resolved. For example, while '[d]am inflows for the next 12 months are uncertain, in a year's time they are a known fact'.[164]

Real options analysis is a method for helping make investment decisions when outcomes are uncertain and there are significant sunk costs once the decision is made. In such cases there may be benefits in retaining the ability to wait for new information on future prices, costs and climatic conditions before committing to the entire project upfront.

Real options analysis values these investment opportunities, taking into account the future flexibility for decision-making inherent in them. The method may be applied to any future investment opportunity, providing that the necessary input data and techniques are available to value the relevant options. The main types of real options include deferring a project, abandoning a project, switching between alternative projects, changing the operating scale of a project, expanding the number of projects and staging investment in the project.

The real options approach provides flexibility by encouraging the development of projects in stages. In addition it accounts for the value now of any option for possibly executing future projects obtained as a result of executing the current project. A traditional investment appraisal only assesses the direct costs and benefits of the project under consideration. Hence traditional

[164] Productivity Commission (2011), p. 106.

appraisal will reject projects that real options would accept with consequent potential lost benefit to the community. Infrastructure projects often deliver value by opening the option to execute further projects in the future by extending the network, road, rail or pipe for example, further.

This difference can be illustrated by considering a hypothetical proposal to build a third pipe network that would take secondary water from LMWQCC to customers in North Canberra when future demand for secondary water is uncertain. The project may not be feasible under a traditional investment appraisal that only considers the revenue stream from the potential North Canberra customers. However, a real options analysis would consider the value now of the potential additional revenue stream from the option to expand the network later to service customers in other areas should there be sufficient demand. Including the potential value of this option in the investment appraisal of the North Canberra project may result in its acceptance.

The Commission agrees with the Productivity Commission's view that committing to upfront ambitious targets, such as for water recycling, regardless of future climatic conditions is 'fundamentally inconsistent with a real options approach and could impose high (and unnecessary) cost on the community'.[165]

The Commission regards a real options approach as essential to realise the full benefits of the adaptive and integrated framework described in this chapter.

Prioritised list of options

At the end of the detailed options analysis there is a prioritised list of initiatives and actions for further investigation and/ or implementation over the short term (0–5 years) and long term (5–50 years). The business case for any substantial investment in initiatives or actions would be presented to the ACT Government for approval. The Commission would assess the prudence of the business case, which, together with advice from ESDD, would be an input into the government's decision-making process.

8.4.3.4 Step 4: Implement actions

The results of the modelling, options assessments and list of priority actions for implementation are documented in a Water Security Plan. The strategy comprises a Fifty-year Plan for the long-term priority actions and a Five-year Plan for the short-term actions. The priority initiatives and actions are then implemented by ACTEW, subject to the review process set out in step 5.

8.4.3.5 Step 5: Review situation regularly and update actions

Each year ACTEW prepares and publishes a *Water Security Outlook* that updates the short-term assessment of the existing ACT water supply system performance on the basis of new information. Based on the updated assessment, ACTEW adjusts the actions contained in the Five-Year Plan as required. This may include bringing identified actions forward, or deferring or even abandoning short-term actions in response to changed circumstances.

Every five years the ACT Government reviews the water security objective and ACTEW reviews and updates the entire Water Security Plan, including the long-term and short-term plans, by revisiting the decision-making process. Priority long-term and short-term actions are updated and adjusted as required based on new information and circumstances.

[165] Productivity Commission (2011), p. 109.

Appendix A: Terms of reference

Australian Capital Territory

Independent Competition and Regulatory Commission (Inquiry into Secondary Water Use)

Terms of Reference Determination 2011

Disallowable instrument DI2011–255

Made under the

***Independent Competition and Regulatory Commission Act 1997*, Section 15 (Nature of industry references) and Section 16 (Terms of industry references)**

Reference for investigation under Section 15

Pursuant to sections 15(1) and 16 of the Act, I refer to the Independent Competition and Regulatory Commission (the Commission) the task of undertaking an inquiry into and assessment of secondary water uses in the ACT.

1. The Commission is to report on the following matters:

a) opportunities for a commercial market in grey water in both commercial and domestic applications and in new construction and retro-fits;

b) the ACT Government's urban waterways and stormwater harvesting programs and their associated built wetlands; and

2. The Commission is to include consideration of:

a) the economic, environmental and social costs and benefits of the matters set out in 1(a) and (b), with and without the Basin Plan, to the extent possible given that the Basin Plan is under development;

b) any water conservation initiatives other than those captured in 1(a) and (b) that also have the potential to deliver economic, environmental and social outcomes; and

c) any other matters the Commission considers relevant to the inquiry.

The Commission will report by the end of June 2012.

Andrew Barr MLA

Treasurer

21 September 2011

Appendix B: Submissions to the issues paper

	Date received	Submitter	Issues raised/information provided
1	23 November 2011	Ms Veronika Sain	Raises concerns about health risks with recycled drinking water (p. 1) Supports building another dam to ensure Canberra's water security (p. 1)
2	16 December 2011	Office of the Commissioner for Sustainability and the Environment	Supports consideration of economic, social and environmental costs and benefits when making water management decisions (p. 2) Submits that returns from the LMWQCC and Queanbeyan STP cannot be considered as environmental flows as they are relatively fixed volumes with little flow variability (p. 2)
3	20 December 2011	Easyrain Pty Ltd	Submits information on products and services supplied including automatic irrigation reticulation systems, pumps, rainwater tanks, pipes and fittings and pumping, filtration and switching control systems for stormwater storage (p. 1)
4	20 December 2011	Mr Ian Lawrence	Supports the integrated and comprehensive scope of the inquiry (p. 1); raises concerns about the lack of recognition of integrated land and water development context of stormwater recycling (p. 9) Submits that the fragmentation of urban waterways management and development is an impediment to the recognition and innovative promotion of urban lakes, ponds and wetlands (p. 2) Submits that ACT urban lakes, ponds and wetlands have been developed on the basis of multiple functions, not just water supply, which enhances economic benefits (p. 3) Submits information on the features of local stormwater-based water supply facilities that underpin their technical, economic environmental and social values Compares the levelised costs of stormwater and the Murrumbidgee to Googong transfer scheme (p. 4) and submits that the CIUWP water supply is cheaper and therefore should be fully implemented (p. 5) Submits information on costs of rainwater tank water supply (p. 6) Submits information on the costs of urban stormwater on downstream water users, and on Lake Burley Griffin (p. 6) Submits information on the value of the Kenny detention pond in preventing local flood damage (p. 7) Submits information on the contribution and value of wetlands and WSUD measures to improving the local micro-climate (p. 8)

	Date received	Submitter	Issues raised/information provided
			Submits information on the potential benefits of urban wetlands in sequestrating carbon through peat accumulation (p. 8) Submits that there are commercial market opportunities in apartment and office building developments for more cost-effective integration of rainwater harvesting and reuse in hot water and toilet flushing facilities (p. 9); and integration of precinct-based wetlands into housing developments to provide a communal water treatment and supply system for irrigating landscapes (p. 9) Submits that the take-up of rainwater tanks and greywater systems in urban areas in Australia is driven by lifestyle sustainability reasons and drought response (p. 10) Submits that impediments to increased greywater use include manufacturers providing expensive systems in excess of fit-for-purpose uses and hesitancy on the part of environmental and health regulators in relation to appropriate management practices being followed (p. 10) Submits that developers are keen to implement WSUD measures in an effort to market sustainable housing, with ACT Government agencies impeding this by rejecting plans incorporating WSUD and recycling measures (p. 10) Submits that the draft Basin Plan reinforces the need to live more sustainably by changing lifestyles and water management (p. 11) Submits that lowland surface water storage is inappropriate due to evaporation losses and that groundwater aquifer storage is preferable (p. 11)
5	22 December 2011	Mr Shane Rattenbury MLA	In relation to the triple bottom line assessment submits that the best approach is to consider all economic, social or environmental criteria that impact positively or negatively, rather than selecting key factors for the analysis (p. 1) Submits that in assessing the CIUWP it is important to go beyond the cost per GL of water and include broader biodiversity and amenity benefits (p. 2) Supports planning for long-term water resilience including water efficiency and diversified storage options (p. 2) Submits that the inquiry provides a valuable opportunity to examine the efficiency of ACT Government rainwater tanks (p. 2) Submits that there are bureaucratic (institutional/regulatory) barriers to ACT developers reducing water use in their estates (p. 2) Submits that greater coordination between ACT Government agencies can facilitate greater use of greywater (p. 3)

	Date received	Submitter	Issues raised/information provided
			Submits that the WSUD Code 40% mains water reduction target could easily be increased (p. 3) Seeks clarification whether aquifers and bores are capable of providing potable water (p. 3)
6	5 January 2012	ACTEW Corporation Ltd	Supports the inquiry’s holistic water management approach (p. 1) Submits information on ACTEW’s involvement in water recycling and water conservation initiatives, including pilot initiatives (p. 2), North Canberra Water Recycling Scheme (p. 2) and LMWQCC water recycling (p. 3) Submits that if treated sewage effluent is reused rather than being returned to the river system, this increases net water use and counts against the ACT Cap and the proposed SDL under the Basin Plan; but if the reuse replaces potable water it will have nil impact (p. 3) Submits pricing and cost information on ACTEW’s water recycling schemes (p. 3) Submits information on concepts and plans for future expansion of ACT recycling to support the ACT Government’s target of 20% recycled water use by 2023 (p. 4) Submits that current ACTEW water augmentation projects will secure the ACT’s water supply for the next 20 to 25 years (p. 5) Submits information on ACTEW’s water balance modelling and notes that current modelling suggests that the ACT has already exceeded the ACT Government’s 2023 target of 25% reduction in primary water use (p. 6) Submits that ACTEW has adopted the National Urban Water Planning Principles in relation to planning ACT water security, which means considering all water security options (p. 6) Submits information on PWCM (p. 6) and temporary water restrictions (p. 9), noting that optimal price increases could not be relied upon entirely to replace temporary water restrictions Submits in relation to the AECOM ACT Non-potable Water Master Plan Study that recycled water supply from the LMWQCC is cheaper per kL than from stormwater (p. 10) Submits that because of ACTEW’s fixed costs, reduced demand as a result of the development of any significant alternative water supply scheme will result in mains water price increases (p. 10) Raises concerns about the reliability of supply from stormwater schemes during hot and dry periods and submits that as a result there will be no cost savings for ACTEW water infrastructure network (p. 10) Submits that ACTEW filtrate from stormwater scheme filtration

	Date received	Submitter	Issues raised/information provided
			cannot be accepted into the sewerage network (p. 10) Submits that the water abstraction charge should be set at the same rate whether water abstraction is from ACTEW or ACT Government water storages (p. 11) Submits that increased abstraction from urban stormwater ponds means that the ponds should be subject to similar environmental flow regulations to ACTEW dams (p. 11) Submits that low water flows in the sewerage network due to water conservation measures has required additional expenditure as a result of increased odours and blockages (p. 11)
7	25 January 2012	ACT Health	Supports reuse of non-potable water as long as public health is not compromised (p. 1) Submits that public health risks include pathogens in and chemical contamination of reuse water (p. 1) Submits that reuse schemes be subject to environmental, health and economic impact assessment (p. 1) Submits that the level of treatment required is dependent on the source and final use of the reuse water, with public health risks particularly dependent on final use of the treated reuse water (p. 1) Submits that health risks from irrigation of public spaces are less than those from treated effluent piped to individual households
8	25 January 2012	The Village Building Co. Ltd (VBC)	Submits that VBC has responded to the WSUD Code 40% primary water reduction requirements by installing water tanks and pumps on lot sizes greater than 300m^2 and reducing lot sizes below 300m^2 to avoid the requirement (p. 1) Submits information on the institutional difficulties associated with implementing other water reduction options such as xeriscape landscaping, stormwater ponds and black water reuse (p. 1) Submits information on the costs of installing rainwater tanks and pumps to meet the 40% primary water reduction target (p. 2) Submits that current mandatory requirements do not offer a valid way of reducing community water usage and simply transfer some costs to purchasers of new dwellings
9	2 February 2012	Territory and Municipal Services Directorate	Submits information on mains and recycled water use on Canberra parklands, public toilets and Gungahlin cemetery Submits responses to the questions set out in the issues paper (Attachment D)

Appendix C: Key stakeholder meetings

Date	Organisation	Participants	Location
28 November 2011	ESDD/ACT Treasury	Ms Jennie Gilles (Manager, Urban Waterways Program) Mr Jack Garside (Canberra Integrated Urban Waterways) Mr Patrick Paynter (Principal Engineer, ESDD) Mr Chris Murray (Executive Director, City Planning) Mr Ben Ponton (Deputy-Director General Planning Policy) Ms Edwina Robinson (Urban Waterways Coordinator) Mr Richard Kingham (Manager Finance and Budget Division, Treasury) Mr Adam Deering (Graduate Investment and Economics Division, Treasury)	Inner North stormwater pilot field trip
5 December 2011	ACTEW	Mr Ross Knee (Executive Manager, Water) Mr Leigh Crocker (Manager, Technical & Consulting Services, Water Division) Ms Kirilly Dickson (Manager, Sewerage Services) Mr Bjorn Tibell (Senior Financial Advisor, ActewAGL Finance & Regulatory Affairs)	ACTEW offices, ActewAGL House, Civic
9 December 2011	Environment and Sustainable Development Directorate (ESDD)	Various—presentation by Professor Tony Wong (AECOM Australia Pty Ltd) on the ACT Non-potable Water Master Plan Study	ESDD Offices, Dame Pattie Menzies House, Dickson
12 December 2011	Land Development Agency (LDA)/Economic Development Division (EDD)	Mr David Dawes (Director-General, EDD) Mr Dan Stewart (Executive Director, Ministerial, Cabinet & Policy) Mr Shane O'Leary (Executive Director, Sport & Recreation Service) Mr Hamish McNulty (Executive Director, Property & Strategic Projects Division, LDA)	EDD/LDA offices, Civic
13 December 2011	ACTEW/ActewAGL	Mr Leigh Crocker (Manager, Technical & Consulting Services, Water Division ACTEW) Mr Tim Purves (Senior Engineer, ActewAGL) Mr Graham Costin (Project Manager (Water Resources), ActewAGL) Mr Bjorn Tibell (Senior Financial Adviser, ActewAGL Finance & Regulatory Affairs)	ACTEW offices, ActewAGL House, Civic
13 December 2011	ESDD	Mr Patrick Paynter (Principal Engineer)	ICRC offices, 12 Moore Street, Civic
15 December 2011	ACT Commissioner for the Environment	Mr Robert Neil (Commissioner for the Environment) Mr Warren Geeves (Senior Manager, Office of the Commissioner for Sustainability and the Environment) Ms Joanna Temme (Project Officer, Office of the Commissioner for Sustainability and the Environment)	ICRC offices, 12 Moore Street, Civic

Date	Organisation	Participants	Location
19 December 2011	LDA/Sport and Recreation Services (SRS)	Mr Rob Thorman (Project Director, Sustainability and Innovation Planning and Design LDA) Mr Hamish McNulty (Executive Director, Property & Strategic Projects Division LDA) Mr David Jeffrey (Manager, Strategic Projects & Planning, SRS) Ms Jenny Priest (Director, Tourism Events and Sport Division SRS)	LDA offices, TransACT House, Dickson
19 December 2011	ESDD	Mr Chris Murray (Executive Director, City Planning) Mr Craig Simmons (Technical Regulator)	ICRC offices, 12 Moore Street, Civic
21 December 2011	ESDD	Mr David Butt (Director, Water Policy) Mr Stewart Chapman (Senior Manager, Water Policy) Mr Michael Ross (Project Manager, *Think water, act water* review)	ESDD offices, Macarthur House, Lyneham
10 January 2012	ActewAGL	Mr Tim Purves (Senior Engineer, ActewAGL)	ActewAGL offices,12 Hoskins Street, Mitchell
6 February 2012	ACTEW/ActewAGL	Mr Leigh Crocker (Manager, Technical & Consulting Services, Water Division ACTEW) Mr Tim Purves (Senior Engineer, ActewAGL)	ACTEW offices, ActewAGL House, Civic
9 February 2012	ESDD	Ms Karen Civil (Manager, Coordination Unit Sustainability Programs) Ms Ann Lyons Wright (Senior Manager, Regulation and Services Division)	ESDD offices, Macarthur House, Lyneham
9 February 2012	ESDD	Mr David Butt (Director, Water Policy) Mr Michael Ross (Project Manager, *Think water, act water* review)	ESDD offices, Macarthur House, Lyneham
9 February 2012	ACTEW/ActewAGL	Mr Leigh Crocker (Manager, Technical & Consulting Services, Water Division ACTEW) Mr Bjorn Tibell (Senior Financial Adviser, ActewAGL Finance & Regulatory Affairs)	ACTEW offices, ActewAGL House, Civic
9 February 2012	Queanbeyan City Council	Mr Andre Pretorius (Manager, Water and Sewer)	QCC depot, 10 Ellerton Drive, Queanbeyan
10 February 2012	Village Building Company (VBC)	Mr John Kenworthy (General Manager, Regulations Review, Sustainability, Project Feasibility & Direct Import Purchasing)	VBC offices, 221 London Circuit, Civic
10 February 2012	ESDD	Ms Jennie Gilles (Manager, Urban Waterways Program) Mr Jack Garside (Canberra Integrated Urban Waterways)	ESDD Offices, Dame Pattie Menzies House, Dickson
22 February 2012	ACT Commissioner for the Environment	Mr Robert Neil (Commissioner for the Environment) Mr Warren Geeves (Senior Manager, Office of the Commissioner for Sustainability and the Environment)	Office of the Commissioner for Sustainability and the Environment, Dickson

Date	Organisation	Participants	Location
7 March 2012	ESDD/SRS	Ms Jennie Gilles (Manager, Urban Waterways Program) Mr Jack Garside (Canberra Integrated Urban Waterways) Mr Patrick Paynter (Principal Engineer, ESDD) Mr David Jeffrey (Manager, Strategic Projects and Planning, SRS)	ESDD offices, Macarthur House, Lyneham
15 March 2012	ACTEW/ActewAGL	Mr Leigh Crocker (Manager, Technical & Consulting Services, Water Division ACTEW) Mr Tim Purves (Senior Engineer, ActewAGL) Ms Katherine Larkings (ActewAGL)	ACTEW offices, ActewAGL House, Civic
26 March 2012	ESDD	Ms Jennie Gilles (Manager, Urban Waterways Program) Mr Jack Garside (Canberra Integrated Urban Waterways)	ESDD offices, Dame Pattie Menzies House, Dickson
2 April 2012	ACT Health Directorate, Health Protection Service (HPS)	Mr John Woollard (Director, HPS) Mr Adrian Farrant (Public Health Adviser) Ms Melissa Langhorne (Director, Environmental Health)	HPS offices, 25 Mulley Street Holder

Appendix D: ActewAGL water supply and demand model summary

ActewAGL has developed a computer-based model of the ACT water resources system which ACTEW uses for its water resources planning. The model is designed for assessing medium- to long-term ACT water security requirements and can be used to predict at what stage additional supply augmentations (or increased demand reduction initiatives) are likely to be necessary and to compare alternative supply and demand options.

In summary, the model consists of the following components.

Stochastic data generation model

The ActewAGL model of the ACT water resources system incorporates the natural variability in the climate by employing a stochastic data generation model. Looking forward, there is natural variation in climate as the community can expect that there will be dry years and wet years. It is this natural variation in future climate that is applied to future climate outcomes.

The advantage of this form of modelling is that it allows the modeller to examine potential uncertain future outcomes in a systematic manner. The alternative would be to calculate the probability of potential outcomes directly under an assumed distribution of future climate. This cannot be done in this case due to the complexity of the modelling, especially the water balance model.

Historical data provides the range and scope of the variability in the climate variables used in the modelling. Climate outcomes are updated to take into account the potential effect of climate change on rainfall and evaporation.

The ActewAGL model generates 10,000 years of climate data (rainfall and evaporation) based upon historical data. The 10,000 years of climate data are grouped into 200 sequences, each 50 years long. All of the models are populated and solved using all of the 50-year climate outcomes.

The output of the models is 200 sequences, each 50 years long, of inflows, water demand and level of water restrictions. One output of interest to this review is the proportion of the 200 sequences that result in water restrictions over the next 50 years.

Water supply

Based on historical rainfall data for particular water catchments and historical evaporation data at Canberra Airport, the **stochastic data generation model** is used to generate a time series of stochastic rainfall and evaporation sequences.[166] The time series is then adjusted for climate change on the basis of the dry case 2030 ACT climate projections made by CSIRO in 2003.[167]

Catchment-specific **rainfall run-off models** then convert the time series rainfall and evaporation data into projections of water inflow volumes into the four ACT water storages.

[166] Random data generated using numerical methods to match the statistical properties of the historical time series data.

[167] See section 5.2 for more detail on ACTEW's climate change assumptions.

A **bushfire impacts model** then reduces the inflow data projections generated by the rainfall run-off models to account for lower water catchment yields as vegetation recovers following the 2003 Canberra bushfires.

Water demand

Based on historic Canberra airport rainfall and evaporation data, a **stochastic data generation model** is used to generate a time series of stochastic rainfall and evaporation sequences adjusted for climate change.

A **water demand model**, calibrated to ACT demand patterns observed during the 1993–2002 period, converts the time series data into projections of future unrestricted ACT and Queanbeyan per capita water demand.[168] The per capita demand data is then multiplied by ACT and Queanbeyan population projections to calculate time series water demand volumes. Demand is then reduced by a factor to account for water-saving measures and behavioural change since the 1993–2002 period.

Water balance

A water balance model (REALM) of the ACT water supply system projects monthly dam storages on the basis of water inflows (using data from the bushfire and climate-adjusted rainfall run-off models), water releases (using unrestricted demand data from the demand model, reduced to account for temporary water restrictions if necessary), dam spills and evaporation.[169] ACTEW system operating rules (such as physical pipe constraints or water treatment plant capacities) and ACT Government environmental flow requirements are additional modelling input constraints.

REALM calculates when, at what level (Stages 1 to 4) and for how long temporary water restrictions apply. This has the effect of reducing demand when dam storages fall to certain restriction trigger levels. It is these calculations that enable the ACT's water security situation to be estimated in terms of the probability of being in water restrictions over a certain period of time.

[168] Unrestricted demand is the output of the demand model before any reduction in demand due to temporary water restrictions is applied.

[169] A linear program-based water supply system simulation model that optimises water allocation within a network for each time step of the simulation period, in accordance with user-defined operating rules.

Appendix E: Population assumptions

Table E.1: ACTEW baseline population assumptions

Year	ACT	Queanbeyan	Other NSW areas	Total population
2012	368,100	41,740	0	409,840
2013	374,400	42,455	0	416,855
2014	380,700	43,169	0	423,869
2015	387,200	43,906	6,467	437,573
2016	393,700	44,643	6,575	444,918
2017	400,400	45,403	6,687	452,490
2018	407,000	46,151	6,797	459,949
2019	413,800	46,923	6,911	467,633
2020	420,600	47,694	7,024	475,318
2021	427,500	48,476	7,140	483,116
2022	434,500	49,270	7,257	491,026
2023	441,500	50,064	7,373	498,937
2024	448,500	50,857	7,490	506,848
2025	455,500	51,651	7,607	514,758
2026	462,500	52,445	7,724	522,669
2027	469,600	53,250	7,843	530,693
2028	476,700	54,055	7,961	538,716
2029	483,700	54,849	8,078	546,627
2030	490,800	55,654	8,197	554,651
2031	497,800	56,448	8,314	562,561
2032	504,900	57,253	8,432	570,585
2033	511,900	58,046	8,549	578,496
2034	518,900	58,840	8,666	586,406
2035	526,000	59,645	8,785	594,430
2036	533,000	60,439	8,902	602,341
2037	540,000	61,233	9,018	610,251
2038	547,100	62,038	9,137	618,275
2039	554,200	62,843	9,256	626,299
2040	561,400	63,660	9,376	634,435
2041	568,500	64,465	9,494	642,459
2042	575,800	65,292	9,616	650,709
2043	583,100	66,120	9,738	658,958
2044	590,400	66,948	9,860	667,208
2045	597,800	67,787	9,984	675,571
2046	605,300	68,638	10,109	684,047
2047	612,800	69,488	10,234	692,522
2048	620,400	70,350	10,361	701,111
2049	628,100	71,223	10,490	709,813
2050	635,800	72,096	10,618	718,514
2051	643,600	72,981	10,749	727,329
2052	651,400	73,865	10,879	736,144
2053	659,300	74,761	11,011	745,072
2054	667,200	75,657	11,143	753,999
2055	675,200	76,564	11,276	763,040
2056	683,200	77,471	11,410	772,081

Source: ActewAGL (2012a), p. 8.

Table E.2: Commission medium population growth assumptions

Year	ACT	Queanbeyan	Total population
2012	360,400	41,633	402,033
2013	364,600	42,118	406,718
2014	368,700	42,592	411,292
2015	372,900	43,077	415,977
2016	377,000	43,550	420,550
2017	381,100	44,024	425,124
2018	385,200	44,498	429,698
2019	389,200	44,960	434,160
2020	393,200	45,422	438,622
2021	397,200	45,884	443,084
2022	401,100	46,334	447,434
2023	405,000	46,785	451,785
2024	408,900	47,235	456,135
2025	412,700	47,674	460,374
2026	416,500	48,113	464,613
2027	420,200	48,541	468,741
2028	423,900	48,968	472,868
2029	427,500	49,384	476,884
2030	431,000	49,788	480,788
2031	434,500	50,193	484,693
2032	437,900	50,586	488,486
2033	441,200	50,967	492,167
2034	444,500	51,348	495,848
2035	447,700	51,718	499,418
2036	450,800	52,076	502,876
2037	453,900	52,434	506,334
2038	457,000	52,792	509,792
2039	460,000	53,138	513,138
2040	463,000	53,485	516,485
2041	466,000	53,832	519,832
2042	468,900	54,167	523,067
2043	471,800	54,502	526,302
2044	474,800	54,848	529,648
2045	477,700	55,183	532,883
2046	480,600	55,518	536,118
2047	483,500	55,853	539,353
2048	486,400	56,188	542,588
2049	489,200	56,512	545,712
2050	492,100	56,847	548,947
2051	495,000	57,182	552,182
2052	497,900	57,517	555,417
2053	500,700	57,840	558,540
2054	503,600	58,175	561,775
2055	506,400	58,499	564,899
2056	509,300	58,834	568,134

Source: ActewAGL (2012c), table 1, p. 5.

Table E.3: Commission high population growth assumptions

Year	ACT	Queanbeyan	Total population
2012	368,100	42,522	410,622
2013	374,400	43,250	417,650
2014	380,700	43,978	424,678
2015	387,200	44,729	431,929
2016	393,700	45,480	439,180
2017	400,400	46,254	446,654
2018	407,000	47,016	454,016
2019	413,800	47,802	461,602
2020	420,600	48,587	469,187
2021	427,500	49,384	476,884
2022	434,500	50,193	484,693
2023	441,500	51,001	492,501
2024	448,500	51,810	500,310
2025	455,500	52,619	508,119
2026	462,500	53,427	515,927
2027	469,600	54,247	523,847
2028	476,700	55,068	531,768
2029	483,700	55,876	539,576
2030	490,800	56,696	547,496
2031	497,800	57,505	555,305
2032	504,900	58,325	563,225
2033	511,900	59,134	571,034
2034	518,900	59,943	578,843
2035	526,000	60,763	586,763
2036	533,000	61,571	594,571
2037	540,000	62,380	602,380
2038	547,100	63,200	610,300
2039	554,200	64,020	618,220
2040	561,400	64,852	626,252
2041	568,500	65,672	634,172
2042	575,800	66,516	642,316
2043	583,100	67,359	650,459
2044	590,400	68,202	658,602
2045	597,800	69,057	666,857
2046	605,300	69,923	675,223
2047	612,800	70,790	683,590
2048	620,400	71,668	692,068
2049	628,100	72,557	700,657
2050	635,800	73,447	709,247
2051	643,600	74,348	717,948
2052	651,400	75,249	726,649
2053	659,300	76,161	735,461
2054	667,200	77,074	744,274
2055	675,200	77,998	753,198
2056	683,200	78,922	762,122

Source: ActewAGL (2012c), table 1, p. 5.

Appendix F: PWCM and temporary water restrictions

Permanent water conservation measures (PWCM), administered by ACTEW, are intended to conserve water on a permanent basis. This is achieved by imposing requirements such as the use of hand-held hoses, prohibition on watering gardens at designated times and other restrictions on use.

The ACT temporary water restrictions scheme is imposed in times of acute water shortage and is intended to restrict rather than conserve water. Temporary water restrictions are currently applied through a four-stage scheme of progressively higher levels of restrictions based on water scarcity.

Table F.1: PWCM and temporary water restrictions arrangements over the past ten years

	PWCM/ restriction level	Start date	End date
Old arrangements	1	17 Dec 2002	28 Apr 2003
	2	29 Apr 2003	30 Sep 2003
	3	1 Oct 2003	29 Feb 2004
	2	1 Mar 2004	31 Aug 2004
	3	1 Sep 2004	28 Feb 2005
	2	1 Mar 2005	31 Oct 2005
New arrangements	PWCM	1 Nov 2005	31 Oct 2006
	2	1 Nov 2006	15 Dec 2006
	3	16 Dec 2006	31 Aug 2010
	2	1 Sep 2010	31 Oct 2010
	Enhanced PWCM	1 Nov 2010	In force

Source: ActewAGL.

The measures have undergone changes since restrictions were first introduced in 2002. Table F.1 provides details of the dates when PWCM and various restriction stages were in force. PWCM were first introduced in November 2005, and effectively replaced the old Stage 1 restriction level. The original PWCM were amended to achieve greater water savings before being reintroduced as ‘enhanced’ PWCM in November 2010. Table F.2 shows the target reduction in water consumption for each of the temporary water restriction stages relative to PWCM.

Table F.2: Water restrictions targets

Water restriction level	Target reduction relative to PWCM
Stage 1	10%
Stage 2	25%
Stage 3	35%
Stage 4	55%

Source: ActewAGL (2011), p. 34.

Appendix G: *Think water, act water* primary water reduction target

Think water, act water (TWAW) sets the following specific target to reduce per capita primary water consumption:

- a reduction (relative to 2003 consumption) in per capita consumption of mains water by 12% by 2013 and 25% by 2023, to be achieved through:
  - water efficiency measures
  - sustainable water recycling
  - use of stormwater and rainwater.

This appendix analyses the performance of ACT and Queanbeyan water customers against the TWAW water primary water reduction targets. While the 2013 and 2023 per capita water consumption targets dates are one and eleven years away, it is possible to evaluate the per capita water consumption at this time compared to the targets.

The starting point for this exercise is the determination of the 2003 baseline per capita consumption. The ACT Auditor-General reported some confusion around which consumption level should be used as the baseline case against which to measure performance in relation to the targets.[170] Table G.1 illustrates four different baseline levels that have been cited by the ACT Government in recent years.

Table G.1: Various 2003 baseline per capita water consumption levels

Baseline consumption figure	Baseline consumption (kL per person)
2003 base year from ACT Government (2004b), p. 20	190
Weather-adjusted 2003 base year from ACT Government (2004a), p. 15	174
Unrestricted demand using the ActewAGL demand model	182
ESDD progress report baseline level	217

Source: ACT Auditor-General's Office (2010), table 2.1, p. 21.

In light of this confusion, the conservative approach is to test performance against the lowest baseline. The lowest baseline is 174 kL/person/annum (kL/p/a) set in TWAW Volume 2:

> Average consumption across all sectors over the period 1992–2001 is 174 kilolitres per person per year. To determine whether we have met the mains water target in 2013, a climate-adjusted model is needed to correct for climate effects on usage in 2013. To meet this target in 2013, climate-adjusted consumption will need to be 153 kilolitres per person per year.[171]

Given the target of a 12% reduction in per capita consumption by 2013 and a 25% reduction by 2023, per capita consumption for the ACT and Queanbeyan must decrease to 153.5 kL/p/a by 2013 and 130.8 kL/p/a by 2023. This information is summarised in table G.2.

[170] ACT Auditor-General's Office 2010.

[171] ACT Government (2004a), p. 15.

Table G.2: *Think water, act water* primary water reduction targets

Targets	2003 baseline	2013 target	2023 target
Per capita reduction (%)		12%	25%
Per capita consumption (kL/person)	174.4	153.5	130.8

One of the issues that must be addressed is that the measure of per capita consumption must be climate adjusted as stated, but not explained in TWAW.[172] While TWAW does not specify the method of climate adjustment that must be made to actual consumption, the Commission's understanding is that actual consumption in 2013 and 2023 is contingent on the realised climate in those years. For example, during warm dry years it is expected that per capita water consumption is greater than during cool wet years. When actual consumption in 2013 and 2023 is realised, the authority testing for achievement of the TWAW target will need to develop a methodology for climate-adjusting actual consumption.

At this time the Commission can relate progress against the targets with respect to forecast consumption for the financial years 2011–12 and 2012–13. The Commission has made forecasts of aggregate water consumption for the ACT and Queanbeyan. These forecasts are used for determining the price of water in the ACT and the current forecasts can be viewed as being climate adjusted as will be described below. The Commission can also forecast population figures for the next two years as well. Table G.3 presents forecast population numbers for 2011–12 and 2012–13.

Table G.3: Population forecasts

Population	2011–12	2012–13
ACT population	368,100	374,400
Queanbeyan population	41,740	42,455
Total population	409,840	416,855

Source: Table E.1.

The Commission forecasts total water consumption for the ACT and Queanbeyan as part of its determination of prices for water in the ACT. The forecasting exercise was undertaken as part of the 2008 review into water and sewerage services in the ACT.[173] In that review the Commission allowed for a mid-term review of the forecasts for water demand in the ACT for the last two years of the price direction, 2011–12 and 2012–13. In April 2011 the Commission completed the mid-term review and announced new prices for water and sewerage services for 2011–12 and 2012–13 in the ACT. The forecast of water demand for 2011–12 and 2012–13 made at that time represent the Commission's best estimate of water demand based upon all available information at that time.

The estimated water demand for the ACT for 2011–12 and 2012–13 assumed that only PWCM (permanent water conservation measures) applied for the two years and was based upon an average climate. Thus, the forecasts for ACT demand satisfy the TWAW requirement that the consumption is climate adjusted. Table G.4 details the water demand forecasts for the ACT and Queanbeyan for 2011–12 and 2012–13. The forecast adopted for Queanbeyan remains the forecast adopted in 2008.

[172] ACT Government (2004a), p. 15.

[173] ICRC (2008).

Table G.4: Water demand forecasts

Demand forecasts	2011–12	2012–13
ACT forecast (ML/year)	47,962	47,962
Queanbeyan forecast (ML/year)	4,918	4,951
Total forecast (ML/year)	52,880	52,913

Given population forecasts and water demand forecasts, it is a simple matter to determine forecasted per capita consumption for 2011–12 and 2012–13 in the ACT and Queanbeyan, as shown in table G.5.

Table G.5: Forecast per capita consumption

Per capita consumption	2011–12	2012–13
ACT (kL/person)	130.3	128.1
Queanbeyan (kL/person)	117.8	116.6
Total (kL/person)	129.0	126.9

As can be seen from table G.5, at this time it appears that the 2013 target of a 12% reduction in per capita consumption (153.5 kL/p/a) will be easily met in 2011–12. It also appears that the 2023 target of a 25% reduction in per capita consumption (130.8 kL/p/a) will also be met in 2011–12, a full ten years before the target date.

There are two questions that follow from this result: what drove the reduction in per capital consumption; and is the reduction permanent?

The answer to the first question is relatively straightforward. The ACT entered water restrictions at the end of 2002 and experienced high level (Stage 2 or 3) from December 2006 through to November 2010. Water restrictions substantially reduce outdoor water use and there is evidence that many customers may have invested in outdoor water-saving devices. There have also been reductions in indoor water use as more efficient water-saving devices have been adopted, such as low-flow shower heads. Therefore, water demand in 2011–12 is much lower than unrestricted water demand during the baseline years of 1992–2001.

The second question queries future behaviour. The concern may be that as the memory of high-level water restrictions recedes, consumer behaviour will revert to something similar to earlier usage patterns before the drought. While this is a potential concern, the Commission’s view is that this is unlikely to occur. A key factor that will mitigate any a return to the high water usage of the past is the increase in the price of water. Table G.6 shows the tariffs for water in 2002–03 and 2011–12. Note that 2002–03 prices include the water abstraction charge, which was a separate component in the price of water at that time.

Table G.6: ACTEW water prices

Water prices	2002–03	2011–12
Fixed $/pa	125.00	95.63
Tier 1 (0–200 kL) $/kL	0.51	2.33
Tier 2 (201 kL +) $/kL	1.07	4.66

The volumetric price of water has more than quadrupled since 2002–03, while the fixed charge has actually fallen. A customer consuming 250 kL/a without changing their consumption level would face a 183% water bill rise over a nine-year period from 2002–03 to 2011–12. Total annual water and sewerage bills for a customer consuming 250 kL/a have more than doubled over this period, which exceeds the rise in the consumer price index by a significant amount. There is no reason to expect that the prices of water and sewerage services will fall in the future. Given the increases in water prices and the effects on household budgets, it is unlikely that customers will return to their previous water use behaviour. The natural response to increases in prices is to expect a reduction in consumption.

The conclusion that can be derived from the analysis is clear. The 2013 target of a 12% reduction in per capita water consumption will be easily met. It is also likely that the ACT and Queanbeyan will meet the 2023 target of a 25% reduction in per capita water consumption by 2013, well ahead of the target date. In its submission to the inquiry, ACTEW supported this conclusion, stating that: 'Recent modelling by ActewAGL has indicated that the ACT has already exceeded a 25 per cent reduction with current changed behaviours'.[174]

While ACTEW raised the concern that 'this may be a "hangover" effect from the recent restrictions'[175] and that per capita water consumption may increase in the future, the Commission's view is that this is unlikely, given the change in the take-up in inside and outside water-savings devices and large increases in water prices.

[174] ACTEW (2012b), p. 6.

[175] ACTEW (2012b), p. 6.

Appendix H: Stormwater modelling

Extract from ActewAGL (2012b), pp. 6–7.

<u>Infrastructure</u>

The model was run with the infrastructure as modelled in WA1112-016. This is used as the baseline water model.

In addition, there were two alternative water source scenarios modelled. These were based on the Canberra Integrated Urban Waterways scheme.

1. The pilot scheme (1.2GL) consisting of North-Canberra Ponds, Weston Creek Pond, and Lake Tuggeranong.
2. The first stage of the scheme (~2.9GL) was assumed to consist of the pilot scheme and the addition of Lake Ginninderra.

The assumptions for these ponds were based on information provided by the ICRC. This is shown in Table 2.

Table 2: Assumptions about the alternative water schemes

	Pilot stage				Next stage
	Inner North	**Weston Creek**	**Tuggeranong**	**Total Pilot**	**Lake Ginninderra**
Water source	Flemington Road Pond Dickson Pond Lyneham Pond	North Weston Pond	Lake Tuggeranong Tuggeranong Weir Isabella Pond Lower and Upper Stranger Ponds		Lake Ginninderra
Minimum Storage (ML)	21	180	2,408	2,609	3,027
Active storage volume (ML)	37	60	360	457	528
Storage capacity (ML)	58	240	2,768	3,066	3,555
Average inflows (ML/a)	1,196	3,596	6,129	10,921	5,500
Average Demand to be met (ML)[2]	**518**	**225**	**450**	**1,193**	**1,684**
% of non potable demand (1.5GL)	*43%*	*19%*	*38%*	*100%*	*n/a*
% of non potable demand (3.0GL)	*18%*	*8%*	*16%*	*41%*	*59%*

In addition to these, the following assumptions were made to allow the water balance model to operate correctly.

1. The schemes were modelled as aggregated ponds (i.e. the Inner North was modelled as one reservoir rather than three ponds, Tuggeranong modelled as a second reservoir etc.)
2. The hypostatic equations used to estimate the pond area at a particular volume were based on the *Canberra Integrated Waterways: Feasibility Study*.[3]
3. The alternative water monthly demand was calculated to be a fraction of the restrictable portion of demand. This causes the demand to fluctuate both with season and with rainfall. This was corrected for population growth.

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[2] Supplied by ICRC.
[3] Maheepala, S. et al., 2009. *Canberra Integrated Waterways: Feasibility Study*. Report for Territory and Municipal Services, ACT, CSIRO: Water for a Healthy Country National Research Flagship, Black Mountain, Canberra, Australia.

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Reference Number: WA1112_016

$$non - potable\ demand = x \times \left(\frac{total\ demand - unrestrictable\ demand}{projected\ population / population\ in\ 2007} \right)$$

Where x = 0.055 for the pilot scheme

0.132 for the Stage 1 scheme.

x is calculated to provide annual demands of 1193 ML/year and 2877 ML/year for the Pilot and Stage 1 schemes.

This demand was split between the four ponds as per the percentages in Table 2.

4. Evaporation/Rainfall for each pond was assumed to be the same as Canberra airport. Stochastic data consistent with that used for the potable water catchments was used for this sequence.
5. Average annual inflows were assumed to be equal to the values shown in Table 2. These inflows are based on the same climate assumption used in ACTEW's baseline modelling and used to develop inputs in this analysis[4].
   A stochastic data sequence was produced by using rainfall-runoff models of some urban catchments in the ACT. These were:
   - Sullivan's Creek @ Barry Drive
   - Yarralumla Ck @ Curtin
   - Yarralumla Ck @ Mawson (subcatchment of Yarralumla @ Curtin).

   The monthly inflow for each pond was assumed to be proportional to the monthly inflow generated for these catchments as shown in Table 3. These factors were calculated so that the average annual inflow generated from the stochastic data was equal to the average inflow shown in Table 2. This enables inflow projections for all of the catchments to use stochastic data (a large amount of synthetic data generated to match the properties of historically observed data) consistent with the other inputs to the model.

Table 3: Inflow relationships

Aggregated Pond	Factor	Urban Catchment
Inner North	0.359	Sullivan's Creek
Weston Creek	0.433	Sullivan's Creek + Yarralumla @ Curtin (including Yarralumla @ Mawson)
Tuggeranong	0.735	Sullivan's Creek + Yarralumla @ Curtin (including Yarralumla @ Mawson)
Lake Ginninderra	0.661	Sullivan's Creek + Yarralumla @ Curtin (including Yarralumla @ Mawson)

6. The demand allocated to each catchment is supplied from the pond whenever storage exceeds the minimum storage values shown in Table 2. Otherwise, demand is allocated to the potable system
7. There are no environmental flow requirements for the alternative water sources.

[4] Maheepala, S. et al., 2009. *Canberra Integrated Waterways: Feasibility Study*. Report for Territory and Municipal Services, ACT, CSIRO: Water for a Healthy Country National Research Flagship, Black Mountain, Canberra, Australia.

Appendix I: Levelised cost formula

$$LUC = \frac{PV(Costs\ in\ \$)}{PV(Water\ Supplied\ or\ Saved\ in\ kL)} = \frac{\sum_{t=0}^{n} \frac{C_t}{(1+r)^t}}{\sum_{t=0}^{n} \frac{Q_t}{(1+r)^t}} \qquad (1)$$

Where LUC = levelised unit cost; *PV* = present value; C_t = costs in current dollars in year t; Q_t = volume of water supplied or conserved in kL in year t; *t* = year; *r* = discount rate.

Following Fane et al. (2003), the reason for discounting the future stream of water can be demonstrated by viewing the levelised cost as 'equal to the income per unit that would need to be received from each unit of supply, for the project to "break even" in present value terms.'[176]

In other words, the levelised unit cost represents a 'price' (P) in real terms that would fully recover the costs (capital, operating and relevant replacement costs) of a project. It is the price that satisfies:

$$PV\ (Revenue) = PV\ (Costs) \qquad (2)$$

The right-hand side of equation 2 is simply the present discounted value of the cost stream. The left-hand side of equation 2 can be expanded:

$$\frac{P \times Q_1}{(1+r)} + ... + \frac{P \times Q_t}{(1+r)^t} \qquad (3)$$

This can be rearranged to give:

$$P \times \left(\frac{Q_1}{(1+r)} + ... + \frac{Q_t}{(1+r)^t}\right) \qquad (4)$$

This is equivalent to price times the present discounted value of the future water stream, an equivalent expression to the levelised cost formula in equation 1.

[176] Fane et al. (2003), p. 4.

Appendix J: Draft Basin Plan ACT SDLs

Box J.1: ACT surface water baseline and sustainable diversion limit

29	Australian Capital Territory (surface water) (SS1)	The BDL is the sum of: (a) the long-term annual average limit on the quantity of water that can be taken from watercourses calculated by: (i) summing the quantity of water that would have been taken by that form of take in accordance with Schedule E to the Agreement for each year of the historical climate conditions (including an adjustment to account for population growth to 30 June 2009); and (ii) dividing that quantity by all the years of the historical climate conditions; and (b) the long-term annual average limit on the quantity of water that can be taken by run-off dams (excluding take under basic rights) calculated on the basis of the take under the level of development that existed on 30 June 2009; and (c) the long-term annual average take of water by run-off dams under basic rights at the level of development that existed on 30 June 2009; and (d) the long-term annual average net take of water by commercial plantations calculated on the basis of the take under the level of development that existed on 30 June 2009. Note to paragraph (a): The Authority estimates this to be 40.5 GL per year. Note to paragraphs (b) and (c): The Authority estimates the sum of items (b) and (c) to be 1 GL per year. Note to paragraph (d): The Authority estimates this to be 11 GL per year.
Australian Capital Territory		
	Australian Capital Territory (surface water) water resource plan area	
29	Australian Capital Territory (surface water)(SS1)	The limit is the BDL. Note: The Authority estimates the BDL to be 52.5 GL per year and therefore this limit is estimated to be 52.5 GL per year.

Source: Draft Basin Plan, Schedule 2—Matters relating to surface water SDL resource units and Schedule 3—BDLs for surface water SDL resource units.

Box J.2: ACT groundwater water baseline and sustainable diversion limit

	Column 1	Column 2	Column 3	Column 4
Item	Groundwater SDL resource unit (code)	Groundwater covered by groundwater SDL resource unit	BDL for the SDL resource unit in gigalitres (GL) per year	Long-term average sustainable diversion limit for SDL resource unit in gigalitres (GL) per year
Australian Capital Territory				
	Australian Capital Territory (groundwater) water resource plan area (GW1)			
1	Australian Capital Territory (Groundwater) (GS56)	all groundwater	1.7	7.25

Source: Draft Basin Plan, Schedule 4—Matters relating to groundwater SDL resource units.

Appendix K: Addressing the terms of reference

Table K.1: Matrix identifying how all terms of reference requirements have been covered

Terms of reference requirement	Draft report location
Report on:	
1(a) opportunities for a commercial market in greywater in both commercial and domestic applications and in new construction and retro-fits	Section 6.2, 6.3, 8.4
1(b) the ACT Government's urban waterways and stormwater harvesting programs and their associated built wetlands	Section 3.2, 7.2
Include consideration of:	
2(a) the economic, environmental and social costs and benefits of the matters set out in 1(a) and (b)	Chapter 5, 6
with and without the Basin Plan, to the extent possible given that the Basin Plan is under development	Section 7.1
2(b) any water conservation initiatives other than those captured in 1(a) and (b) that also have the potential to deliver economic, environmental and social outcomes	Chapter 3 Section 4.3

Abbreviations and acronyms

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ACTEW	ACTEW Corporation
ACTPLA	ACT Planning and Land Authority
CIUWP	Canberra Integrated Urban Waterways Project
Commission	Independent Competition and Regulatory Commission (ACT)
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ECD	Enlarged Cotter Dam Project
ESDD	Environment and Sustainable Development Directorate
FWO	Future Water Options
GL	gigalitre (one million kilolitres)
ICRC	Independent Competition and Regulatory Commission
ICRC Act	*Independent Competition and Regulatory Commission Act 1997* (ACT)
kL	kilolitre
LMWQCC	Lower Molonglo Water Quality Control Centre
M2G	Murrumbidgee to Googong Pipeline Project
MDB	Murray–Darling Basin
MDBA	Murray–Darling Basin Authority
MDBC	Murray–Darling Basin Commission
ML	megalitre (one thousand kilolitres)
NCWRS	North Canberra Water Reuse Scheme
PWCM	permanent water conservation measures
SDL	sustainable diversion limit
TAMSD	Territory and Municipal Services Directorate
TWAW	*think water, act water*
WSR	Water Security Review
WSUD	Water Sensitive Urban Design

References

ACT Auditor-General's Office 2010. *Performance audit report: Water demand management administration of selected initiatives: ACTEW Corporation Limited, Department of the Environment, Climate Change, Energy and Water*. ACT Auditor-General's Office, Canberra ACT.

ACT Government 1997. *Environment Protection Act 1997*. ACT Parliamentary Council, Canberra ACT.

ACT Government 1999. *ACT wastewater reuse for irrigation: Environmemt protection policy*. ACT Government, Canberra ACT.

ACT Government 2004a. *Think water,act water*. Volume 2: Explanatory document, ACT Government, Canberra ACT.

ACT Government 2004b. *Think water,act water: Strategy for sustainable water resource management in the ACT*. Volume 1, ACT Government, Canberra ACT.

ACT Government 2004c. *Think water,act water: Strategy for sustainable water resource management in the ACT: Summary*. ACT Government, Canberra ACT.

ACT Government 2005. Environment Protection Regulation 2005. In: Counsel, AP (ed.). ACT Government, Canberra ACT.

ACT Government 2006. *2006 Environmental flow guidelines*. ACT Government, Canberra ACT.

ACT Government 2007. *Greywater use: Guidelines for residential properties in Canberra*. ACT Government, Canberra ACT.

ACT Government 2009a. *Water use and catchment general code*. ACT Government, Canberra ACT.

ACT Government 2009b. *Waterways Water Sensitive Urban Design General Code*. ACT Government, ACT Planning & Land Authority, Canberra ACT.

ACT Government 2010a. *Competitive neutrality in the ACT*. ACT Treasury Directorate, Canberra ACT.

ACT Government 2010b. *Rainwater tanks: Guidelines for residential properties in Canberra*. ACT Government, Canberra ACT.

ACT Government 2011a. *2009 Demand management progress report*. ACT Government, Environment and Sustainable Development Directorate, Canberra ACT.

ACT Government 2011b. *ACT Government submission to the to Murray–Darling Basin Authority on the Guide to the proposed Basin Plan*. ACT Government, Canberra ACT.

ACT Government 2011c. *ACT Population Projections: 2009–2059*. ACT Government, Canberra ACT.

ACT Government 2011d. *Canberra Integrated Urban Waterways Project: Final report*. ACT Government, Environment and Sustainable Development Directorate, Canberra ACT.

ACT Government 2011e. *Canberra Integrated Urban Waterways: Background and progress briefing*. ACT Government, Environment and Sustainable Development Directorate, Canberra ACT.

ACT Government 2011f. *Sportsgrounds sustainability progress report*. ACT Government, Canberra ACT.

ACT Government 2012a. *ACTSmart homepage*. ACT Government, Canberra ACT. See http://www.actsmart.act.gov.au/home.

ACT Government 2012b. *Rainwater tank rebate*. ACT Government, Canberra ACT. See http://www.actsmart.act.gov.au/your_household/rainwater_tank_rebate.

ACT Government 2012c. *Technical regulation of utility networks*. ACTPLA, Canberra ACT.

ACT Government 2012d. *Use of treated effluent from the Lower Molonglo Water Quality Control Centre*. ACT Health, Canberra ACT.

ACT Health 2012. *Submission to the secondary water use inquiry issues paper*. Canberra ACT.

ACT Labor & Greens, 2008. *Parliamentary Agreement between ACT Labor and the ACT Greens*. Canberra ACT.

ACT Legislative Assembly 2000. 'Utilities Bill 2000 Explanatory Memorandum.' In: Council, AP (ed.). ACT Government, Canberra ACT.

ACTEW 2004. *Options for the next ACT water source*. ACTEW, Canberra ACT.

ACTEW 2005a. *Future water options for the ACT region—Implementation plan: A recommended strategy to increase the ACT's water supply*. ACTEW, Canberra ACT.

ACTEW 2005b. *Future water options report*. ACTEW, Canberra ACT.

ACTEW 2008a. *Future water planning: Recycled water strategy for Canberra—Options to increase the use of recycled water in Canberra*. ACTEW, Canberra ACT.

ACTEW 2008b. *Water security for the ACT and region: Recommendations to ACT Government*. ACTEW, Canberra ACT.

ACTEW 2011. *ACTEW water modelling presentation*. ACTEW, Canberra ACT.

ACTEW 2012a. *ACT water supply system*. ACTEW, Canberra ACT. See http://www.actew.com.au/Water%20and%20Sewerage%20Systems/Water%20Supply%20System.aspx.

ACTEW 2012b. *ACTEW submission to the secondary water use inquiry issues paper*. ACTEW, Canberra ACT.

ACTEW 2012c. *Back to work in May—Enlarged Cotter Dam*. ACTEW, Canberra ACT. See http://www.actew.com.au/News%20and%20Publications/News%20and%20Events/2012/April/5/Back%20to%20work%20in%20May%20-%20Enlarged%20Cotter%20Dam.aspx.

ACTEW 2012d. *Tantangara Transfer*. ACTEW, Canberra ACT. See http://www.actew.com.au/Our%20Projects/Tantangara%20Transfer.aspx.

ACTEW and ActewAGL 2011. *Canberra Sewage Strategy 2010–2060*. Canberra ACT.

ActewAGL 2011. *Water planning 2011: Review of planning variables for water supply and demand assessment—A review of the changes in water resources modelling assumptions*. ActewAGL Infrastructure Development and Asset Management Branch Water Division, Canberra ACT.

ActewAGL 2012a. *ACTEW baseline model results for the ICRC*. ActewAGL, Canberra.

ActewAGL 2012b. *ICRC modelling scenario results*. ActewAGL, Canberra ACT.

ActewAGL 2012c. *Scenario model results for the ICRC*. ActewAGL, Canberra ACT.

AECOM 2011. *ACT Non-potable Water Master Plan Study*. AECOM Australia Pty Ltd, Canberra ACT.

Australian Government 2012. *Canberra Urban Waterways Rehabilitation*. Australian Government, Canberra ACT. See http://www.environment.gov.au/water/policy-programs/water-smart/projects/act02.html.

Australian Government & ACT Government 2007. *Funding deed in relation to funding from the Australian Government Water Fund for the following Watersmart Australia project: Canberra Integrated Urban Waterways*. Australian Government, Canberra ACT.

Barr, A 2010. *Targeted investments support local sport and recreation sector*. Media release, ACT Government, Canberra ACT.

CityNews.com.au 2011. *Corbell lauds latest water plan*. Canberra ACT.

COAG 1995. *Competition Principles Agreement*. Council of Australian Governments, Canberra ACT.

Corbell, S 2009. *Water security statement*. 2009 Week 4 Hansard, ACT Legislative Assembly, Canberra.

Corbell, S 2011. *ACT secures water supply for a sustainable future*. Media release, ACT Government, Canberra.

CSIRO 2003. *Climate change projections for the Australian Capital Territory*. CSIRO, Canberra ACT.

CSIRO 2009. *Canberra Integrated Waterways: Feasibility study*. CSIRO, Canberra ACT.

ERA 2008. *Final report: Inquiry on competition in the water and wastewater services sector*. ERA, Perth WA.

ESC 2009. *Inquiry into an access regime for water and sewerage infrastructure services* Essential Services Commission, Melbourne Vic.

Fane, S, Robinson, J & White, S 2003. *The use of levelised cost in comparing supply and demand side options*. Inistitute for Sustainable Futures, University of Technology Sydney, NSW.

Farrell, D & Lundy, K 2011. *Secure water future for Australia's National Botanic Gardens*. Australian Government and ACT Government, Canberra ACT.

Fyfe, J, Mohr, S, May, D & Rickwood, P 2011. *Statistical evaluation of water, electricity and greenhouse gas savings from the* Think Water, Act Water *residential efficiency programs*. Institute for Sustainable Futures, University of Technology, Sydney NSW.

ICRC 2008. *Water and wastewater price review: Final report and price determination*. Report 1 of 2008, Independent Competition and Regulatory Commission, Canberra ACT.

ICRC 2010. *Final report: Enlarged Cotter Dam water security project*. Report 9 of 2010, Independent Competition and Regulatory Commission, Canberra ACT.

ICRC 2011a. *Context paper: Water in the ACT*. Report 8 of 2011, Independent Competition and Regulatory Commission, Canberra ACT.

ICRC 2011b. *Issues paper: Secondary water use in the ACT*. Report 9 of 2011, Independent Competition and Regulatory Commission, Canberra ACT.

IPART 2008. *The NSW water industry access regime: A guide to declaration of infrastructure under the* Water Industry Competition Act 2006. Independent Pricing and Regulatory Tribunal of New South Wales, Sydney NSW.

Lawrence, I 2011. *Submission 4 to the Secondary water inquiry issues paper*. Canberra ACT.

MDBA 2011. *Water audit monitoring report 2009–10: Report of the Murray–Darling Basin Authority on the cap on diversions*. Murray–Darling Basin Authority, Canberra ACT.

MDBC 2000. *Review of the operation of the cap: Overview report of the Murray–Darling Basin Commission*. Murray–Darling Basin Commission, Canberra ACT.

NSW Government 2008. *Interim NSW Guidelines for management of private recycled water schemes*. NSW Government, Sydney NSW.

NSW Government 2010. *Assessing impact of climate change on non-metropolitan NSW water supplies*. NSW Office of Water, Sydney NSW.

NSW Government 2012. *Greywater treatment systems*. NSW Government, Sydney NSW. See http://www.health.nsw.gov.au/publichealth/environment/water/accreditations/gts.asp.

NWC 2012. *Water dictionary*. National Water Commission, Canberra ACT. See http://dictionary.nwc.gov.au/water_dictionary/index.cfm.

Productivity Commission 2011. *Australia's urban water sector*. Report No. 55, Final inquiry report, Volume 1, Productivity Commission, Australian Government, Canberra ACT.

Queensland Government 1997. *Queensland Competition Authority Act 1997*. In: Government, Q (ed.). Queensland Government, Brisbane Qld.

Queensland Government 2010. *South East Queensland Water Strategy*. Queensland Government, Brisbane Qld.

Queensland Government 2012. *Greywater treatment plants*. Queensland Government, Brisbane Qld. See http://dlgp.qld.gov.au/plumbing/greywater-treatment-plants.html.

Rattenbury, S 2011. *Submission to the secondary water inquiry issues paper*. Canberra ACT.

SA Government 2010. Water Industry Bill 2010. South Australia Government,Adelaide SA.

SECG 2012. *Secondary water use inquiry—Cost analysis working paper*. Strategic Economic Consulting Group, Melbourne VIC.

Stanhope, J 2005. *Government receives final report on water options*. ACT Government, Canberra ACT.

Stanhope, J 2006. *Transfer scheme lets ACT keep water options open*. ACT Government, Canberr ACT.

Stanhope, J 2007. *Enlarged Cotter Dam, Murrumbidgee Extraction and Pilot Purification Plant—Highlights of water plan*. ACT Government, Canberra ACT.

TAMSD 2012. *TAMSD submission to ICRC secondary water use inquiry*. TAMSD, Canberra ACT.

The Village Building Company 2012. *Submission to the issues paper: Secondary water use in the ACT*. The Village Building Company, Canberra ACT.

URS 2011. *Final report: Managed aquifer recharge investigation at Mitchell and Flemington Road, ACT—Pre-commissioning residual risk assessment*. URS, Canberra ACT.

Victorian Government 2011. *Guidelines for the development of a water supply demand strategy*. Department of Sustainability and Environment, Melbourne Vic.

Whitaker, R 2005. *Australia's natural disasters.* Reed New Holland, Frenchs Forest NSW.

White, S & Howe, C 1998. *Water efficiency and reuse: A least cost planning approach*. Proceedings of the Sixth NSW Recycled Water Seminar, Sydney NSW.

Wood, B 2002. *Water resources ministerial statement*. Week 14 Hansard 10 December 2002, ACT Legislative Assembly Hansard, Canberra ACT.