Secondary Water Use in the ACT

ACTEW Submission to the ICRC Inquiry (Report 9 of 2011, November 2011)

January 2012

ACTEW Corporation Ltd.
GPO Box 366 Canberra ACT 2601

Introduction

ACTEW is pleased to provide this submission in response to the recently released Issues Paper on *Secondary water use in the ACT* (Report 9 of 2011, November 2011). We have reviewed the document and its supporting context paper: *Water in the ACT* (Report 8 of 2011, November 2011). We commend the Commission for approaching water management holistically and the papers represent well a wide range of issues and their high level implications.

The context papers identify key issues that we concur with:

- Public health cannot be compromised in any water management activity;
- Public water investment must be cost effective and affordable;
- Environmental values need to be considered in water management decisions;
- Climate change and drought have increased the variability in seasons and associated water security;
- The ACT has a minimal net impact on the Murray Darling Basin in terms of water quality and quantity;
- The current investment in Enlarged Cotter Dam and Murrumbidgee to Googong Transfer is expected to achieve appropriate water security for 20 to 25 years; and
- The fixed cost of operating ACTEW's water business means that if water use is displaced through provision of water by another entity, water prices charged by ACTEW must increase.

ACTEW's history in secondary water use

ACTEW has been a leader in developing water recycling[1] and water conservation options having:

- Constructed and operated several water recycling schemes in the ACT;
- Developed many water recycling options to achieve the *Think water, act water* target of 20 per cent recycled water by 2013;
- Considered the capacity of further water recycling to meet water security needs;
- Participated in water policy development forums including development of rainwater tank guidelines, greywater guidelines and stormwater harvesting schemes;
- Developed levelised cost assessments of water conservation initiatives for Government consideration (2004); and
- Developed, adapted and administered temporary water restrictions and permanent water conservation measures.

There are no major manufacturing industries in the ACT requiring large quantities of water. Thus the principal reuse opportunities are irrigation of public open space, sportsgrounds, private gardens, residential and commercial buildings (toilet flushing and landscaping) and horticulture. These demands are mostly seasonal, with high demand in summer months and low demand in winter and the demands are widely

[1] Water recycling refers to the reuse of treated effluent from ACTEW networks

dispersed throughout the city. The seasonal demand in the ACT requires significant storage to meet peak demands.

The following sections will expand on:

1. Water Recycling;
2. Water Security;
3. Permanent Water Conservation Measures;
4. Temporary Water Restrictions;
5. Stormwater; and
6. Water Conservation Measures.

Water Recycling Operational Experience

Pilot Trials

The first ever watermining plant was constructed at Southwell Park in 1995 as a pilot trial to test the treatment technologies and operations of the concept. This concept involves extracting effluent from a sewer and treating it for use for irrigation of open space. After more than 15 years of operations the plant has now been closed down and will soon be decommissioned. Although the facility was able to provide recycled water of a quality which did not compromise social or environmental values, its operations were inefficient in terms of the cost of production and the ability to meet variable season demands for irrigation in the ACT.

At the same time (1995) ACTEW installed six domestic recycling plants in various residential properties around Canberra to ascertain their future role in the ACT. These units were used to treat all the sewage from the individual properties and, similar to Southwell Park, the trial is now being closed down. The operations of these systems demonstrated the plants were:

- Expensive to maintain;
- Problematic and expensive in achieving and monitoring stringent water quality requirements for public health; and
- Unable to demonstrate any significant potable water savings.

North Canberra Water Recycling Scheme (NCWRS)

The NCWRS scheme has been operational in its current form since 2005. Prior to that it was run as a inaugural example of water recycling in urban areas using water from Fyshwick Sewage Treatment Plant (FSTP) for irrigation of the Australian Defence Force Academy grounds since the late 1970s. The current scheme draws treated water from the lagoons at the FSTP and treats it with ultrafiltration and disinfection, then pumps water supply to a reservoir where it is fed to about seven sites for irrigation of open space. NCWRS has high operational costs and is inefficient due to the seasonal demands for irrigation in the ACT.

ACTEW introduced the NCWRS as an opportunistic operation from the existing FSTP. A recent review was undertaken to determine the next round of augmentations required for the FSTP. This review did not take the premise that the NCWRS scheme must continue to operate, but looked at the basic functions of the site and how they could be achieved in the most cost effective manner.

The review clearly identified that the existing lagoons at FSTP provide the most cost effective and sustainable option for managing wet weather flows, including mitigating the risk of overflows in the central urban area (and Lake Burley Griffin). In short it is apparent that the existing plant needs to continue to operate for at least the next twenty years. This will allow the NCWRS to continue as an opportunistic initiative. However further investment in NCWRS specific infrastructure would be unlikely to be deemed prudent in the next ten years.

Lower Molonglo Water Quality Control Centre (LMWQCC) Water Recycling
LMWQCC is a tertiary treatment plant that treats 96 per cent of Canberra's sewage for discharge into the Molonglo River. It produces high quality water which has very low concentrations of phosphorous, organic solids and coliforms.

During periods of drought the discharge from LMWQCC can represent a high proportion of water that flows out of the ACT via the Murrumbidgee River. The value of this quantity of water has been recognised in the management of the Murray Darling Basin with the ACT having a net cap on diversions (abstraction minus effluent discharge).[2]

Water is recycled within the treatment processes at LMWQCC for use including screen washing, dissolving chemicals, wet scrubber, sprays on primary tanks and plant washdown. In addition about 250 ML/yr is recycled for irrigation use on a golf course and vineyard in Holt.

Murray Darling Basin Cap
Sewage or effluent from ACTEW's sewerage system that is re-used and hence not discharged from LMWQCC, increases the ACT's net water consumption and hence counts against the Cap or the proposed Sustainable Diversion Limit in the draft Murray Darling Basin Plan. However, if the re-use replaces the use of potable water it has a nil impact on the Cap.

Stormwater use or rainwater tanks do not currently impact on the Cap unless they reduce potable water use.

Pricing regulation for recycled water for ACTEW
Revenue from recycled water is included in ACTEW's information return provided to the ICRC and is included in the revenue modelling for price reviews. This marginal revenue is deducted from the total revenue requirement for water (along with other sources of unregulated revenue) in order to achieve a net revenue requirement. Water tariffs are set to achieve the net revenue requirement.

There is no set tariff for effluent reuse – prices are negotiated on an individual contract basis because the cost of delivering recycled water varies substantially between sites. Since 1999, the ICRC has noted that "ACTEW must provide bulk water and reuse water on the basis that customers pay at least the avoidable cost of supply, and less than the stand-alone cost of supply."[3]

---

[2] ActewAGL, 2010
[3] ICRC, 2004

Throughout the same period, debate has also taken place over the inclusion of recycled water projects in the asset base. In the 2008 Decision, the ICRC allowed expenditure for the FSTP and its associated NCWRS. It was recognised that these projects contribute to meeting the ACT Government's target of increasing the use of recycled water to 20 per cent by 2013, but does not reach the target.

The current performance of ACTEW's water recycling schemes contributes about 14 per cent water recycled based on water treated at LMWQCC and FSTP.

Table 1 – Summary of ACTEW's water recycling schemes[4]

Scheme	**Available Supply** **GL/yr**	**Typical annual Use** **GL/yr**	**Marginal Cost of Recycled Water Production** **per kL**	**Status**
LMWQCC	30	4	$0.7	Operational
NCWRS	1.5	0.26	$3.50	Operational
Southwell Park Water mining scheme		0.02	$13	To be decommissioned

Concepts for More Water Recycling

Since 2005, ACTEW has developed several concepts for expansion of water recycling in the ACT to support the ACT Government's target for 20 per cent recycled water use by 2013 and seek funding through national water policy reform initiatives such as the Australian Water Fund and the National Water Commission.

Two concepts were developed in 2004 and 2006 for increased water recycling in the ACT. The first was based on extending the supply of recycled water back from LMWQCC to inner Canberra, Woden and large parts of Belconnen. The second was based on connecting supply from Queanbeyan Sewage Treatment Plant through to FSTP and extending supply south of Lake Burley Griffin to the Parliamentary Triangle including Parliament House. Both of these concepts were not financially feasible due to high capital costs for pumps and pipeline to deliver water to disaggregated sites of demand across Canberra.

In 2008, ActewAGL prepared a strategy on behalf of ACTEW – *Recycled Water Strategy for Canberra*[5] – to again review opportunities for increased recycling. The main components of the strategy were to expand the capacity of the FSTP so that it could supply the full demand of customers served by the NCWRS network, and to extend the NCWRS to supply Southwell Park and support the closure of the watermining facility. The recycling strategy also envisaged expansion of the recycled water network from LMWQCC to supply recycled water to parks, sportsfields and public open space in Belconnen, with a connection to the NCWRS, to make best use of recycled water produced at the FSTP.

[4] AECOM, 2011
[5] ActewAGL, 2008

Recycled water options were again reviewed in the context of the *Canberra Sewerage Strategy* in 2010[6]. In addition, ACTEW has been involved with the development of the Non-potable Water Master Plan commissioned by the ACT Government to develop a strategic approach to non-potable water development in the ACT.

All of these studies have similar findings with respect to water recycling expansion which can be summarised as:

- The most cost effective option for pursuing significant water recycling is to extend supply from LMWQCC back to the city;
- Due to geography of supply and demand, there are significant capital costs involved with pipes and pumps to distribute secondary water supply;
- Generally costs for the extension in the LMWQCC scheme have been in the order of about $100 M to increase water recycling by about 2 GL per year to achieve the ACT Government target; and
- The cost of connecting LMWQCC back to a network in central Canberra is in the order of $1.20 per kL.[7]

The impact on downstream flows from the ACT through increased recycled water use from treated effluent is minimal in terms of quantity and quality. Recent modelling[8] indicated that for every 9 GL per year of water recycled, flows downstream would reduce by about 1 GL per year. This is due to increased overflows from the Enlarged Cotter Dam which compromises the cost effectiveness of the investment in that infrastructure.

Water Security

As concurred with the ICRC context paper, it is expected that the current round of infrastructure investments (Enlarged Cotter Dam, Murrumbidgee to Googong Transfer and Tantangara Transfer) will secure water supply for the ACT for at least 20 to 25 years. It is critical to note that the decision to proceed with these three projects was made with due consideration of the potential for various options including:

- Groundwater use;
- Stormwater use;
- Rainwater tanks;
- Greywater use;
- Accelerated demand management;
- Extension to water recycling from ACTEW networks;
- Watermining;
- Cloud seeding;
- Evaporation control;
- Seawater source; and
- Potable reuse.

[6] ActewAGL, 2010
[7] ActewAGL, 2010: concept costs only, order of accuracy +- 50%
[8] ActewAGL, 2010

The analysis in 2005 and 2007 compared these options with respect to the costs and benefits involved prior to committing to the water security investments[9].

Planning for Canberra's water supply security involves extensive modelling of scenarios relating to water demand, water supply security and infrastructure availability. Six key variables influence the security assessment. These are:

1. Climate change and variability;
2. Bushfire impacts;
3. Population growth;
4. Per capita water consumption;
5. Environmental flow requirements; and
6. Level of service.

All current modelling is undertaken on the assumption that the ACT Government's 25 per cent reduction in per capita consumption is achieved in 2023. It assumes that the reduction occurs linearly from 12.7 percent. The 2009 review of the progress made towards achieving this target identifies that the most cost effective option is permanent water conservation measures. Recent modelling by ActewAGL has indicated that the ACT has already exceeded a 25 per cent reduction with current changed behaviours. This may be a "hangover" effect from the recent restrictions and it is yet to be seen if it can be maintained.

ACTEW has adopted the National Urban Water Planning Principles[10] in relation to planning Canberra's future water security. Whilst all are important, principles 4, 5 and 7 are particularly relevant to this inquiry. By adopting these principles ACTEW will be considering all options for the continued water security of Canberra: demand side options, reuse, stormwater, water trading and, of course, optimising the use of existing infrastructure. ACTEW will be using its technical expertise to ensure all options are compared on an equal basis and that the costs, benefits and risks associated with each option are well documented. ACTEW will also continue its open and transparent approach to the publication of all its relevant reports and considerations.

Further information is provided in the following sections in relation to Permanent Water Conservation Measures (PWCM) and Temporary Water Restrictions (TWR).

Permanent Water Conservation Measures

Permanent Water Conservation Measures (PWCM) incorporate a range of non-price measures effectively designed to increase water use efficiency. This in turn effectively leads to an increased availability of water with benefits that include:

- Increased water security including reduced time in TWR and delayed implementation of higher levels of water restrictions;
- Avoided cost of incremental capital investments to increase water security;
- Reduced water system operating costs; and
- Potential increments to environmental flows.

[9] ACTEW, 2007

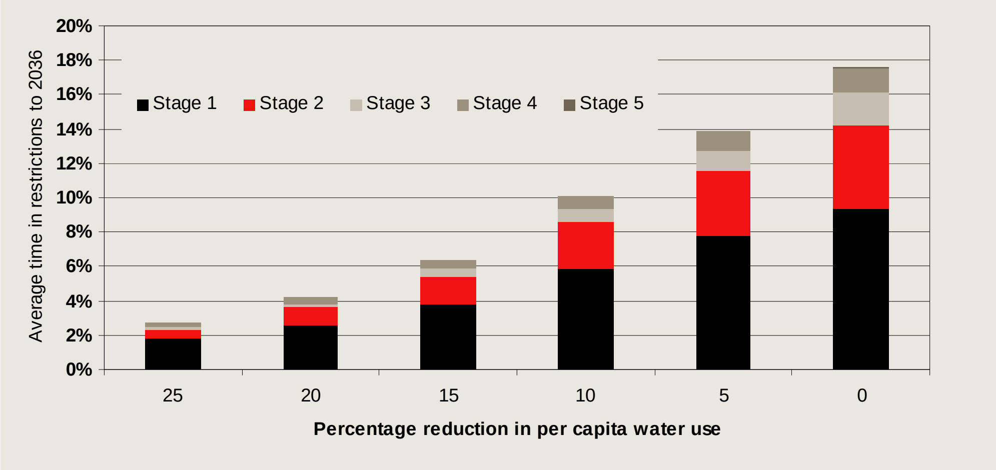
[10] http://www.environment.gov.au/water/policy-programs/urban-reform/nuw-planning-principles.html

The first (reduced time in restrictions) and third (reduced operating costs) of these can be calculated using the same methods currently used by ACTEW to assess the benefits of investment in new water sources. Differences in time in restrictions and operating costs can be calculated using scenarios with ActewAGL's REALM model of the Canberra water supply systems.

Changes in time in restrictions

The chart below summarises the average time spent at each level of restriction from 2011 to 2036 under different scenarios for water use efficiency. The chart illustrates that as water use efficiency declines, the time spent in restrictions increases, as does the composition of the different levels of restrictions[11].

Proportion of time spent at different levels of restrictions



Data source: ActewAGL simulations with the REALM model of Canberra's water supply system

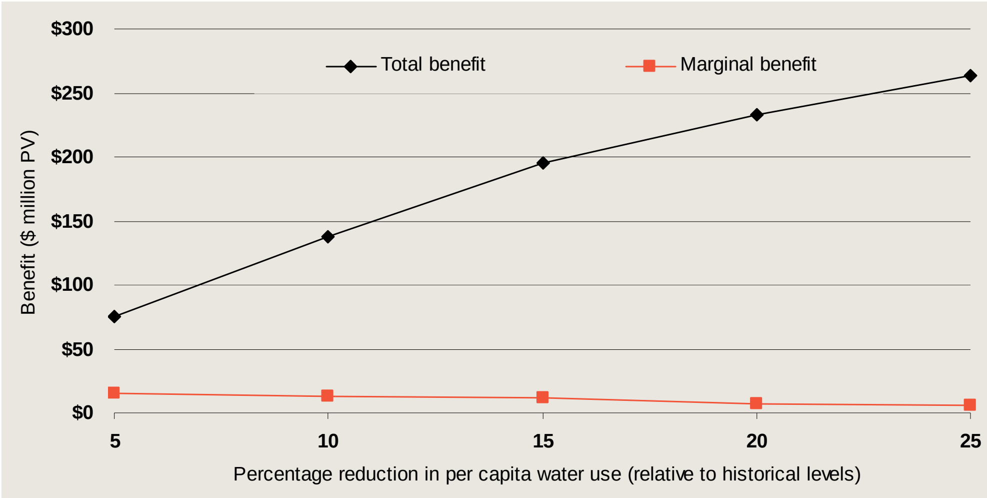
Valuing increased water use efficiency

Values of the increments in water use efficiency can be found by applying cost of restrictions information to these different times in restrictions in addition to the changed operating cost as a consequence of changes in efficiency.

The next chart shows both the total and the marginal benefits for increments in per capita water use efficiency measured as the value of reduced time spent in restrictions. These results confirm that the total benefit increases at a decreasing rate — that is, that the marginal benefit is declining.

[11] water efficiency is defined as the reduction in per capita water use relative to 1992-2003 levels.

Total and marginal benefits from increased water use efficiency



Data source: ActewAGL simulations with the REALM model of Canberra's water supply system

These results are based on the current configuration of the ACT's water supply system and including the water security benefits of:

- The enlarged Cotter Dam (from late 2012);
- The pipeline transfer from the Murrumbidgee River to Googong Dam (from mid 2012); and
- Transfers from Tantangara Dam (from mid 2012).

This shows that an increase in water use efficiency of 25 per cent (measured as a reduction in per capita water use) yields total benefits of around $260 M when compared with no reduction in per capita water use (over the period 2011 to 2036 in present value terms). The marginal benefit from each increment in efficiency starts at around $15 M, and declines to around $6 M with efficiency at 25 per cent[12].

ACTEW is currently reviewing how PWCM will be implemented in the future. Part of this review is developing methods of expanding PWCM coverage to non-residential customers. Whilst the review is yet to be finalised, and subsequently provided to the ACT Government, ACTEW expects the ongoing cost of implementation of PWCM to be of the order of $500,000 per year. This includes staff costs, advertising/promotion, plus an education component.

There are compliance costs associated with the implementation of PWCM. The proposed scheme is designed to minimise these compliance costs, but estimates of these costs are not yet available. The proposed PWCM scheme will be able to be escalated in future years if consumption drifts back towards pre 2002 levels.

[12] The total benefits curve (within the range shown here) is well described by a second order polynomial of the form $benefit = -0.2429*efficiency^2 + 16.706*efficiency - 3$. The R^2 is 0.9996. This implies that the marginal benefits curve is linear (and declining). Based on the range shown, the marginal benefit would be zero when efficiency is at 35 per cent.

Temporary Water Restrictions

The major benefit from Temporary Water Restrictions (TWR) is that they have proven they can reduce water demand and hence reduce the likelihood of more severe rationing and/or exhaustion of water supply. However, they are recognised as a blunt instrument with significant behaviour and cost impacts to the community and all consumers (domestic, business, and government) and damage to gardens, parks, ovals and the urban environment in general.

The merits of TWR need to be considered by comparison with alternative methods of influencing demand in times of acute water shortages. Aside from different configurations within the TWR, and noting that methods designed to increase water efficiency over the long term are not alternatives to TWR, the only major alternative is scarcity pricing.

In theory[13] optimal price increases may be able to take the place of TWR. However, pricing as the only response to acute water shortages has not been tested for effectiveness in reducing demand sufficiently or for social or political acceptance, in Australia. Therefore, scarcity pricing as part of the overall balanced approach is worth considering but not with a reliance on scarcity pricing alone.

However, TWR have some relative advantages which mean they will continue to play a role in future water shortages even once price-based instruments have been introduced. In particular, TWR:

- Are widely perceived as being equitable and therefore easier to implement in an emergency situation as an acceptable response to water scarcity;
- Are likely to have the same administrative costs as price based rationing (both measures would probably require the same amount of advertising/public information, particularly in the short term);
- Do not require alteration to current metering and billing systems — effective use of scarcity pricing would require a current (or prospective) rather than a lagged price signal as is the case with current billing systems; and
- Most importantly, from recent experience in the ACT and across Australia, they have proven to achieve the desired water reduction targets.

Since first identifying customers' willingness to pay in 2002, ACTEW has been at the forefront of estimating costs of restrictions and including these in assessments of water security and options. Initial estimates were developed in 2005 and were most recently updated in 2009.[14] Costing TWR has provided a cost benchmark against which to evaluate projects that increase water security.

[13] the optimal pricing/infrastructure approaches recently modelled by the Productivity Commission, the Australian Bureau of Agricultural and Resource Economics, and ANU Professor Quentin Grafton

[14] CIE, 2009

Stormwater
The ACT Government recently completed its *Non-Potable Water Master Plan*[15]. The final report outlines a scheme that delivers non-potable water at a cost of $3.57 per kL for a scheme with a capital cost of $452 M and produces about 13.7 GL per year of water. This scheme involves about 4 GL per year of stormwater use and 9 GL per year of water recycling from an extended scheme from LMWQCC to the central areas. It is understood that these costs are only capital and operational and would not represent full project delivery.

This would indicate that the costs of a combined stormwater and LMWQCC water recycling scheme are more than the LMWQCC water recycling scheme which has been identified in the order of $1.20 per kL. A basic conclusion that may be drawn from the report is that supply from LMWQCC is an order of magnitude lower in cost per kL than stormwater.

The water quality benefit of a combined scheme has been identified in the report as reducing nutrients to waterways in the order of 2.84 T per year of Total Phosphorous (TP) and 25.3 T per year of Total Nitrogen (TN). This equates to about 31% of the TP and only 3% of the TN discharged through LMWQCC each year. The reduction in TP is considered worthwhile in mitigating the risk of algal blooms in the Murrumbidgee River downstream of the ACT. Further reduction of TP through treatment processes at LMWQCC would come at a tradeoff with total dissolved solids (TDS) levels which are currently close to licence limits. To maximise these benefits, further work is required to understand the different options available to achieve the reduced nutrient levels.

It is critical to recognise that any development of a significant alternative water supply can result in cost shifting from one scheme to another. As identified in the ICRC papers, ACTEW's fixed costs means that any reduced demand will result in price increases for the potable network.

Concerns remain about the security of supply from stormwater schemes. During hot, dry, summer periods and extended drought the storages will be insufficient to maintain supply or may be jeopardised by algal outbreaks. This has the risk that it will create a demand shock to the potable network. 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. In addition the stable customers to the potable network would pay for this capacity. This outcome goes against the "user pays" principles of water reform.

Furthermore, the development of the stormwater scheme requires significant investment on behalf of the customer including storage, pumping and filtration. This may prove to be an impediment to customers who would not be able to raise upfront costs or may not be in a position to effectively operate and maintain the infrastructure.

The management of filtrate from the filtration of stormwater is of concern. ACTEW is unable to accept the filtrate into the sewerage network as it does not meet acceptance

[15] AECOM, 2011

criteria and would threaten ACTEW's ability to meet licence conditions at LMWQCC, specifically in relation to TDS. Other alternatives for filtrate management include disposal back to urban waterways or land and would need to be considered, regulated and costed appropriately to ensure that the outcome is sustainable.

A disparity has been identified in the Water Abstraction Charge (WAC) which ACTEW understands has recently been amended. Water abstraction charges should be equal for all surface water whether abstraction occurs from ACTEW's storages or ACT Governments as the resource has equal value prior to treatment. In the past the inequity of this charge has often resulted in feasibility assessments favouring stormwater use over treated effluent.

The requirements for environmental flows from ACTEW's water storages are dramatically different than those required from urban stormwater ponds. The reasoning for this in the past has been that the flows from urban ponds are not being affected by abstractions and therefore do not need to be artificially managed. Increased abstraction from stormwater ponds and rainwater tanks will affect the flows in urban streams particularly during summer periods. Similar regulation should apply from urban ponds where abstraction is occurring to ensure that the environmental flows downstream are adequate and the aquatic ecology is not jeopardised.

Water Conservation Measures

In addition to the use of recycled water from ACTEW's networks and harvesting of stormwater from urban lakes and ponds, ACTEW provides comment on other water conservation measures focusing on the implications on ACTEW's business. The reduction in potable water use and outdoor irrigation has had multiple impacts on ACTEW's business.

With the 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. Odour complaints increased about three fold in the six year period post 2003 compared to pre 2003. This results in unplanned investments being initiated to address the odour. These can be in the order of $1M per site and up to $3M if it is in a sensitive area. This issue is exacerbated by urban encroachment on sewerage assets with the rapid land development programs underway in recent years.

The encouragement of customers to install rainwater tanks and/or greywater systems has implications for the operation and planning of ACTEW's infrastructure. It is a basic requirement that sites with these systems have a backflow prevention device on the connection with the potable network. This is to prevent any contamination should a cross connection occur within the boundary. This adds additional cost to the customer and the utility.

Summary

ACTEW has been a leader in the industry in terms of introducing new concepts for secondary water use and conducting pilot trials to better inform the benefits and costs of such schemes.

It has emerged through this experience, that there are considerable challenges for recycling and stormwater schemes to have any significant benefits in terms of cost effectively providing water security, water quality and environmental value outcomes.

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. With the current investments in water security almost completed, it is not necessary from a water security perspective to pursue additional investment.

However it is recognised that there may be additional social and environmental demands that drive investment in secondary water use and clear and consistent principles to direct these initiatives are required.

References

ACTEW 2007: Water Security for the ACT and Region

ActewAGL 2008: Recycled Water Strategy, Future Water Planning

ACT Government 2009: *Think water, act water* 2009 Demand Management Progress Report

KBR 2010: Recycled Water Options for Canberra Sewerage Strategy

ActewAGL 2010: Canberra Sewerage Strategy, Future Sewerage Options

AECOM 2011: Non-potable Water Master Plan

ActewAGL 2011: Water Planning 2011 Review of Planning Variables for the Water Supply and Demand Assessment

ICRC 2004: ActewAGL’s Water and Wastewater Price Review: Final Report and Price Direction

CIE 2009: Economic Benefits of New Water Supply Options