3 - Assessment of water savings opportunities

Each feasibility report and proposed options were reviewed, assessed and compared. The comparison factors have been detailed in Section 2 - Methodology for assessment of measures, and can be broadly categorised into understanding the costs and benefits of each program. In addition to understanding the costs and benefits, a risk assessment was undertaken to understand the ease of implementing each option alongside a number of additional comparison factors.

The results have been presented as a series of conservation supply curves and other representations of savings, costs and benefits.

The assumptions included within each option have been provided as *Appendix 3: Assumptions for programs included in recommendations* .

3.1 - Irrigation infrastructure upgrades

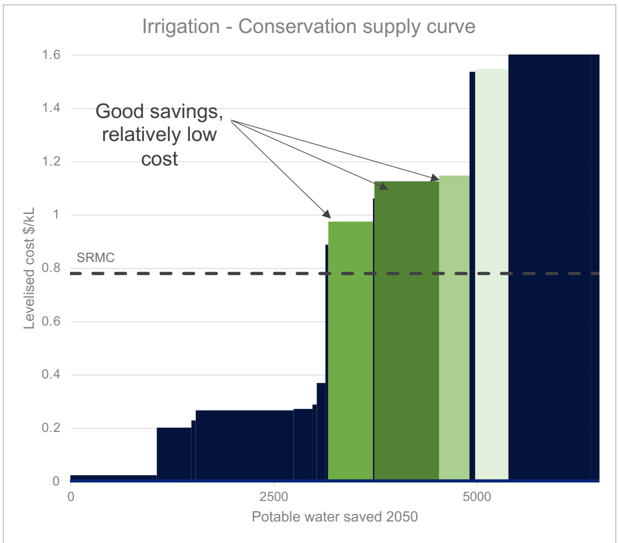
3.1.1 – Overview

The irrigation infrastructure upgrade report examined the opportunities for improving irrigation at 136 parks and ovals across the ACT. **The savings could commence relatively soon, are relatively low cost and are easy to implement (Figure 7). Water bill savings would equate to around $10 million/yr resulting in a simple payback of under 4 years.** The savings may be overstated as they are based on demand assumptions that do not align with metered data, they rely on achieving best practice for irrigation and do not consider climate change. They also do not consider increased open space irrigation demand due to population growth.

Low risk in relation to
SAVINGS
COSTS

ACT Government
4yr
$23M

SAVINGS ASSUME BEST PRACTICE ACHIEVED



136 Irrigated parks — 2.1 GL/yr savings 2050 — $1.1/kL Levelised cost — $23M Over 4 years

MISSED OPPORTUNITIES
- Soil replacement

ISF Changes
- Split into four options
- Allowed for decay

RISKS:
- Savings may be high as based on best practice and uncertain demand data (lack of good billing data for estimates).
- Savings will decay if systems not maintained
- Savings do not account for climate change or growth in irrigation area demand
- Costs may be overstated – opportunity for improving irrigation maintenance practices.
- Reduction in RW use
- Increase in irrigation @ under irrigated parks

IRR1	Irrigation upgrades at top 20 parks (by opportunity to save water)
IRR2	Irrigation upgrades at second 20 parks (by opportunity to save water)
IRR3	Irrigation upgrades at third 20 parks (by opportunity to save water)
IRR4	Irrigation at parks 61-109 (by opportunity to save water)

ENVIRONMENTAL IMPACT

- WW: NIL
- SW: ↑388ML/yr
- GREENING: Better field condition?
- ENERGY: ↓1435 tonnes GHG/yr
- SDL: 100%

Figure 7: Summary of irrigation infrastructure upgrade costs and benefits.

The Hyrodoplan report only provided analysis for one overall option. From the data provided by the consultants, ISF has developed four separate options that segregate the parks into four separate options based on the ranking of each individual park in relation to potential water savings (as assessed by the irrigation consultants). The highest water using parks should be targeted first, as 25 parks account for 50% of the water demand and about 40% of the irrigated area. Less than half of the parks account for 80% of water demand (Figure 8). Some of the largest water savings parks are connected to water reuse schemes. This increases the levelised cost for potable water saved. However, many of these water reuse schemes rely on potable top up and back up, so it is still important to include them in any irrigation efficiency upgrade program.

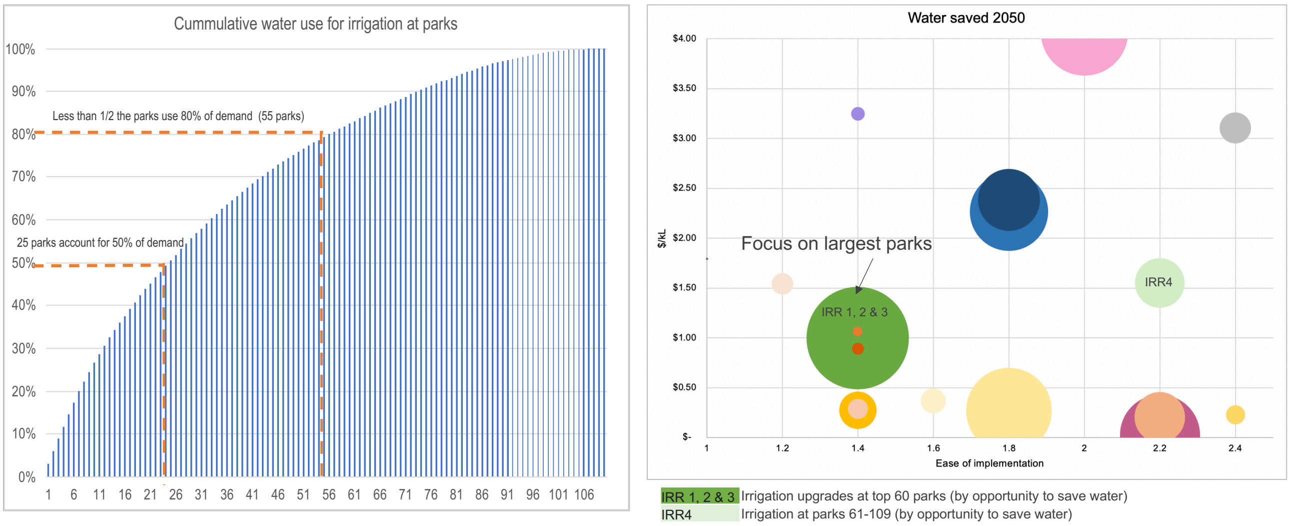


Figure 8: Implementation risk for irrigation infrastructure upgrade options

The assessment of irrigation efficiency did not include an assessment of soil profile and drainage. Studies have shown the type of soil and the quality of the drainage has a bigger impact on turf quality than water application rates (Sydney Water 2011). As part of the irrigation efficiency upgrade program the opportunity for upgrading soils and drainage should also be investigated.

There is a potential for the savings to decay if the irrigation infrastructure upgrades are not maintained. It would appear that there is an existing issue with ongoing maintenance of the existing irrigation infrastructure, with the HydroPlan report identifying that many of the existing systems were in disrepair. Therefore, ISF have included ongoing maintenance costs in the overall levelised cost calculations.

Table 2: Recommended irrigation options by Hydroplan

ID	$/kL	Water saved 2024 ML/yr	Water saved 2050 ML/yr	4-year program cost ($M)	Present value using 30-year investment horizon, 7% discount rate ($M)
IRR1	$1.13	800	800	$8.29	$10.36
IRR2	$0.98	564	564	$5.06	$6.33
IRR3	$1.15	359	359	$3.79	$4.74
IRR4	$1.55	403	403	$5.73	$7.17

3.1.2 - Implementation and next steps for irrigation

Parks have been ranked in terms of water use. There was some concern with the robustness of water demand estimates and associated water and bill savings. Next steps include:

- Obtaining billing data from Icon Water and confirming the prioritisation list
- Liaising with the owners and users of the parks for upgrade timing, prioritisation and funding mechanisms
- Considering soil and grass type improvements as part of the irrigation efficiency upgrades
- Ensure that an education and awareness program is rolled out in conjunction with the irrigation upgrades to ensure the equipment is used and maintained as intended to preserve water savings.

3.2 - Stormwater harvesting

The GHD stormwater harvesting report identified two key projects:

- The Lake Tuggeranong stormwater harvesting scheme
- The expansion of the INRN stormwater harvesting scheme.

These have been summarised in Table 3 below.

Table 3: Stormwater harvesting options recommended by GHD

ID	$/kL	Water saved 2050 ML/yr	4-year cost ($M)	Present value ($M) using 30-year investment horizon, 7% discount rate	Other considerations
Lake Tuggeranong	$6.22	350	$23.94	$25.02	
INRN expansion	$6.69	307	$22.89	$23.59	The current scheme is considered to not be operating optimally.

These options have a relatively high cost in relation to their savings as identified in Figure 9.

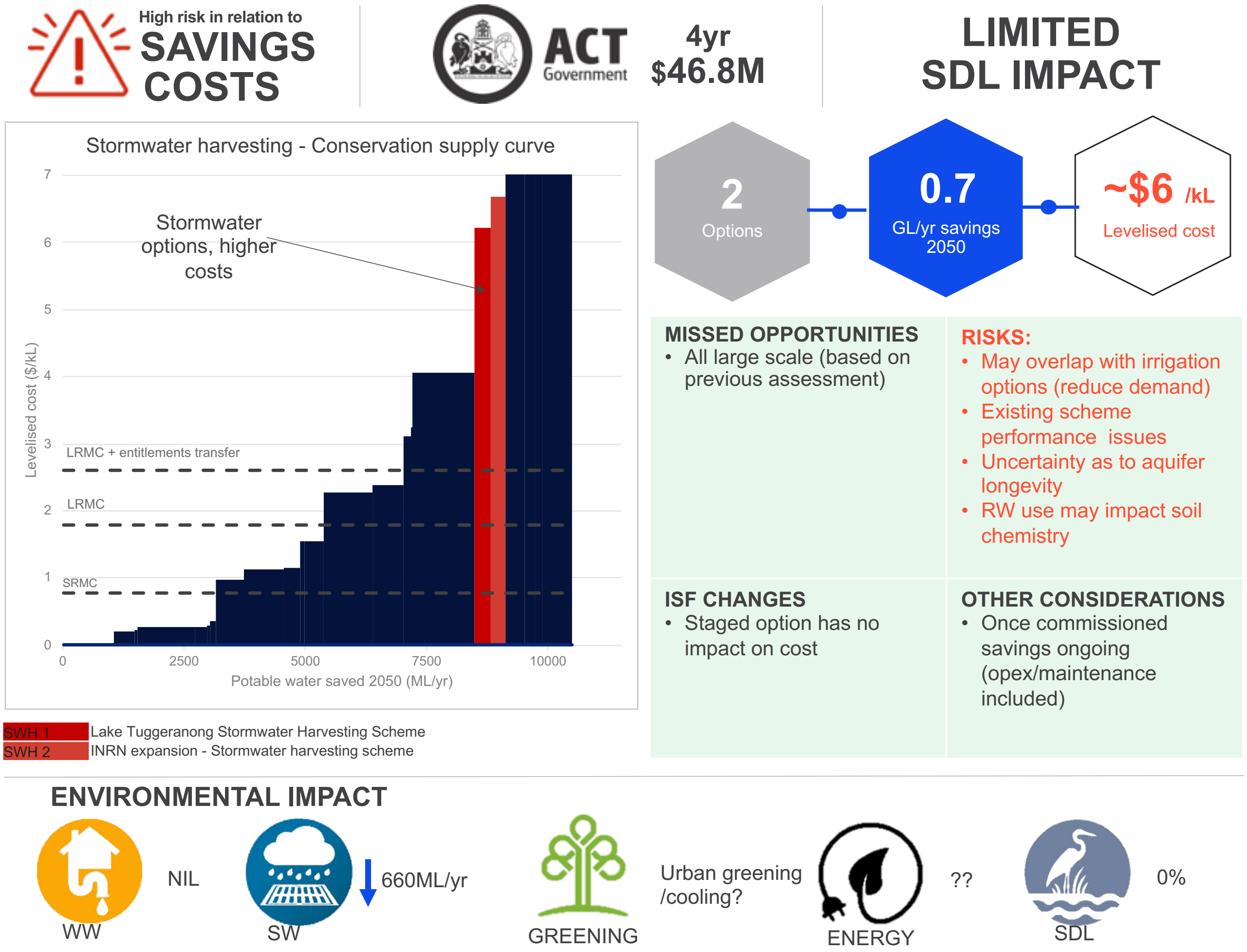


Figure 9: Summary of stormwater harvesting recommended options

In addition to the high cost, these options are also relatively difficult to implement (Figure 10) when compared with other options. **Therefore, these options are not included in the recommended suite of viable options under this program.**

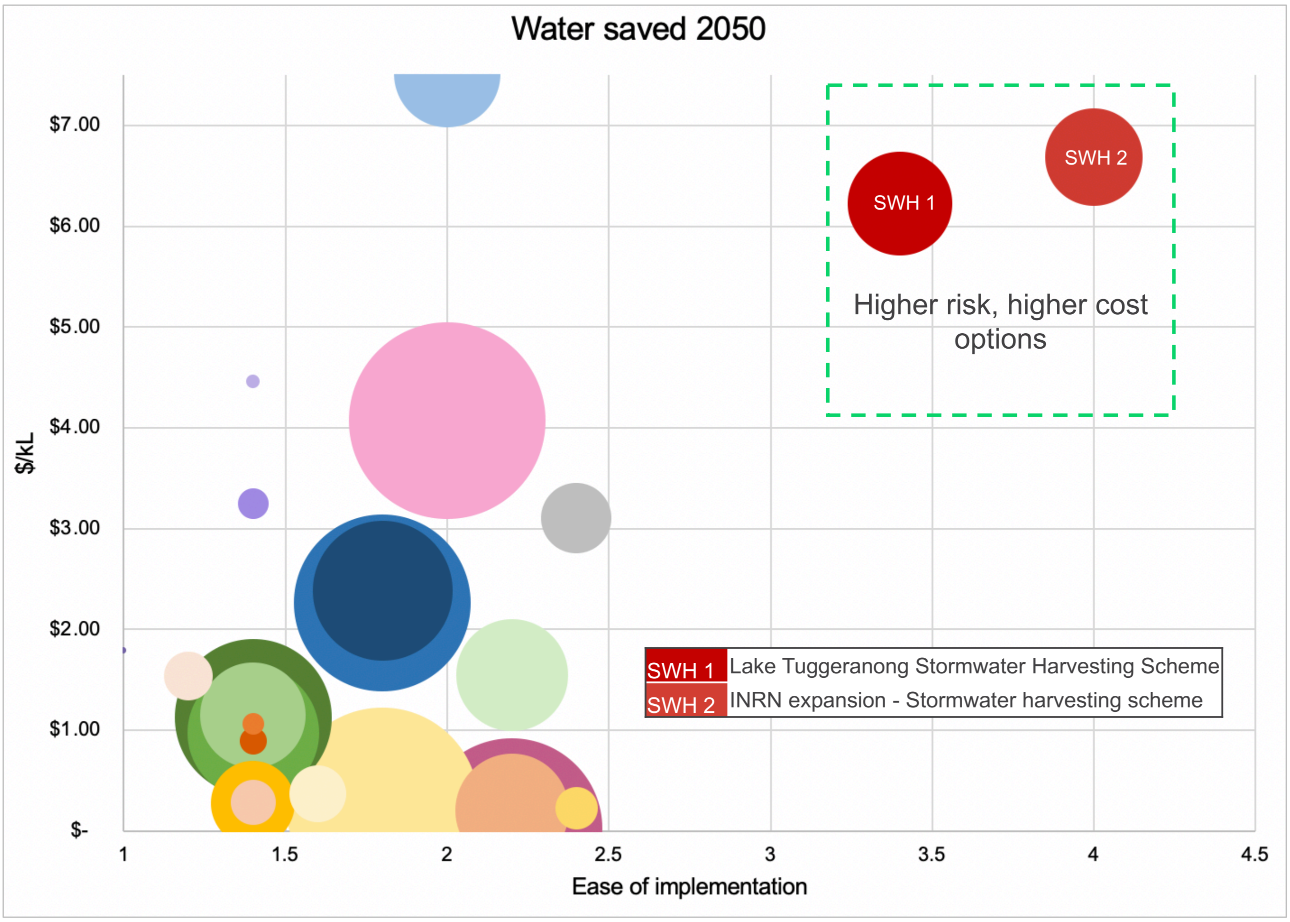


Figure 10: Relative implementation risk of stormwater options

There may be other drivers that will help progress the stormwater harvesting projects, such as urban cooling and greening objectives and stormwater quality objectives. If progressed, these projects will contribute to overall potable water demand savings in the ACT, but will have a minimal impact on the SDL as described in *Section 2.2.5 - Sustainable Diversion Limit* and *Appendix 2: Sustainable Diversion Limits.*

The stormwater harvesting and reuse options appear to be high risk in relation to both demand and supply with no anticipated impact on savings for the SDL except for a reduction in losses from the potable water delivery network and changes to dam releases which have not been estimated (based on ISF understanding of the Murray-Darling Basin Commission's rules, see Section 2.2.5 - Sustainable Diversion Limit and Appendix 2: Sustainable Diversion Limits).

The demand and supply risks associated with these measures, as well as the high contingency estimates on capital included in the analyses, mean that the estimated savings and costs in the report and subsequent levelised costs have a significant degree of uncertainty associated with them.

Irrigation infrastructure upgrades may also impact the demand assumptions for the stormwater harvesting projects, but at this stage it is unclear the extent of overlap between the two projects. The overlap is unlikely to significantly impact on savings available under SDL from these measures.

While the levelised costs of the stormwater harvesting projects are lower than the rainwater tank options in the WSUD code changes, they do not impact SDL (where the rainwater tank options would appear too, see Section 2.2.5 - Sustainable Diversion Limit and Appendix 2: Sustainable Diversion Limits), they provide lower overall savings (less than half) and are much higher risk.

3.3 – Water Sensitive Urban Design (WSUD) Code Changes

The Alluvium report identified and assessed the water savings benefits of changes to the Water Sensitive Urban Design General Code. Three options addressed increasing the requirements for water efficiency fixtures and four proposed changes to the requirements for rainwater tanks (Table 4). The options were also assessed in groups by the consultant including:

- The water fixture and fittings options (WSUD 5,6, 7a)
- All source substitution options (WSUD 1,2,3,4)
- Plumbing certification focus (WSUD 3,5,6 and 7a).

Table 4: WSUD options as proposed by Alluvium

ID	$/kL	Water saved 2024 ML/yr	Water saved 2050 ML/yr	4-year total cost ($M)	4-year cost to Gov ($M)	PV ($M)	Included/ excluded
Rainwater tank options							
WSUD 1 75% roof connection	$17.02	25	144	$2.26	$0.05	$11.73	Excluded on cost
WSUD 2 tanks for small blocks	$15.02	40	232	$3.20	$0.05	$16.74	Excluded on cost
WSUD 3 Certification	$3.11	27	160	$0.49	$0.05	$2.38	Included
WSUD 4 Monitoring and repair	$19.03	43	601	$3.85	$3.85	$38.25	Further investigation recommended
Efficient fixture and fitting options							
WSUD 5 – outdoor taps	$2.38	63	630	$1.10	$0.05	$5.61	Included – rolled up in WSUD 7
WSUD 6* Indoor fixtures and fittings	$2.27	104	1014	$1.67	$0.05	$8.63	Included – rolled up in WSUD 7
WSUD 7a appliances for apartments	$7.51	38	372	$2.03	$0.05	$10.54	Included – rolled up in WSUD 7
WSUD 7** (combined 5,6,7a)	$1.21	182	1786	$1.65	$0.15	$8.08	Included

Notes: * *WSUD 6 option does not include four-star showerheads. Four-star showerheads are available and should be included.*

** *The cost for the combined option is much lower than for the sum of the individual options. The water savings are not a simple addition. The combined option (as developed by Alluvium) has been included in the overall program.*

4-year total cost includes costs to customers (such as the marginal cost for new appliances and fittings and rainwater tanks.)

4 year cost to Government only includes the cost of regulatory change and inspection and auditing of tanks.

Present value costs is calculated over a 30-year investment horizon using a 7% discount rate

The increase in efficient appliances options have been included in the final program, as has the rainwater tank certification. **These options are relatively low cost and reliable savings (Figure 11).**

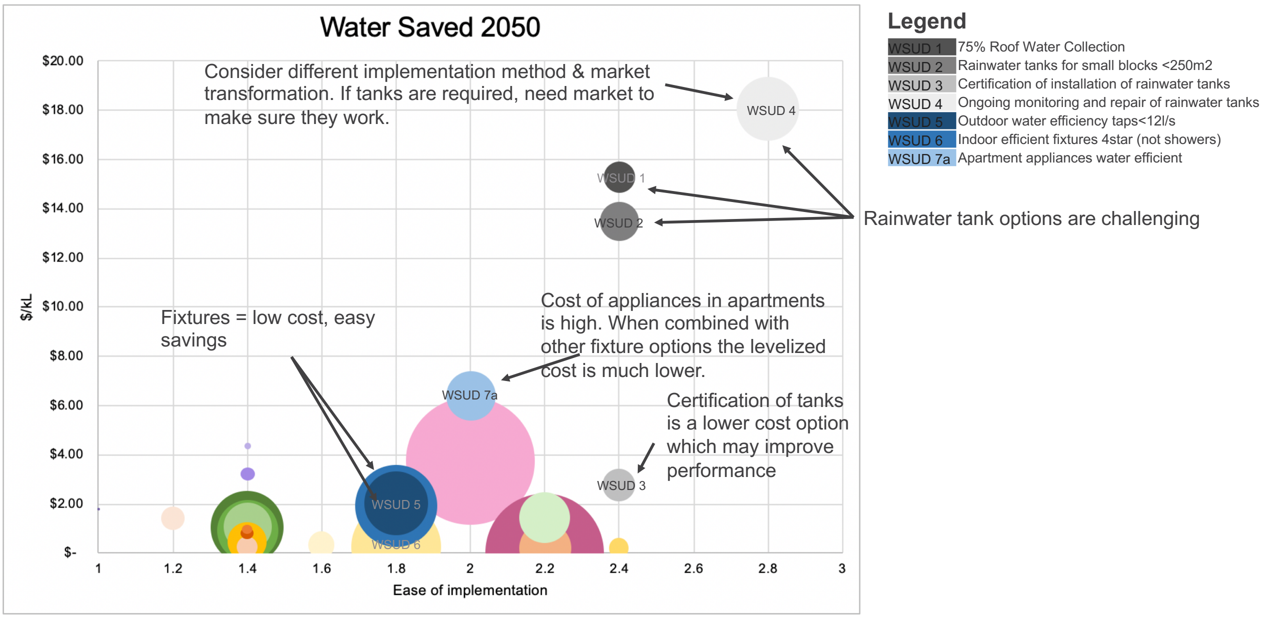


Figure 11: Implementation risk and cost of WSUD code change options

These options also have the additional benefit of growing with time as discussed in *Section 3.5 - Timing and impacts of decay*. Unlike other measures, savings from code changes will grow slowly over time, but will not reduce current levels of water usage. Instead, WSUD code changes will dampen the magnitude of water demand increases associated with growth.

As part of workshop 1 and 2, it was agreed that the issue of poorly performing rainwater tanks is of concern in relation to efficient investment and to ongoing water demand projections. The proposed model to deliver rainwater tank efficiency is expensive, and alternative models of delivery that improve rainwater tank performance should be considered further.

The changes to the WSUD General Code to increase water use from rainwater tanks would save both potable water and create corresponding savings for the Territory's SDL. The rainwater tank options, however, have much higher levelised costs (based on potable water savings) than other measures assessed in the WSUD report (Figure 12). Increasing the requirement for the size of rainwater tanks and requiring rainwater tanks on compact blocks have not been included in the final suite of recommended options based on their high costs.

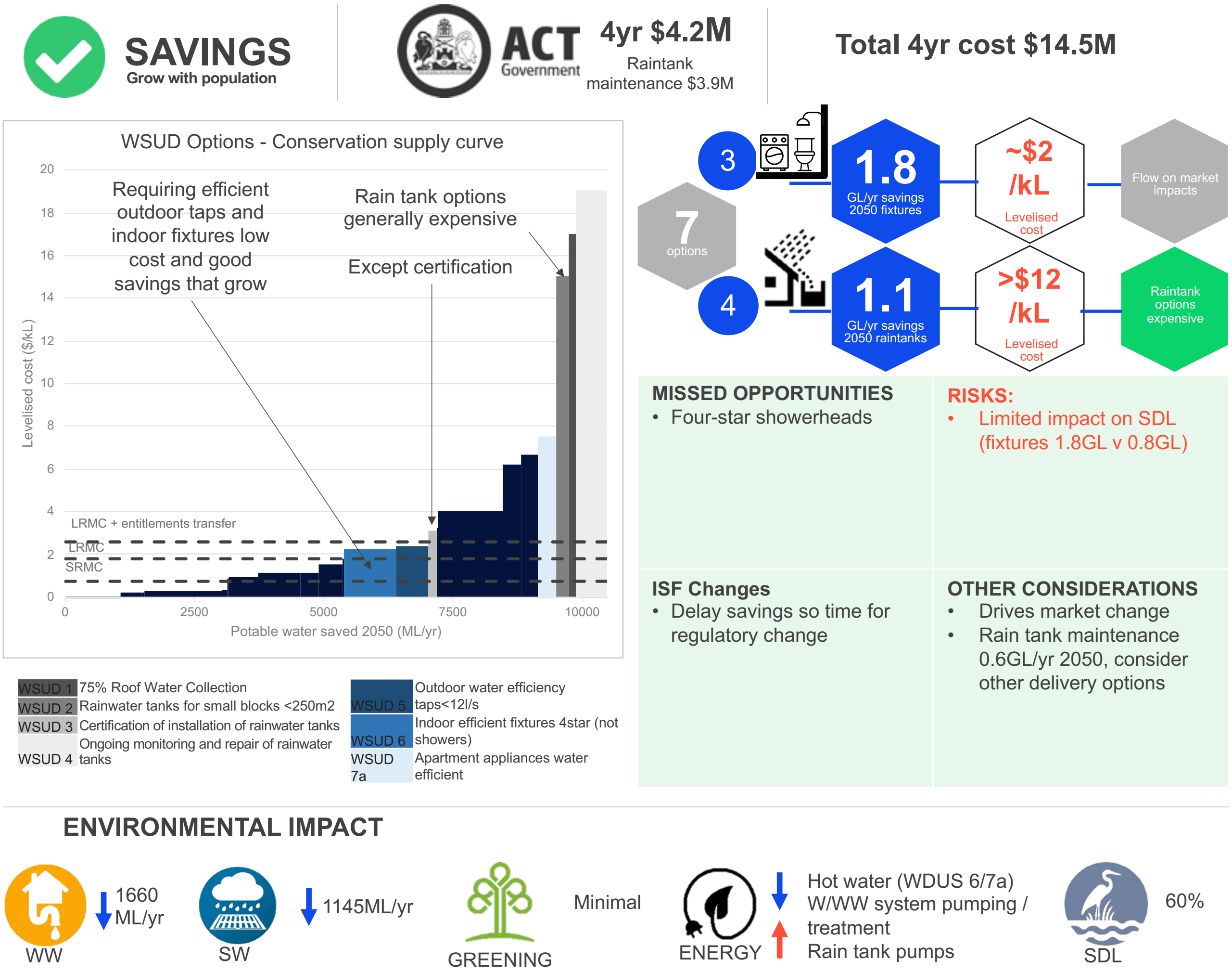


Figure 12: Summary of WSUD recommended options

The changes to the WSUD General code for water efficiency measures have low levelised costs (based on potable water savings) but will not create the same level of savings in relation to the SDL. Savings from efficient fixtures and appliances will depend on losses in the water delivery and sewer networks as well as changes to dam releases which have not been estimated.

3.3.1 - Implementation and next steps

Changes to the design code should be made for increased efficiency of fixtures and fittings. There should be further consideration of including WELS four-star rated showerheads in this change. Including WELS four-star rated showerheads will not only provide increased water savings it will have additional benefits in relation to reduced energy consumption.

The changes to the design code should include a requirement for certification upon completion of a building. Further engagement with stakeholders such as plumbing inspectors and building certifiers is required specifically to identify the best way to implement considering:

- Reducing barriers for the installation of tanks and efficient fixtures
- How to avoid issues with certification in other areas
- How to assess the compliance of fixtures that do not have a label attached.

A rainwater tank maintenance and a rainwater tank education program should be considered further. This will require engagement with stakeholders such as:

- Rainwater tank industry

- Industry peak bodies
- Customers and owners of tanks.

A pilot program to understand the current issues with tanks and customer intentions to repair tanks should be trialled.

3.4 - Demand management programs

HARC reviewed the potential of both residential and non-residential demand management programs, developing a long list of 56 options. In consultation with the EPSDD project team they developed a short list of 24 options and their final recommended program included nine options including three residential options and six non-residential options.

Options that were not considered in the HARC report and should be considered in future program development include:

- System pressure management.
- Washing machine replacement for customers facing financial hardship[7].
- Evaporative cooler maintenance and efficiency programs.
- Long-term maintenance contract review for government, schools and social housing plumbing contracts to incentivise water efficiency opportunities.
- Encouraging uptake of NABERS ratings for office buildings, hotels and schools.

Overall ISF recommend including five residential options and nine non-residential options, and suggest the options listed above are also considered in the next phases of program development. ISF did not include the HARC recommendations of irrigation efficiency in the final program as these options overlapped with other more comprehensive options from the Hydroplan report (see section 3.1 - Irrigation infrastructure upgrades). The HARC estimates of savings in relation to compliance with the WSUD code are not included as they are more comprehensively assessed in the Alluvium report that focuses on changes to the WSUD design code (see section3.3 – Water Sensitive Urban Design (WSUD) Code Changes).

HARC also recommended further investigation of a smart metering program. ISF would also recommend this program is investigated further and has included it in the overall program recommendations. There will be substantial overlap between the smart metering program and the education program. The savings from both programs have been halved in the estimates to account for overlap (Figure 13).

ISF has also recommended the further investigation of non-residential fixtures and fittings programs and WEMPs, as discussed in the non-residential demand management section. ISF would also recommend that the residential retrofit program and the public housing retrofit program include WELS four-star rated showerheads should be promoted to encourage market transformation. This would also help to support the move to required WELS four-star rated showerheads in the WSUD code.

The demand management programs recommended options have the potential to save 3.2 GL by 2030. A global smart metering program would save an additional 1GL by 2030.

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[7] Note the final version of the HARC report referenced this program but did not provide any cost or savings information. It was not included in their final recommended program.

3.4.1 - Residential Demand management programs

HARC's final report recommended four residential demand management programs as identified below and in Table 5:

- A general education program
- A residential retrofit program
- A public housing program
- WSUD code compliance.

Table 5: Residential demand management options

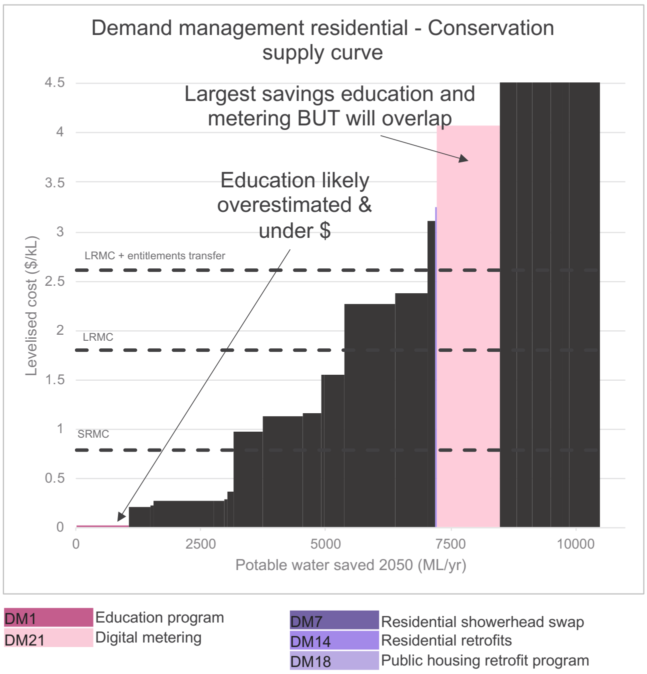
ID	$/kL	Water saved 2024 ML/yr	Water saved 2050 ML/yr	4-year cost ($M)	PV ($M)	Comments
DM7 – WELS four-star showerhead replacement	$1.79	13	1	$0.19	$0.17	Plumbing code requirement for plumbers to install showerheads will substantially increase cost of program. The program assumes very low uptake (2%) and rapid decay of savings, possibly due to market transformation.
DM14 – residential retrofit	$3.25	300	30	$8.04	$6.83	Low savings assumed 1.78% of demand as opposed to other similar programs that saved 20% increases levelised costs and underestimates savings. The estimated cost for the targeted high water user residential retrofit program was $0.35/kL. **Programs will achieve much better value if targeted.**
DM18 – public housing retrofit	$4.46	26	6	$1.05	$0.90	Low savings assumed 8% of demand as opposed to other similar programs that saved well over 20% increases levelised costs and underestimates savings.
DM1 – general education	$0.03	771	1060	$0.24	$0.52	Cost for design and dissemination are underestimated, savings are duplicated with metering. ISF recommendations reduce the savings to account for overlap.
DM21 – smart metering	$4.07	895	1256	$81.48	$89.63	Unlikely that metering program can be rolled out in 4-years. Icon Water Currently operates on 12-year replacement program for meters. Costs do not include customer costs to repair leaks, ongoing renew costs of meters or asset write off of meters replaced before their full asset life. Costs do include ongoing subscription to the smart metering software.

Notes: * *Present value costs is calculated over a 30-year investment horizon using a 7% discount rate*

65%
ACT DEMAND

ACT Government **4yr $9.5M**

Total 4yr cost $91M
SIGNIFICANT METERING COSTS



5 Options — **1.1-2.3** GL/yr savings 2050 — **MUST**

MISSED OPPORTUNITIES
- WELs 4-star showerheads
- Washing machine replacement
- Targeting

RISKS:
- Savings decay
- Education high savings, low cost – unlikely to be sustained
- Small savings v non-res

ISF CHANGES
- Reduce education savings
- Add showerhead replacement

OTHER CONSIDERATIONS
- Targeted retrofits much better value - $0.35 v $3.22
- Opportunity to drive market change – 4 star showerhead
- High levelized cost for residential retrofit – low assumed savings

ENVIRONMENTAL IMPACT

WW: 2.7 GL
SW: NIL
GREENING: NIL
ENERGY: Hot water W/WW system pumping/ treatment
SDL: Varies: leakage & outdoor efficiency 100%, Indoor efficiency minimal

Figure 13: Residential demand management recommendations overview

HARC assume rapid decay for the residential in-home fixtures and fitting programs as discussed in *Section 3.5 - Timing and impacts of decay.* ISF suggest that this decay is overstated and too rapid, meaning savings in later years are underestimated and levelised cost estimates are overstated.

Overall ISF estimate the residential demand management programs will save 2 GL in 2030 and over 2.3 GL in 2050. The programs also have the additional benefit of reducing hot water costs for customers of around $25 million over four years.

Implementation and next steps

The residential retrofit program and the social housing retrofit program should be progressed to implementation phase.

The analysis has demonstrated that there are large differences in the value of the retrofit program with and without targeting. The next steps for the retrofit program are to consider how best to target high water using customers within a general program and identify the best mechanism for delivery. The current program costs are based on the service and devices being provided free of charge. Changes in the distribution of cost will impact program uptake, particularly by customers least able to afford the service.

The education program has the potential to build upon a large body of work already established in the ACT including:

- The website and factsheets developed as part of Actsmart

- Smart Water Mark
- Care for Water campaign
- Information collected from residential retrofit programs.

Next steps are to identify and engage with key stakeholders and to undertake preliminary work including customer segmentation and market research.

The smart metering program needs further consideration before a recommendation to include the water savings can be made. Icon Water currently work on a 12-year replacement program for meters. It is unlikely that the metering program would be rolled out within the 4-year timeframe currently used to undertake the analysis. The meter program will not save water unless it is supported by education and other tools. The app development and platform are included in the HARC costs. Overall, the costs for the metering program are likely to be on the high end compared to other market analysis.

3.4.3 - Non-residential Demand management programs

HARC's final report recommended six non-residential demand management programs:

- Mandatory use of smart meters for large customers (DM4)
- Best practice benchmarks and guidelines (DM 5)
- Mandatory audits of government buildings (DM11)
- Mandatory audits of schools (DM17)
- Voluntary audits and retrofits for large customers (DM20)
- Open space irrigation audits and upgrades (excluded due to more comprehensive analysis in the irrigation infrastructure upgrade assessment completed by Hydroplan).

ISF also suggest the inclusion of:

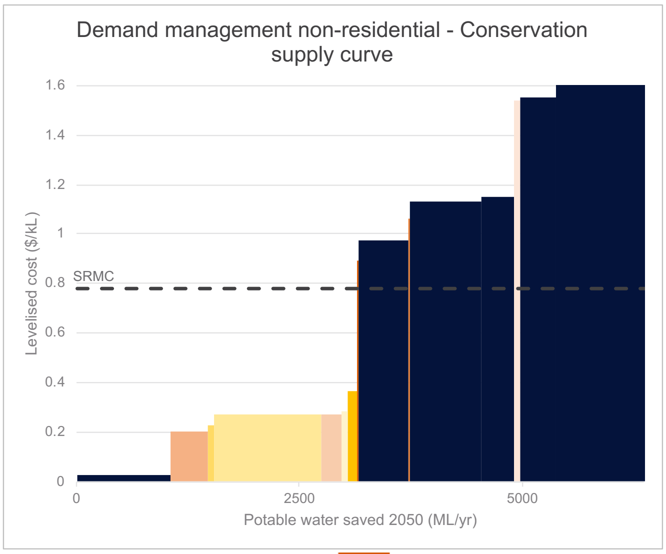
- Targeted small business water efficiency including Asian restaurant efficiency (waterless woks) (DM9), Smart rinse retrofits (DM10), Commercial laundry washing machine rebate (DM16)
- Non-residential WEMPs (DM13) potentially included as part of the review of permanent water savings measures.

These proposed non-residential options are estimated to have a low cost with relatively large savings (Figure 14).

LOW COST LARGE
SAVINGS

4yr $4.2M

Total 4yr cost $8.9M



DM4	Non residential smart metering
DM5	Non residential best practice guidelines
DM13	Non residential WEMPS (over XML/yr)
DM20	Voluntary non residential audit program
DM9	Asian restaurant efficiency
DM10	Smart rinse retrofit
DM11	Government Buildings Audits
DM16	Commercial laundry washing machine rebate
DM17	Schools audit program

9 Options

2.2 GL/yr savings 2050

<$0.5 /kL Levelised cost

ISF Changes
- Added in targeted options – woks, rinse, commercial wash machine

Considerations
- NABERS - free ratings for 12 months

RISKS
- Uptake and engagement
- Actioning savings from audits and WEMPS
- ACT Gov power to create regulatory change & lead with government buildings

ENVIRONMENTAL IMPACT

WW NIL

SW 660ML/yr

GREENING minimal

ENERGY ??

SDL ??%

Figure 14: Overview of HARC non-residential demand management options

An overview of the results of each non-residential demand management option has been presented in Table 6 below.

Table 6: Summary of non-residential demand management options.

ID	$/kL	Water saved 2050 ML/yr	4-year total cost ($M)	4-year cost to Gov ($M)	PV ($M)	uptake	comment
DM4 – smart metering	$0.28	229	230	$0.72	$0.70	1%	Cost distribution split as modelled by HARC.
DM5 – best practice guidelines	$0.23	60	60	$0.17	$0.15	10%	Only $70k is allowed to target all of non-residential demand. It may be preferable to target one or two sectors or leverage the NABERS ratings program and best practice in other states.
DM13 - WEMPS	$0.27	1192	1201	$4.20	$3.56	1%	
DM20 - Audits	$0.37	104	104	$0.49	$0.42	5%	Ratio of overhead to audit costs seems high. Average of 9 audits a year for 4 years. Audit cost =$3,000/audit, average overhead cost =$10,000/audit. Costs for audit and actions seem low, particularly if targeting very large water users.
DM9 – Asian restaurant efficiency	$0.89	24	24	$0.28	$0.24	1.6%	Ratio of overhead to wok costs seems high. Average of 6 woks a year for 4 years. Wok cost =$4,000/audit, average overhead cost =~$7,000/wok.
DM10 – smart rinse retrofit	$1.06	15	15	$0.20	$0.18	1%	Ratio of overhead to smart rinse valves costs seems high. Average of 30 sites a year for 4 years. Site cost =$200/site, average overhead cost =~$1,400/site.
DM11 – Government building Audits	$0.20	414	416	$1.09	$0.93	4.3%	Unusual to include campaign planning and advertising for mandatory government audits. Audit plus retrofit costs seem low for large water savings.
DM16 – commercial laundry washing machine rebate	$0.29	66	67	$0.25	$0.21	10%	Ratio of overhead to washer replacement costs seems high. Average of 3.5 machines a year for 4 years. Machine cost =$2,000/machine, average overhead cost =~$15,000/machine.
DM17 – Schools audit program	$1.54	75	76	$1.51	$1.28	50%	Consider leveraging the Victorian SWEP.

Notes: * *4-year total cost includes costs to Government and cost to customers. These cost distributions have been assumed by HARC and influence the water savings. The optimal cost distribution should be investigated in the implementation and piloting phases of projects.*

Present value costs is calculated over a 30-year investment horizon using a 7% discount rate

Overall ISF estimate the non-residential demand management programs will save 2.2 GL in 2030 at a cost of $8.9 million over 4 years, with over half the savings coming from the WEMP program. The 4-year cost to government is substantially lower at $4.2 million, as many of these programs uptake and savings assumptions have been calculated assuming co-funding from the non-residential customers. The majority of the programs are well below the water abstraction charge. These options provide low cost and easy to implement water savings (Figure 15).

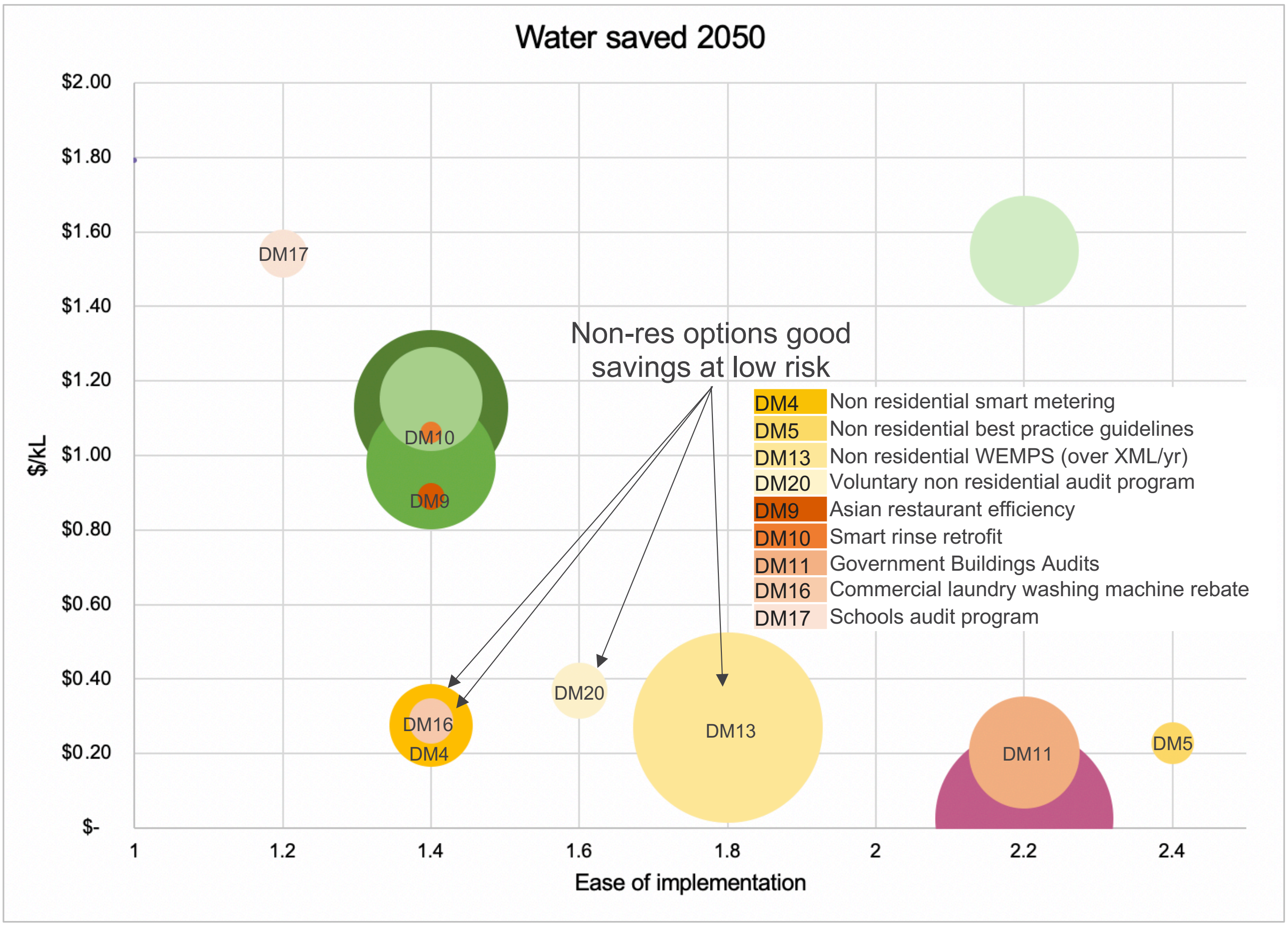


Figure 15: Non-residential demand management options (low cost easy to implement savings)

Implementation and next steps

Generally, the options have been assessed assuming a very low uptake. This means that overheads dominate the cost build up. Further work is required to optimise the programs so that more of the funding goes to saving water.

Smart metering for large users, WEMPs and the audit program require further demand analysis to identify the appropriate demand thresholds for targeting the programs. The most appropriate threshold was not identified in the HARC report. Icon Water has previously run a smart metering program for large water users, so any new program should build upon learnings from the previous program.

The WEMP program could be aligned with the Icon Water review of Permanent Water Conservation Measures (PWCMs). The current PWCMs in place across the ACT and Queanbeyan already require Water Efficiency Management Plans (under certain conditions) for public sports amenities, public parks and gardens, public open spaces, pubic pools, nurseries, market gardens and turf growing businesses[8]. The review of the existing Permanent Water Conservation Measures provides a good opportunity to target other high-water using customers that are not covered by the existing segments.

The budget allocated for the best practice guidelines is insufficient to address all small to medium business demand. It is recommended that this project is developed in collaboration with other States, perhaps through WSAA. There are already a number of existing best practice guidelines. Some examples of best practice guidelines are provided in Appendix 4: Examples of best practice guidelines.

[8] https://www.iconwater.com.au/my-home/saving-water/when-can-i-water/pwcm-business.aspx

The current ratio of overhead to water savings for the small-medium business water efficient fixtures and fittings programs is high. Leveraging a common platform for administering the incentives (similar to the NSW Energy Savings Scheme[9]) will reduce overhead and make the program more effective.

The audit program for schools and government buildings will achieve greater water savings if assistance is provided to action the audit findings. A revolving fund assistance program, similar to the Carbon Neutral Government Fund, could be used. Long-term maintenance contracts should also be reviewed for government, schools and social housing to incentivise water efficiency opportunities. Further opportunities may be available in school by leveraging the successful Victorian Schools Water Efficiency Program (SWEP)[10].

3.4.3 - Measures not included in the HARC recommended program that should be considered

The final HARC report recommended a program that included nine options. The justification for the selection of some measures in the program over others was not clear. ISF recommends that the following measures excluded from the final recommended program be considered. They have been included in our overall analysis:

- Residential shower head swap. Both the demand management assessment of this option and the WSUD options did not consider four-star showerheads to be viable. As discussed above, ISF would recommend that a showerhead swap combined with a phased requirement under the WSUD code would help to create market transformation in this space. The ACT plumbing code requires all showerheads are installed by a licenced plumber, which greatly increases the cost of this option.
- Targeted proven fixture and fitting replacement for small to medium business. The HARC review of past programs in the ACT noted that there was limited success in engaging the small to medium business sector in past programs. While the savings are low, a program to address the largest water using sectors of small-medium business provides an opportunity to engage with this previously untargeted sector. Proven low cost/high water savings options from other jurisdictions excluded from the recommended program include:
    - Asian restaurant efficiency – $0.89/kL, 24 megalitre (ML)/yr savings by end of 4 year program. HARC assumed a very low uptake of 1.64% for this program. As demonstrated in Sydney, targeted engagement with the Asian community can significantly increase the uptake of this program.
    - Smart rinse retrofit – $1.06/kL 15ML/yr savings by the end of a 4 year program. This is based on an uptake rate assumption of 4%.
    - Commercial laundry washing machine rebate – $0.29/kL 66ML/yr savings by the end of a 4 year program. While ISF suggests these costs may be on the low side for administering this program, the allowance of $2000 per commercial machine seems reasonable. This is based on a very low uptake rate assumption of 1%.

  One of the issues with these programs is the high level of overhead. It may be worth considering leveraging an existing platform to administer the rebates, such as the Carbon Neutral Government Fund.
- Non-residential WEMPs. This program overlaps with DM 4 non-residential smart metering and the voluntary non-residential audit program. ISF have not made any adjustments to the costs and savings to remove overlap amongst these programs, as the assumptions in the calculations by HARC have such low uptake assumptions (1% uptake of non-residential demand). Previous

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[9] https://www.business.gov.au/Grants-and-Programs/Energy-Savings-Scheme-NSW

[10] https://www.myswep.com.au

analysis by ISF suggests a small number of users make up over more than 50% of the total non-residential demand. The current PWCMs in place across the ACT and Queanbeyan already require Water Efficiency Management Plans (under certain conditions) for public sports amenities, public parks and gardens, public open spaces, pubic pools, nurseries, market gardens and turf growing businesses[11]. The current PWCMs are under review, and this would provide a good opportunity to target other high-water using customer that are not covered by the existing segments.

- Digital metering program. HARC recommended further investigation of this program and ISF would also make this recommendation. It should be noted that the current program costs do not consider customer costs to repair leaks, the write-off associated with replacing assets before their useful life (current meters), or the ongoing renewal of smart meters as a life cycle cost (approximately every 15 years). It should also be noted that due to the relatively new nature of smart water meters there are no studies that support the longevity of the water savings. The success of the program would depend on how the program was implemented and adapted to continue customer engagement.

3.5 - Timing and impacts of decay

Over time many water efficiency programs are likely to erode. New leaks will occur and behaviours may not be sustained. Decay of water savings was not explicitly discussed in any of the specialist reports, however, by examining the water savings over time we can see that some water savings measures increase over time, some increase initially as the program is rolled out and then decrease over time and others remain steady. Except for the irrigation programs, where additional maintenance costs have been added, ISF has not altered the assumptions for decay.

An assessment of the appropriate treatment of decay is provided below. These considerations have been included in the assessment of the reliability of savings in the risk assessment.

3.5.1 - Water savings measures that decline over time

The residential savings as modelled by HARC and provided in Figure 16 have sharp decay curves. HARC assume that leakage repairs only last a couple of years. The decay due to leakage is one reason why smart metering should be considered. This will help reduce the loss of savings due to reoccurring leakage.

[11] https://www.iconwater.com.au/my-home/saving-water/when-can-i-water/pwcm-business.aspx

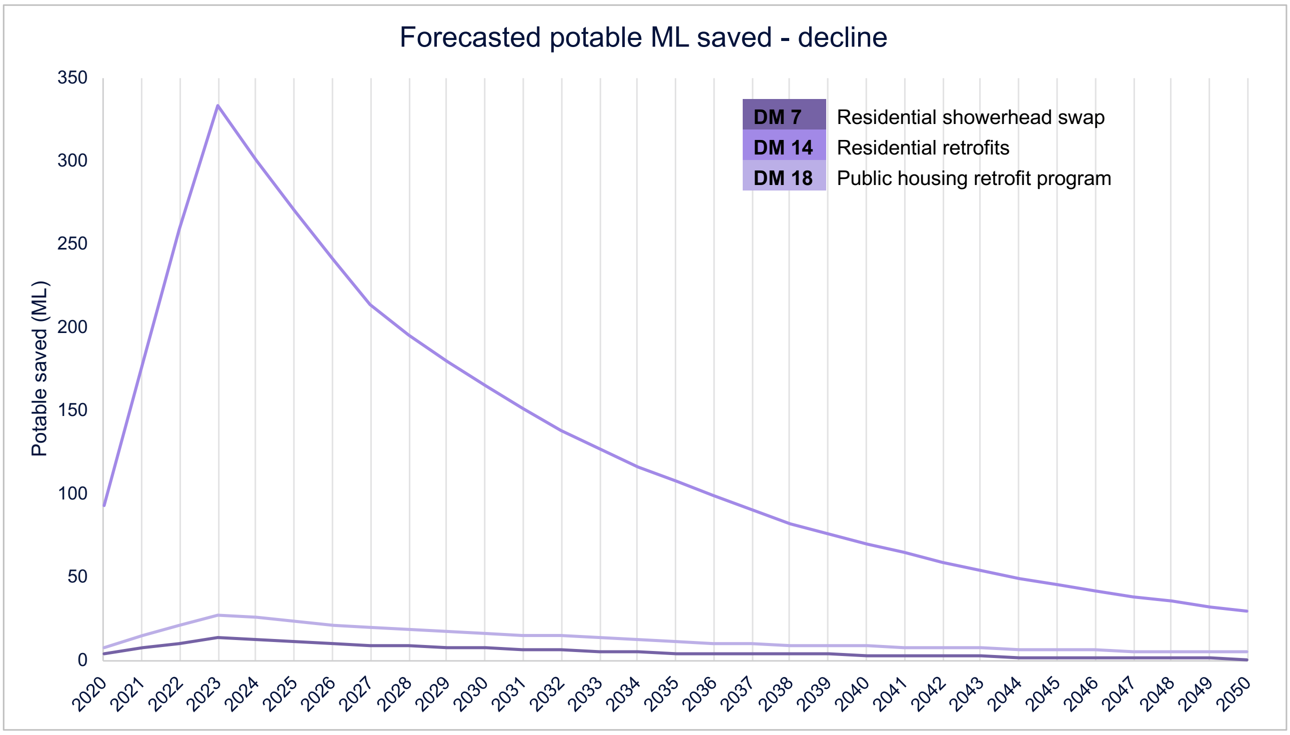


Figure 16: Forecasted potable ML saved - decay

HARC also assume that any saving from installing more efficient fixtures and fittings are lost over time because fixtures would naturally become more efficient. ISF suggests the decay is too steep, and that although more efficient fixtures become the normal this does not mean the water savings are lost, in fact, initiating market transformation is a key factor in developing and supporting these water efficiency programs.

Overall these programs will probably save more water in 2050 than predicted in HARCs modelling.

3.5.2 - Water savings measures with growth over time

The programs with water savings growth over time are programs that are linked to ongoing uptake (Figure 17). The WSUD measures are a good example of this as they will grow with new housing growth.

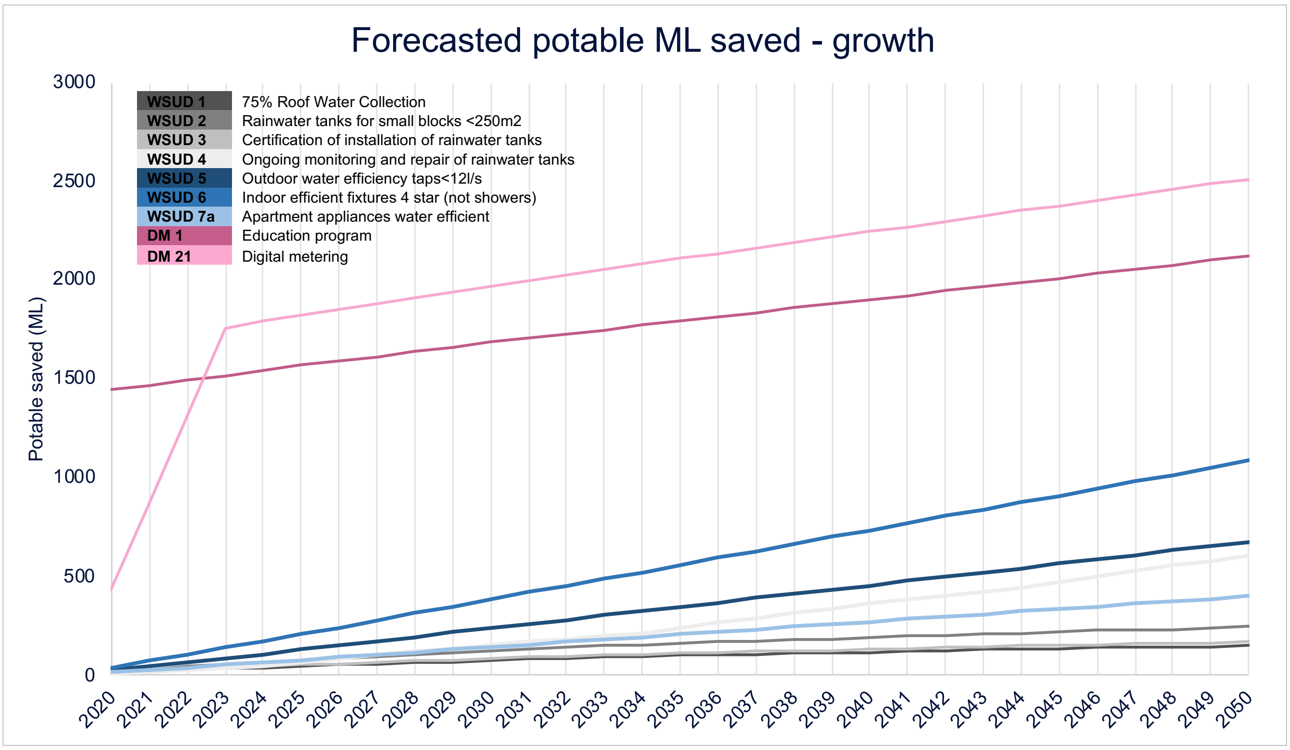


Figure 17: Forecasted potable ML saved - growth

Two examples where there is expected growth of water savings over time is the education program and the metering program. The assumptions of growth for the metering program are in line with population growth. A number of studies (Lui et al) have demonstrated the ability of smart metering to encourage water savings behaviours, saving around 5%. However, there are no studies that have demonstrated whether these savings are sustained.

The assumption of savings growth for the education program is ambitious. The program does have sustained investment over the full 30-year period of assessment, however at $35,000 per year, it is unlikely to be enough to sustain savings, let alone increase them. The overestimate of the education and metering estimates should be minimised by the reduction in total savings in the programs due to overlap but should still be treated with caution.

3.5.3 - Water savings measures that are sustained over time

Most of the other water efficiency measures suggest sustained savings over time (Figure 18). This is likely to be true for the irrigation efficiency upgrade programs, smart metering and stormwater harvesting options as they have ongoing investment included over time to sustain the savings.

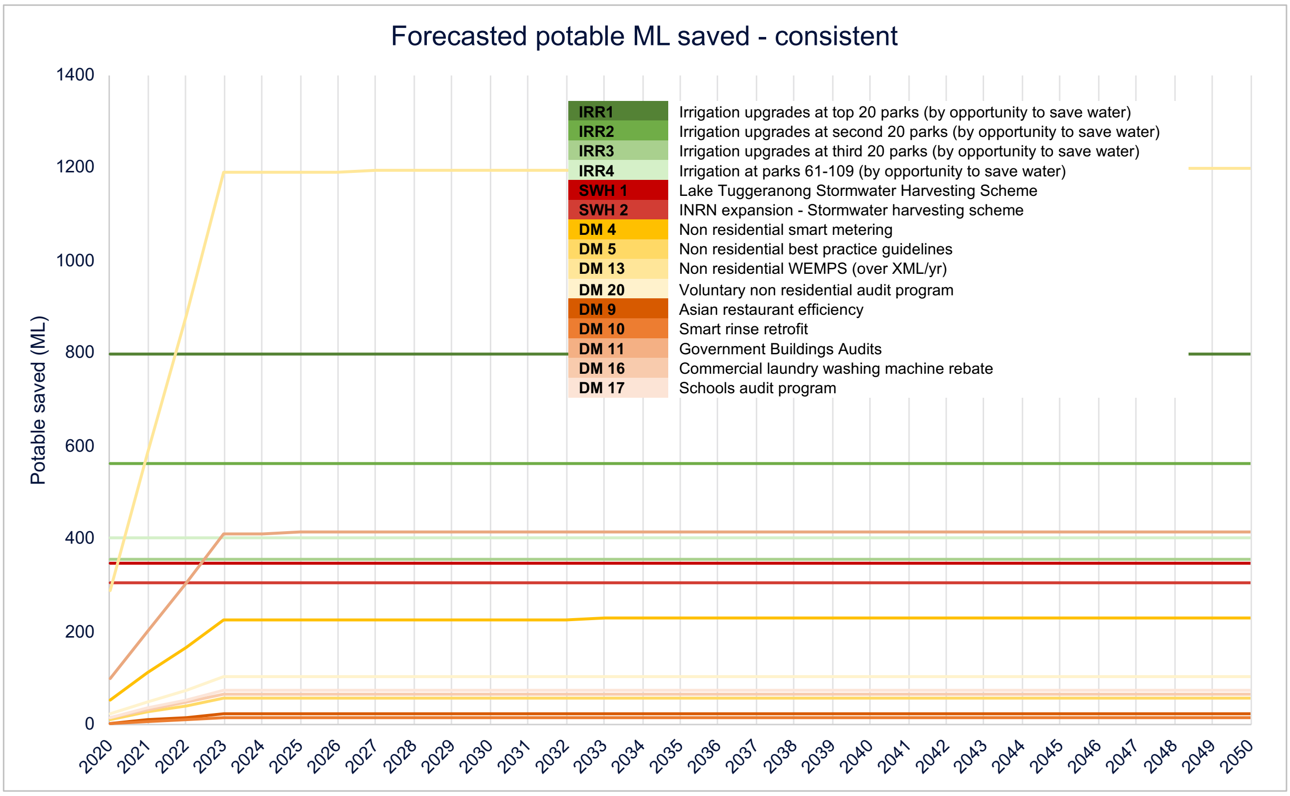


Figure 18: Forecasted potable ML saved - consistent

For the other non-residential programs there is likely to be some decay due to failing fixtures and returning leaks unless the programs have ongoing review. **The lack of decay should not impact the overall savings too significantly as the majority of programs assume low levels of savings and low uptake. However, ISF recommends ongoing monitoring and evaluation of programs to help identify where additional investment is required to sustain and improve water savings.**

3.6 - Economic comparison of all options

Over 12.2 GL of savings were identified across 27 options (Figure 19) ranging in cost from $0.03/kL (general education program) to $19.03/kL (ongoing monitoring and repair of rainwater tanks). More than half of these options could provide around 5.7 GL/yr of water savings in 2030 and7.2 GL/yr of savings in 2050) and can be implemented for less than the LRMC of water supply estimate (excluding benefits from sale of water entitlements to the Commonwealth or additional benefits to customers) (Figure 19).

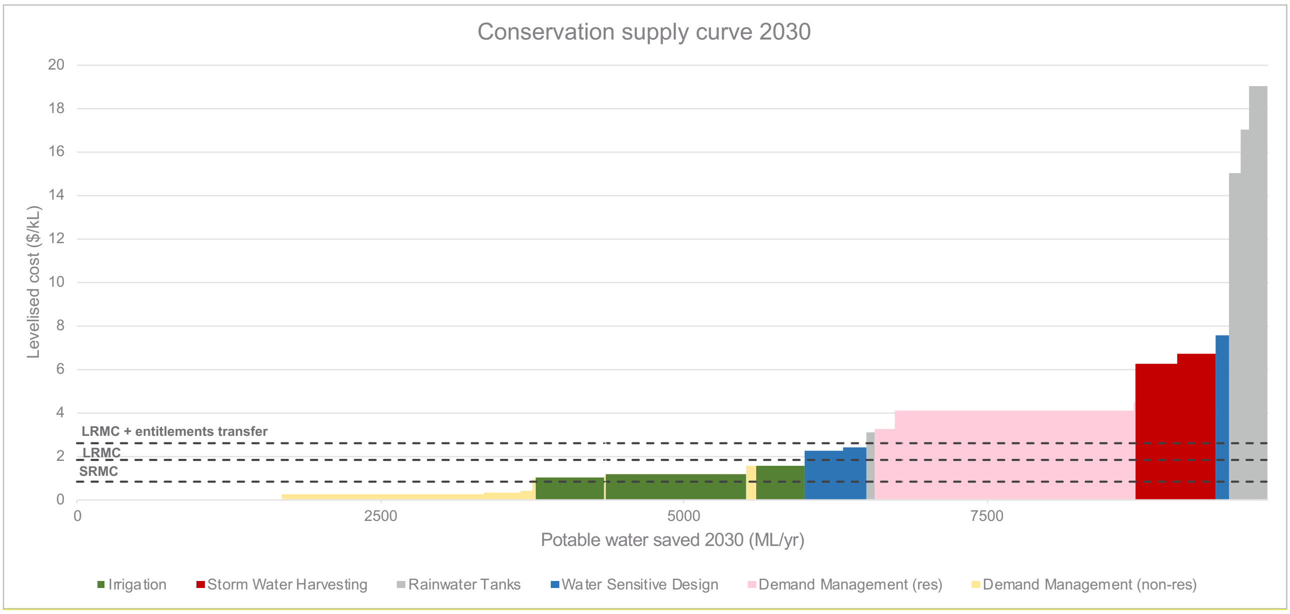


Figure 19: Conservation supply curve 2030 for all options recommended in specialist reports

4 - Recommended water savings program

After review and assessment of the 27 discrete measures recommended across the four separate reports, ISF recommends a water savings program with 20 measures. This program will save around 6.9 GL of water by 2030 and 8.6 GL by 2050, costing around $44 million over four years to implement. An additional $90 million will be required to implement the metering program. The recommended program has a net benefit of $72M (or $159M without smart metering) and the positive net benefit holds even without the sale of entitlements.

The proposed program has taken into consideration the costs, benefits and risks of each program as detailed in *Section 3 - Assessment of water savings opportunities*.

4.1 - Viable recommended options

Of the 27 discrete measures identified across the four separate reports, there are 20 measures that are recommended for implementation (Table 7).

These options will save around 6.9 GL of water by 2030 and 8.6 GL by 2050 (Figure 20). They will cost around $44 million over four years to implement. An additional $90 million will be required to implement the metering program. This represents a present value investment of just under $150 million.

Table 7: Table of viable options

ID	Program	Ease of implementation	Levelised cost ($/kL)	Water saved 2024 (ML)	Water saved 2030 (ML)	Water saved 2050 (ML)	SDL saved 2050 (ML)	4-year cost ($M)	PV ($M)	GHG reduction (2050)
Residential demand management				**2005**	**2015**	**2353**	**1412**	**$91.01**	**$98.05**	**321,180**
DM 1	Education program	2.2	$0.03	771	841	1060	621	$0.24	$0.52	148,100
DM 21	Digital metering	2	$4.07	895	984	1256	780	$81.48	$89.63	107,800
DM 7	Residential showerhead swap	1	$1.79	13	8	1	0	$0.19	$0.17	2,900
DM 14	Residential retrofits	1.4	$3.25	300	165	30	5	$8.04	$6.83	57,150
DM 18	Public housing retrofit program	1.4	$4.46	26	17	6	6	$1.05	$0.90	5,225
Non-residential demand management				**2179**	**2184**	**2193**	**680**	**$8.89**	**$7.66**	**256,400**
DM 4	Non residential smart metering	1.4	$0.28	229	229	230	76	$0.72	$0.70	21,700
DM 5	Non residential best practice guidelines	2.4	$0.23	60	60	60	20	$0.17	$0.15	6,800
DM 13	Non residential WEMPS (over XML/yr)	1.8	$0.27	1192	1196	1201	398	$4.20	$3.56	134,000
DM 20	Voluntary non residential audit program	1.6	$0.37	104	104	104	26	$0.49	$0.42	13,600
DM 9	Asian restaurant efficiency	1.4	$0.89	24	24	24	4	$0.28	$0.24	13,600
DM 10	Smart rinse retrofit	1.4	$1.06	15	15	15	2	$0.20	$0.18	6,200
DM 11	Government Buildings Audits	2.2	$0.20	414	415	416	103	$1.09	$0.93	3,600
DM 16	Commercial laundry washing machine rebate	1.4	$0.29	66	66	67	17	$0.25	$0.21	53,750
DM 17	Schools audit program	1.2	$1.54	75	75	76	34	$1.51	$1.28	6,200
WSUD rainwater tanks				**27**	**69**	**160**	**184**	**$0.49**	**$2.38**	**2,000**
WSUD 3	Certification of installation of rainwater tanks	2.4	$3.11	27	69	160	184	$0.49	$2.38	2,000
WSUD fixtures and fittings				**182**	**549**	**1786**	**836**	**$1.65**	**$8.08**	**190,900**
WSUD 7	Combined WSUD 5, 6, 7a	1.9	$1.21	182	549	1786	836	$1.65	$8.08	190,900
Irrigation Efficiency				**2126**	**2126**	**2126**	**2673**	**$22.86**	**$28.60**	**41,357**
IRR1	Irrigation upgrades at top 20 parks (by opportunity to save water)	1.4	$1.13	800	800	800	1161	$8.29	$10.36	15,600
IRR2	Irrigation upgrades at second 20 parks (by opportunity to save water)	1.4	$0.98	564	564	564	641	$5.06	$6.33	11,000
IRR3	Irrigation upgrades at third 20 parks (by opportunity to save water)	1.4	$1.15	359	359	359	402	$3.79	$4.74	7,000
IRR4	Irrigation at parks 61-109 (by opportunity to save water)	2.2	$1.55	403	403	403	470	$5.73	$7.17	7,800

[*]ISF suggests the assumptions for the water savings associated with the residential retrofit programs are low, which artificially increases the levelised cost. ISF recommends these programs proceed or are investigated further. The final group includes the metering program which has benefits for Icon Water beyond water savings.

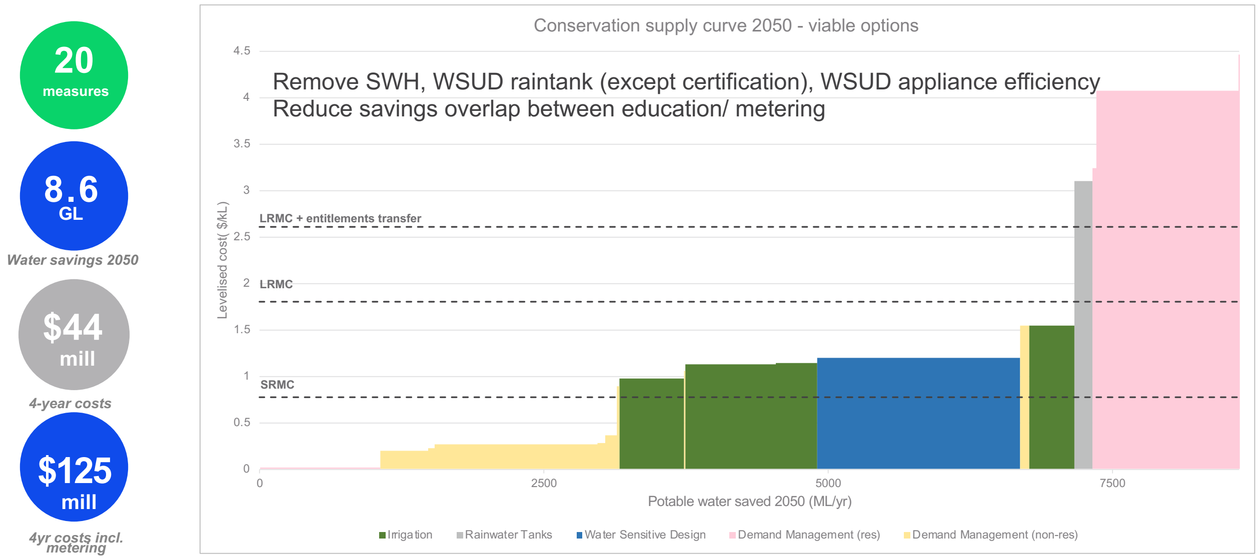


Figure 20: Viable options summary

4.1.1. - Comparison of the option costs to the cost of water

One way of evaluating the benefits of a water efficiency program is to compare the cost of the water savings to the cost of supplying or buying the water. Table 8 outlines the potable water savings that can be achieved for a range of different thresholds including:

- Options that cost less than the current water abstraction charge. These options can be delivered for less than the cost that must be paid to abstract the water, which is a proxy for the environmental value of the water.
- Options that cost less than the short run marginal cost of water (SRMC). The SRMC of water is the direct cost of supplying the water including the abstraction charge. The SRMC considers the costs of supplying an additional unit of water when the capacity cannot be increased. The value used for the SRMC is $0.79 and includes operating costs of supplying an additional unit water (for example pumping and treatment costs).
- Options that cost less than the long run marginal cost of water (LRMC). The LRMC of water is the cost of supplying an additional unit of water where the amount of supply can be varied. The LRMC value used is $1.80 (Icon Water estimated a range of $1.60-$1.75 in $2016). This value includes both the SRMC and the marginal capacity cost. The marginal capacity cost is a function of the timing and cost of the next supply augmentation.
- Options that cost less than the LRMC plus the money received from the entitlement transfer. This ‘value of water saved’ threshold is approximately $2.61/kL in present value terms, similar to the tier one price of water in the ACT.
- The tier two water price in the ACT which is currently $4.94/kL.

All of the options that cost less than LRMC are of economic value to deliver.

The majority of the options and the equivalent of 5.7 GL of savings in 2030 cost less than the LRMC of water supply plus the additional payment provided by the Commonwealth Government for returning water rights/transferring entitlement (Table 8).

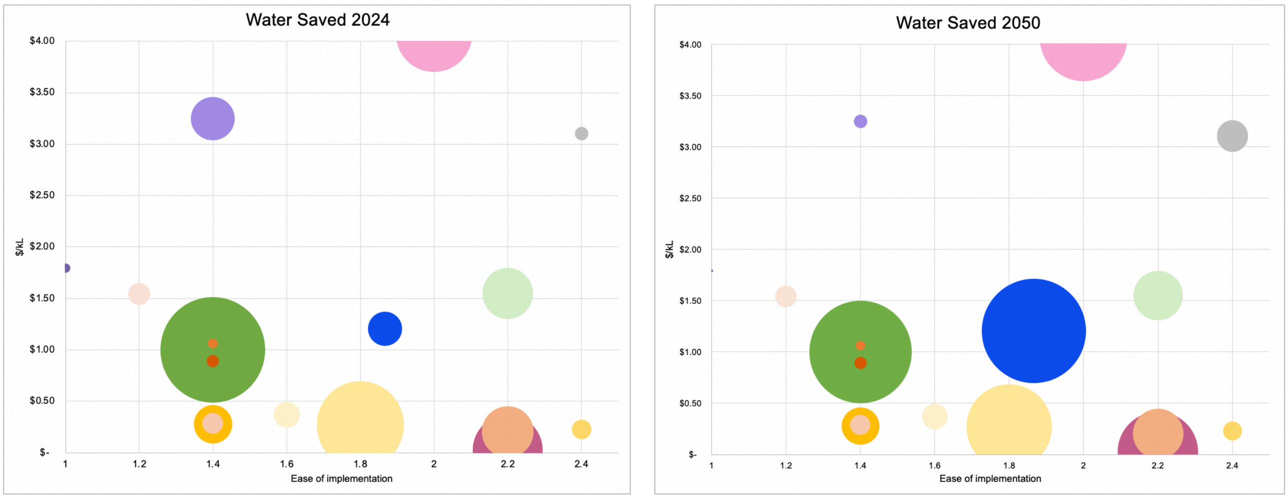
Table 8: Comparing the cost of saving water to different economic and cost thresholds.

Threshold	potable water savings 2030 (GL/yr)	potable water savings 2050(GL/yr)	Number of measures	Levelised cost range	PV cost ($million)
Abstraction charge ~$0.61	2.9	3.1	7	$0.03-$0.37	$6.5
SRMC* ~ $0.79	2.9	3.1	7	$0.03-$0.37	$6.5
LRMC ~ $1.80* (SRMC + marginal capacity cost equivalent of new supply option)	5.7	7.2	15	$0.03-$1.55	$44.9
Tier 1 water price – $2.46/kL	5.7	7.2	16	$0.03-$1.79	$45.0
LRMC + entitlement transfer ~ $2.61	5.7	7.2	16	$0.03-$1.79	$45.0
Tier 2 water price - $4.94/kL	6.9	8.6	20	$0.03-$4.46**	$144.8

Notes **SRMC and LRMC are taken from estimates in ICRC (2016) and updated to $2019/20 by Icon Water.*

PV is the present value of the cost of the options over 30years using a 7% discount rate and does not include the value of any benefits.

In addition, the viable options have been assessed as being relatively easy to implement (Figure 21).



Legend

IRR1	Irrigation upgrades at top 20 parks (by opportunity to save water)
IRR2	Irrigation upgrades at second 20 parks (by opportunity to save water)
IRR3	Irrigation upgrades at third 20 parks (by opportunity to save water)
IRR4	Irrigation at parks 61-109 (by opportunity to save water)
WSUD 3	Certification of installation of rainwater tanks
WSUD 7	Combined 5, 6, 7a
DM 1	Education program
DM 21	Digital metering
DM 7	Residential showerhead swap
DM 14	Residential retrofits
DM 18	Public housing retrofit program

DM 4	Non residential smart metering
DM 5	Non residential best practice guidelines
DM 13	Non residential WEMPS (over XML/yr)
DM 20	Voluntary non residential audit program
DM 9	Asian restaurant efficiency
DM 10	Smart rinse retrofit
DM 11	Government Buildings Audits
DM 16	Commercial laundry washing machine rebate
DM 17	Schools audit program

Figure 21: Viable options water savings and implementation risk

The proposed program will also provide a reduction in greenhouse gas emissions of over 250,000 tonnes from reduced energy usage in the system and an additional reduction of 560,000 tonnes from reduced hot water usage.

4.2 - Excluded options

The key options that have been excluded from the analysis of viable options include:

- A WSUD code change to increase the size and roof area connectivity percentage for rainwater tanks
- A WSUD code change to require rainwater tanks for small blocks (under 250m^2)
- Ongoing inspection and repair of rainwater tanks
- Stormwater harvesting options.

The rainwater tank options were mainly excluded on cost (Figure 22). The option for ongoing monitoring and repair of rainwater tanks has also not been included in the analysis due to the high cost.

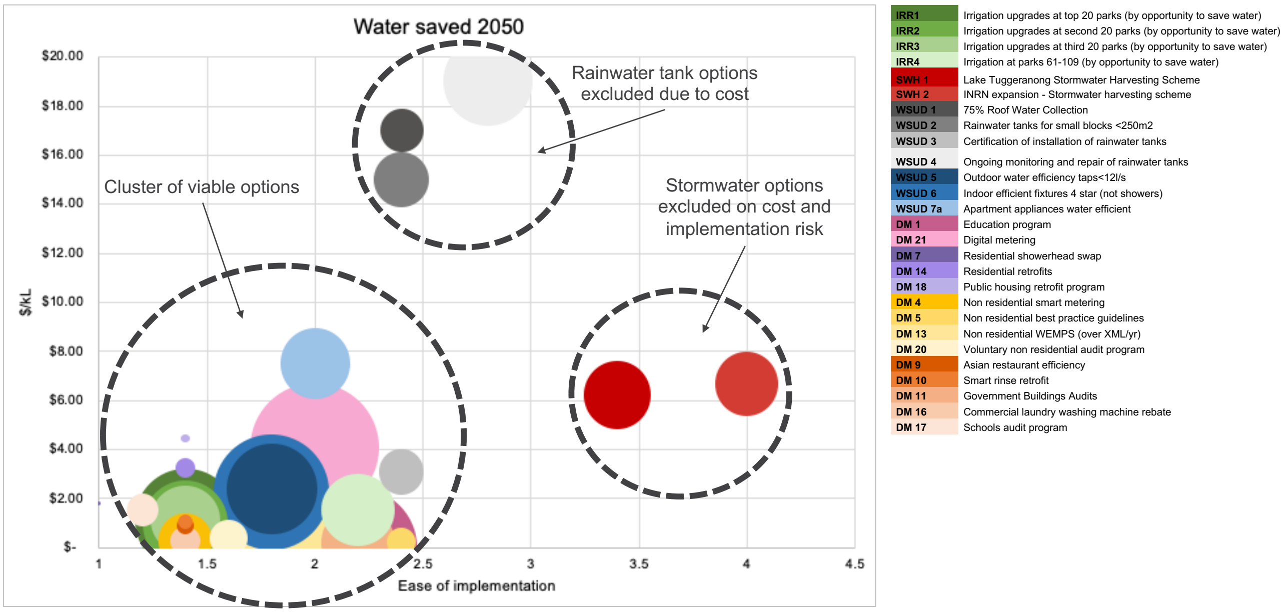


Figure 22: Risk assessment of options

It is recommended that different implementation mechanisms that share the cost and improve the performance of existing rainwater tanks is explored further. The stormwater options were excluded at this stage based on their cost and implementation risk (Figure 22).

4.3 - Cost benefit analysis

The full recommended program with metering has a net benefit of $72 million and the positive net benefit holds even without the sale of entitlements (Table 9).

Table 9: Cost benefit analysis of recommended program

Costs and benefits of program ($2020/21)	With metering	Without metering
Present Value (PV) cost of program	$ 145 M	$ 55 M
Present value (PV) avoided cost with LRMC of water - $1.80/kL	$ 182 M	$ 180 M
Approx. current value of 8GL/yr entitlement sold to Commonwealth (assumed ~ $10,000ML)	$ 80 M	$ 80 M
Results		
PV Net Benefit	$ 117 M	$ 205 M
Benefit Cost Ratio without entitlement sale	1.3	3.3
Benefit Cost Ratio with entitlement sale	1.8	4.7

Note: The present value of the benefits is calculated using the LRMC value of water only. It does not include any wastewater avoided costs as these numbers were not available. If there were additional avoided costs in the wastewater network this would further improve the Benefit Cost Ratio (BCR). The BCR calculation for the entitlement sale is calculated using a 1.75 multiplier on the current market value for entitlements. The calculations use a 7% discount rate and a 30-year analysis period.

The smart metering program accounts for 62 percent of the total program costs, with a present value cost of $90 million. The metering project would have a wide range of other benefits to the utility in terms of managing their systems and their operations with improved water conservation being a side benefit.

Without metering the program net benefit climbs to $205 million and the $55 million present value costs of the remaining program are more than covered by the potential entitlement sale to Commonwealth.

5 - Reasons for the program and issue to resolve

Improving water use efficiency and stopping water wastage provides an array of benefits to the environment, customers and the community in generally. If water and wastewater systems can achieve the same level of service in terms of sanitation, activities like clothes-washing or showering and the same (or improved) amenity in parks and gardens using less water there are benefits such as reduced extraction of water from the environment, reduced energy and chemicals used in the treatment and transport and reduced bills for customers.

To increase the engagement with and acceptance of the water savings program, the range of the additional broader benefits should be clearly communicated. To implement and effectively manage water demand across the Territory, the context and impacts of undertaking water efficiency measures must be understood. This chapter provides an overview of the various rationales for the program, and outlines issues that must be resolved to make it a success.

5.1 – Reasons for the program

There are a number of additional benefits of the recommended water efficiency program beyond the simple cost-benefit. These additional benefits include the potential to:

- Help water users in the ACT improve their water use efficiency and reduced wastage, thereby reducing water and energy bills
- Ensure water security in the Territory and/or provide water security at a reduced cost by delaying the need for future supply augmentations
- Provide water savings to the environment and the improved health of the rivers of the Murray-Darling
- Reduce energy use and associated greenhouse gas emissions.

These additional arguments for the program are discussed below.

5.1.1 – With help customers can improve their water efficiency and make bill savings

Over the period (1995-2020) the ACT has experienced prolonged periods of drought including the Millennium drought lasting from 2001 to 2010 and the current drought beginning in mid 2017. The ACT Government introduced a range of measures to reduce overall demand as a part of the Think Water Act Water Strategy, these were further strengthened in the ACT Water Strategy 2014-44, including:

- changes to the design code making new buildings more water efficient
- the introduction of PWCMs
- increase in alterative supplies (such as stormwater reuse and wastewater recycling).

A number of demand management programs were run by the ACT government and Icon Water (then ActewAGL) to assist customers reduce water usage including:

- Retrofits, rebate and subsides
  - Rainwater tanks rebate
  - AAA showerhead rebate
  - Think Water Act Water - Smart Homes, dual flush toilet rebate, rainwater tanks rebate, ToiletSmart, ToiletSmart Plus, ToiletSmart pensioner program, GardenSmart, Commercial bathroom retrofit, Outreach energy and water efficiency program.
- Water pricing and metering

- – Large customer demand management.
- Community and business education programs
  - – Actsmart – business energy and water program, schools, generally educating people to take positive actions themselves
  - – Care for Water.

Combined these measures have helped to reduce water consumption by around 40 percent (see Figure 23) from the per capita average demand from before the Millennium drought.

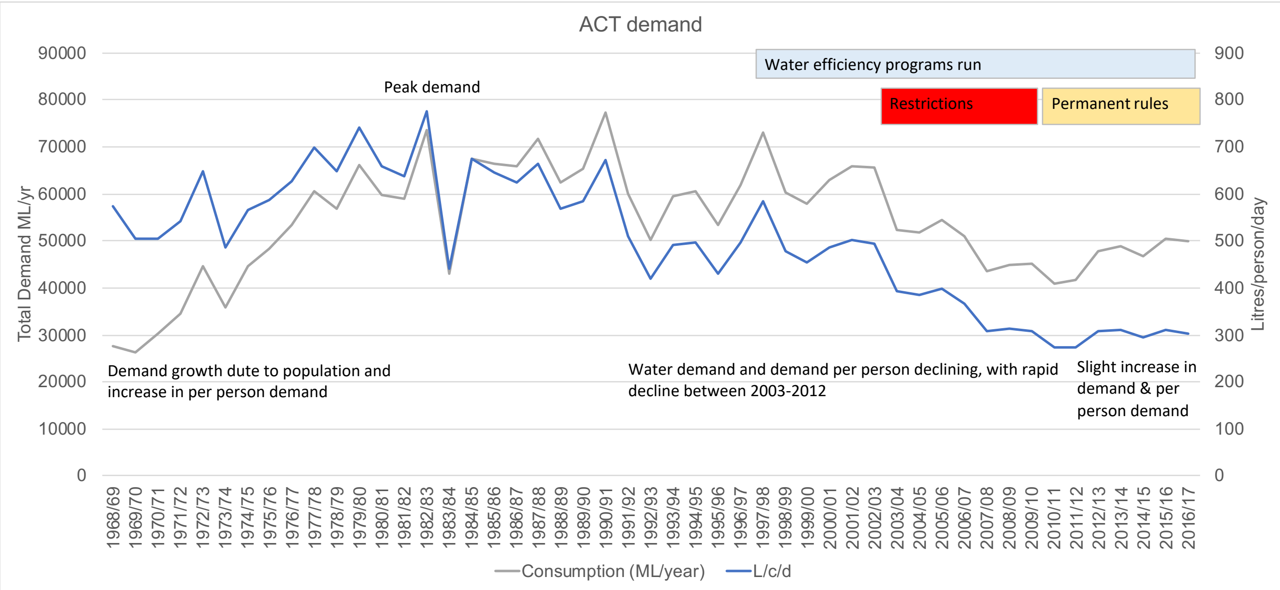


Figure 23: ACT water demand trends (data provided by ACT Government, sourced from Icon Water)

Despite these past measures, ACT demand per person is higher than Sydney or Melbourne (Figure 24) and has increased slightly in the last few years (Figure 23). It is likely that there are still many remaining opportunities for water efficiency.

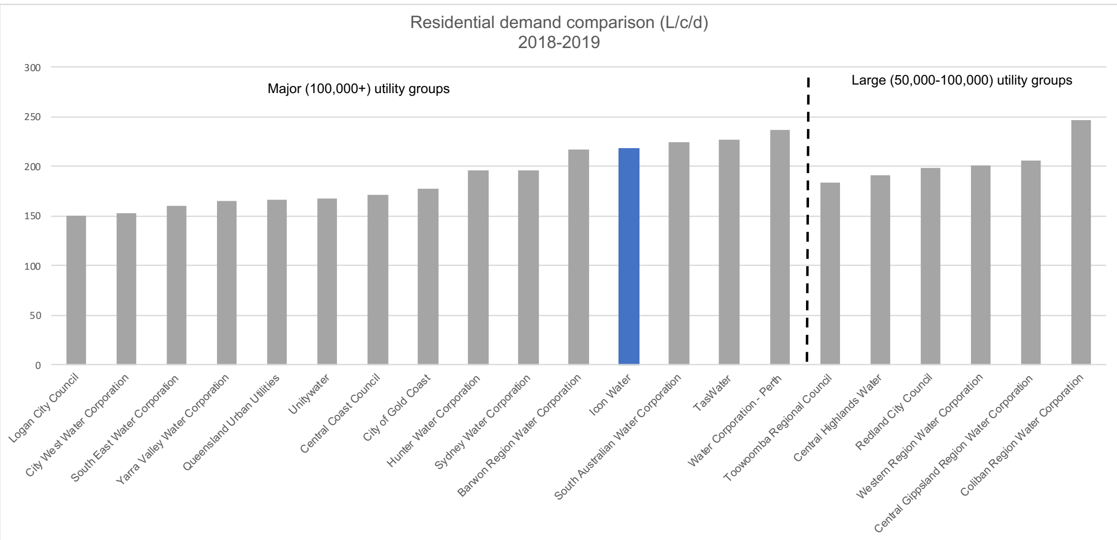


Figure 24: Icon Water demand in comparison to other similar sized utilities (data extracted from BoM urban national performance report 2018-19[12])

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[12] http://www.bom.gov.au/water/npr/

Given the comparison to other utilities, the potential to help ACT residential water users further improve their water efficiency is likely to exist. Similar potential can also be expected in the non-residential sectors. The recommend water saving programs would see not just water bill savings by households and business but also electricity and gas savings from reduced hot water usage.

5.1.2 - Water savings are necessary to ensure water security in the ACT

The ACT manages security of supply through a network of dams and transfer pipelines. To improve security of supply and to reduce the frequency of restrictions, the ACT has augmented its storage capacity including enlarging the Cotter Dam and building a pipeline to transfer water from the Murrumbidgee River to the Googong Reservoir. The ACT manages its demand via a series of storage dams and transfer pipelines. The current capacity is designed to provide a level of service where restrictions are not required more than 5 percent of the time.

Icon Water modelling suggests that no further augmentations will be required until 2045-2050 (ACT 2014). Under low demand growth scenarios this extends to post 2060 and under high demand growth scenario's this is brought forward to 2030-40. It is important to note that this modelling assumed a **further 40 percent reduction** in average demand. ACT average demand is currently around 300 L/p/d (Figure 23). A 40 percent reduction equates to around 180 L/p/d. In comparison Sydney currently uses around 210 L/p/d and Melbourne uses around 161 L/p/d. It is important therefore, to recognise the current water planning is anticipating further water efficiency gains and failing to invest in ongoing water savings measures has its own set of risks.

5.1.3 – Changing ACT's Sustainable Diversion Limits has limited impact on water security

The amount the ACT can extract from water courses (the SDL) is 37.8 GL/yr (42.7 GL minus 4.9 GL SRA). This is calculated as the total extraction minus the amount discharged back into the river via wastewater treatment plants (net take).

The Basin Plan includes a commitment to recover, through water efficiency projects, 450 GL of environmental water by 30 June 2024. The ACT is investigating a contribution of up to 15GL, with the 4.9GL SRA counted as part of this contribution.

It is important that any entitlement returns align with secure water savings to minimise the impact on ACT water security in the longer term. The savings identified in this report are being considered as part of a broader package of work that considers the implications for water security.

The ACT uses the 'net' abstractions to account for water use as it returns over half the water used to the MDB system (mainly via discharge of treated wastewater from the Lower Molonglo Water Quality Control Centre). The ACT Government has issued Icon Water with Water Access Entitlements equal to 71.0 GL/yr in gross take. While this volume is greater than the ACT SDL for watercourses, return discharge volumes result in net take being below the SDL. The current net extractions are much less than the available extractions (Figure *25*).

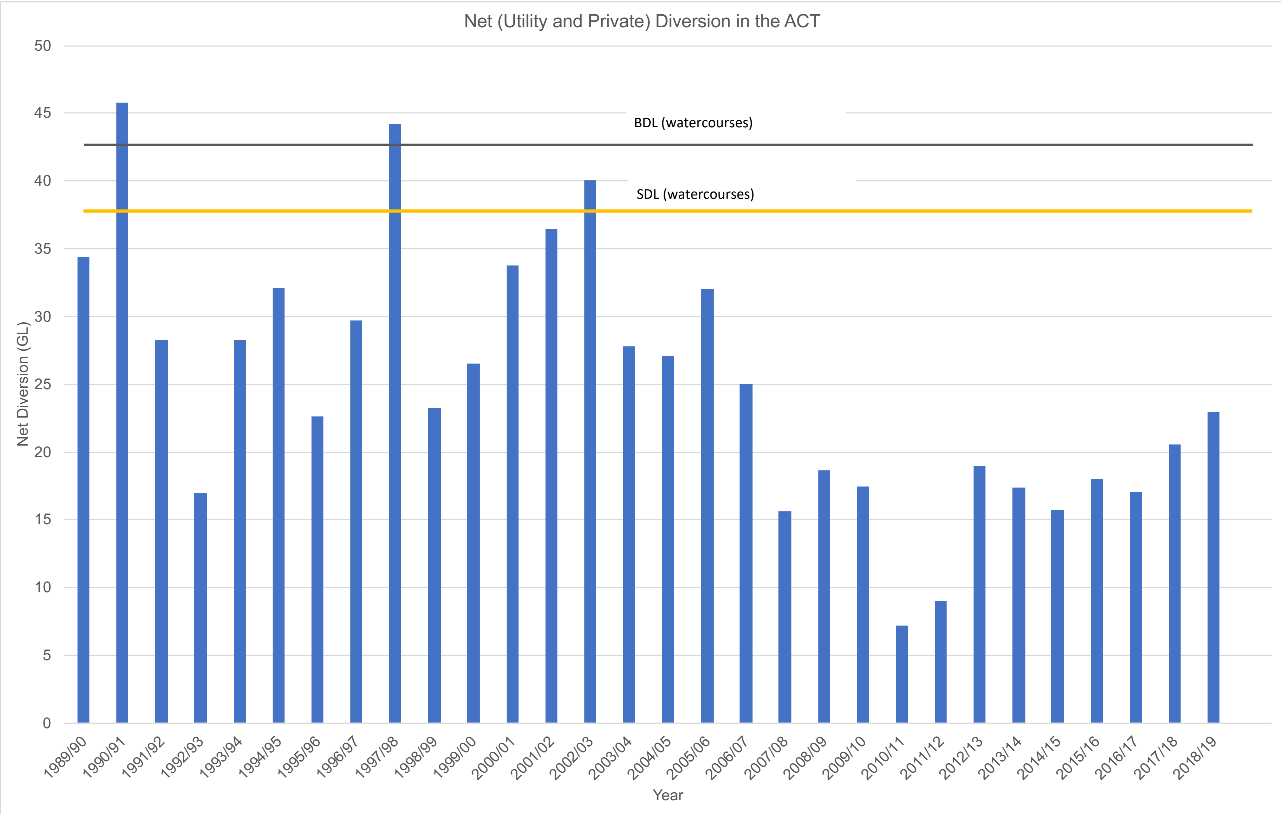

Figure 25: Historical ACT new water course take (GL) (Source: ACT Government)

To understand the possible impact of selling water entitlements to the Commonwealth on water security and future supply augmentations, the ACT Government engaged eWater to conduct modelling. This modelling will help to inform decisions on the magnitude of entitlements that are returned to the Commonwealth, and was in draft form at the time of writing this report. The draft eWater modelling used the following scenarios:

- Base case (no savings implemented)
- Saving the SRA only (4.9GL)
- Saving a total of 10GL
- Saving a total of 15 GL.

The modelling included a steady state growth assumption, four climate change scenarios (no, low, medium and high climate change) and two savings options (100% savings contribute to SDL and 33% savings contribute to SDL). From these scenarios, the earliest the cumulative SDL is exceeded 25% of the time is 2081, assuming high climate change impacts. Clearly understanding how the eWater and Icon Water projections align and identifying the overall impact of transferring of water entitlements is a key next step.

5.1.4 Reduce energy use and associated greenhouse gas emissions

The Act Government has a policy to be 100% renewable. Greenhouse and energy savings due to water efficiency programs can be substantial. The co-benefits associated with increased water efficiency, such energy savings and reductions in greenhouse gas emissions, align with the priorities of *the ACT's Climate Change Strategy (2019-2025)*[13]. In particular, reducing the emissions that arise from water and

[13] https://www.environment.act.gov.au/__data/assets/pdf_file/0003/1414641/ACT-Climate-Change-Strategy-2019-2025.pdf/_recache

wastewater treatment, distribution, and water heating would help contribute towards the ACT's commitment to net zero emissions by 2045.

The reduction in water and wastewater demand will reduce greenhouse gas emissions due to transporting and treating water and wastewater by over 250,000 tonnes by 2050. The savings were estimated using the GHG values from the HARC report and water and wastewater savings as provided by the consultants:

- Water = 0.6275 cubic tonnes of GHG emissions saved per ML of water saved
- Wastewater = 1.0458 cubic tonnes of GHG emissions saved per ML of wastewater reduced

Even larger greenhouse and energy come from savings hot water. Water heating is twenty five percent of energy used in homes. The proposed program will also provide a reduction in greenhouse gas of 560,000 tonnes from reduced hot water usage. These calculations are based on estimates of GHG savings due to reduce hot water demand in NSW and ACT, as detailed in ISF's evaluation of the Commonwealths Water Efficiency Labelling and Standards (WELS) scheme (ISF, 2018). The WELS scheme estimates accounted for projected changes in fuel mix (e.g the move from electricity to gas), technology type (e.g. growth of heat pumps) and anticipated changes in the sources of electricity in the National Electricity Market, in particular the growth of renewables. The calculation assumes that the ACT Government maintains its commitment to funding renewable energy, rather than lowering it to account for electricity savings made by this program.

Combined these reductions in greenhouse gas emissions is the equivalent of removing nearly 6,000 cars from the road over the 30-year period.

5.2 - Issues to resolve

Understanding key stakeholder concerns and requirements will be important for enabling the successful design and implementation of the water efficiency program. An initial 'stocktake' of issues to address that relate specifically to stakeholder and the Territory context is presented below. The sub sections cover:

- Overall program design
- Economic and financial consideration
- Other impacts of the program.

The key internal and external stakeholders for the recommended water efficiency program were identified as part of the second workshop (with stakeholders). Key stakeholders, their concerns and how these might be addressed is reported in Table 10, Table 11 and Table 12. This should inform the consideration of the next steps in implementing the program, as a whole, and making it a success.

5.2.1 – Stakeholder issues when considering the overall program design

Stakeholder agreement with the overall program design and justification is important to the overall success of the program. These issues are outlined in Table 10.

Table 10: Stakeholder issues: Overall program design

Issue	Stakeholder	How this might be addressed	Further work required?
Governance issues			
What are the ACT's obligations under the Murray-Darling Agreement? And will they be met by the program?	ACT Treasury MDBA	Obligations of exploring water savings is met by this report. This report also shows that a viable water efficiency program is possible. However total saving are likely less than the full 15GL/yr considered. Further work should be conducted to assess what are the implication for entitlements transfer.	✓
What are the implications of transferring the rights for the future of water security	ACT Treasury Minister Icon Water	Outside of the scope of this report. But has been investigated by eWater as a separate project (referenced above in 5.1.3)	?
Does the program and the final volume to be transferred have the support of other directorates?	EPSDD executive Policy & Cabinet	Seeking a consensus position was not the role of this project, however Treasury, Policy and Cabinet and Icon Water were included in workshops and report review.	✓
How does the program align with future ACT water policy	Icon Water Shareholders	Broader ACT Government question.	✓
Are there any cross-border supply issues?	Icon Water Shareholders Policy and Cabinet Division, Regional Policy	Broader inter-governmental question impacting NSW.	✓
What are the impacts on downstream NSW irrigators?	NSW Gov – DPIE water	as above.	✓
What are the impacts on water trading with NSW	NSW Gov – DPIE water	as above.	✓
What are the impacts on regional supplies by Icon?	Regional councils	as above.	✓
Water saving issues			
Are the water savings robust?	EPSDD executive	The robustness of the water savings has been assessed in Section 3 - Assessment of water savings opportunities, of this report.	

Issue	Stakeholder	How this might be addressed	Further work required?
Will the water savings be delivered as expected?	EPSDD executive DAWE MDBA	The water savings are estimates only and further work is required in how to best implement the programs to drive uptake and achieve the savings.	✓

5.2.2 Economic and financial considerations

The program has been shown to have a positive cost benefit even without including customer energy savings or GHG. Costs and savings will however be distributed across various parties, which becomes a policy question for redistribution. Some of these financial questions are raised in Table 11 below.

Table 11: Stakeholder issues, economic and financial issues

Issue	Stakeholder	How this might be addressed	Further work required?
Economic impacts			
Are the measures the most cost effective?	ACT Treasury	The measures are assessed using a cost-effective comparison ($/kL). The lowest cost alternatives have been recommended, with some exceptions as detailed in the HARC report.	
Is there consistency in the way the costs/ benefits are assessed across different initiatives.	ACT Treasury	The costs and benefits have been assessed in an equal manner. The assumptions used for the benefits are presented in Section 4.3 - Cost benefit analysis.	
Financial impacts			
Will the program be cost neutral?	EPSDD executive ACT Treasury Pricing regulator	The program has a net benefit, but how the costs and benefits of the program are distributed is a policy question for Government.	✓
Is any expenditure by Icon Water to be funded by customers economically efficient and prudent	Icon Water Pricing regulator	The water efficiency program as recommended does not currently consider Icon Water funding.	✓
Financial impact for Icon Water (water revenue reductions) And consideration of the impact on Icon Water's returns to Government (Dividends etc).	ACT Treasury Government Icon Water Icon Water Shareholders	The analysis of financial impacts on various parties from the proposed program are outside the scope of this project. Impacts on Icon water are being investigated by Frontier Economics as a separate project.	✓
Pricing impact on customer segments	Icon Water Pricing regulator	As above. This is being investigated by Frontier Economics as a separate project.	✓
Will Icon Water get funding for the programs that are their responsibility?		Future decision of Government.	

5.2.3 Other impacts of the program

The recommended program has a number of environmental and social issues to address.

Table 12: Stakeholder issues: environmental and social impacts

Issue	Stakeholder	How this might be addressed	Further work required?
Environmental Impacts			
Are there any climate change benefits?	Minister Government	See section 5.1.4 above for GHG estimates.	
What is the impact of the program on energy demand and carbon emissions.	Minister	The energy impact of the overall program is a reduction of 812,000 tonnes of greenhouse gas over 30-years. The energy impacts are assessed for each of the options where possible.	
Social impacts			
What are the social impacts and are they positive	Minster Customers MDBA	The ACT Government is conducting a separate report on the social impacts of the program.	✓
Is there community support for the program	Minster	While water efficiency is commonly highly popular with communities, the communications around water entitlements and water security need to be considered closely by the Government.	✓
Impact of program on cost of living and in particular water bills	Government Icon Water Customers	The water bill savings for participants are evaluated for each option. The impacts on water bills overall is not part of this project but is being assessed by Frontier Economics.	✓
Are there third-party impacts?	DAWE		
Maximising social benefits via maintenance contracts		The current approach for Housing and Education in relation to water using fixtures and fittings maintenance is fix on fail. Contracts often replace like with like. There is an opportunity to engage with these departments on the economic, financial, environmental and social of water efficiency more broadly, and seek to develop policies to improve water efficiency aspects in contractual maintenance.	✓

6 - Conclusions and Recommendations

This chapter synthesizes the outcomes of this report and provides recommendations for next steps for the implementation of the recommended program.

Twenty water savings options have been assessed as viable. These programs are described in Table 13. The twenty recommended programs have a save around 6.9 GL/yr of water by 2030 and 8.6 GL/yr by 2050 (Figure 26).

Table 13: Recommended water savings program

	Costs		Key benefits		
ID[14]	4-year cost ($M)*	PV Cost ($ M) **	Potable water saved ML/yr 2050	Water savings that reduce net extractions ML/yr 2050	GHG reduction (tonnes total by 2050)
Irrigation Efficiency	$22.86	$28.60	2126	2673	41,360
WSUD rainwater tanks	$0.49	$2.38	160	184	2,000
WSUD fixtures and fittings	$1.65	$8.08	1786	836	190,900
Residential demand management	$91.01	$98.05	2353	2825	321,200
Non-residential demand management	$8.89	$7.66	2193	680	256,400
TOTAL	**$125**	**$145**	**8620**	**7200**	**811,800**

**The majority of the programs are conducted over the four years.*

***Present value costs calculated over 30 years at discount rate of 7%*

[14] Irrigation efficiency options are from the HydroPlan report, WSUD rainwater tank and fixtures and fittings options are from the Alluvium report, Residential and non-residential demand management options are from the Harc report. For full cross reference of options please see Appendix 5.

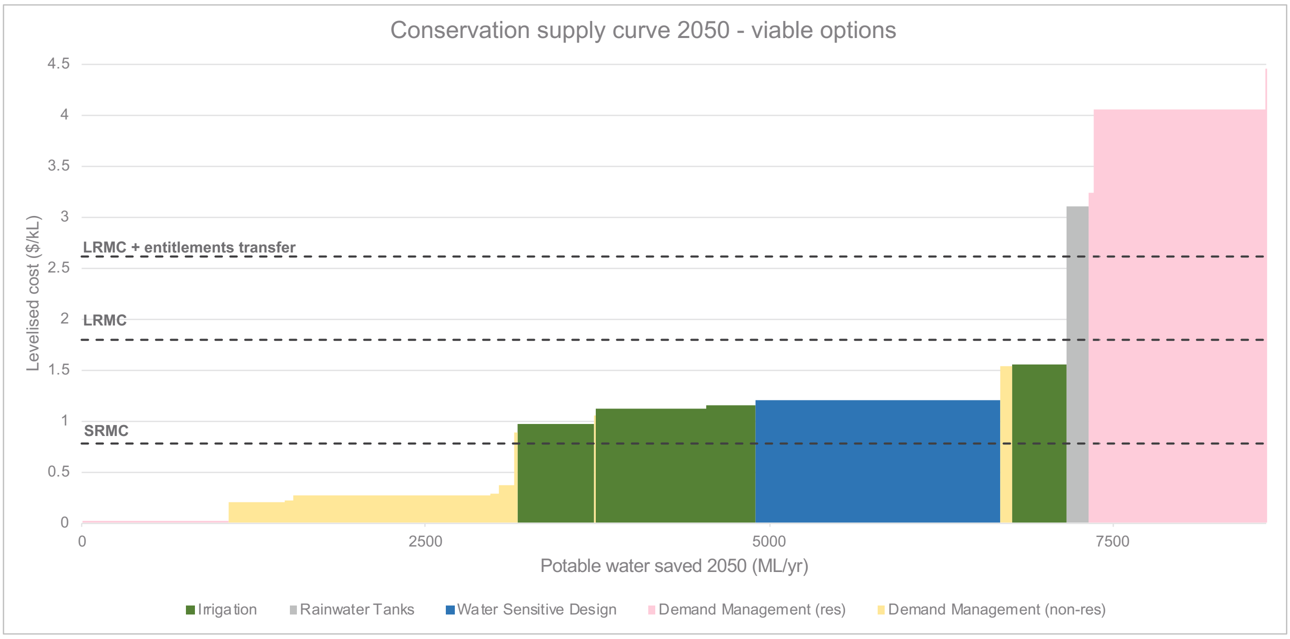

Figure 26: Recommended programs and cumulative water savings

The following conclusions can be drawn from the analysis of this report:

- Total water saved: 6.9 GL/yr in 2030 and 8.6 GL/yr in 2050
- Total additional water left in the environment due to increased water efficiency: 7.2 GL/yr in 2050
- Total costs and benefits - the recommended program has a net benefit of $117 million with metering and $205 million without metering.
- Total GHG saving estimate of 812,000 tonnes from now to 2050, which is the equivalent of taking just under 6,000 cars off the road over the same period.
- Impact of water efficiency program on water security and avoiding new supply augmentation is positive and necessary. Regardless of whether water rights are returned under the MDBWEP, the water efficiency program proposed in this report should be considered viable.
- Program will have significant bill savings for households and business in ACT.

There is further work required to:

- Develop the overall program design, including roles and responsibilities and defining governance issues
- Assess the financial implications of program to various parties. While the program provides an overall net benefit the individual impacts need to be analysed and addressed as necessary
- Maximise the social benefits from the program and create community support for the initiatives.

The key next steps for specific programs are provided in Table 14.

Table 14: Key next steps for recommended programs

Program	Key next steps	
Irrigation efficiency	Confirming the magnitude of water savings based on Icon Water metered data and re-evaluation if necessary Liaising with the owners and users of the parks for upgrade timing, prioritisation and funding mechanisms Considering soil and grass type improvements as part of the irrigation efficiency upgrades Ensure that an education and awareness program is rolled out in conjunction with the irrigation upgrades to ensure the equipment is used and maintained as intended to preserve water savings.	
WSUD Code – fixtures and fittings	Include transition to WELS four-star rated showerheads	
WSUD Code - certification	Engagement with stakeholders such as plumbing inspectors and building certifiers is required specifically to identify the best way to implement considering: • Reducing barriers for the installation of tanks and efficient fixtures • How to avoid issues with certification in other areas • How to assess the compliance of fixtures that do not have a label attached.	
Rainwater tank maintenance and education	A pilot program to: • better understand issues with tanks and costs to repair • explore funding mechanisms	
Residential demand management	Education program	Identify and engage with key stakeholders Undertake preliminary work including market segmentation and market research
	Digital metering	Further detailed consideration with key stakeholders
	Residential retrofit	Develop implementation plan including: • how to target to highest water users • including four-star showerheads • data collection to further target future programs • identifying the preferred delivery mechanism
Non-residential demand management	Fixtures and fittings programs	Consider how to maximise uptake and minimize overhead Include ongoing monitoring and evaluation to identify where additional investment is require to sustain and improve water savings

Program	Key next steps	
	WEMPS	Conduct analysis to determine appropriate thresholds for large users smart metering and WEMPS Link in with the review of permanent water conservation measures
	Best practice guidelines	Review scope of existing best practice and target program on gaps and information dissemination.
	Audits for schools and government buildings	Investigate revolving fund or other financial assistance programs to encourage implementation of audit findings. Review long term maintenance contracts to incentivize water efficiency opportunities
	Schools	Consider how to leverage the Victorian Schools Water Efficiency Program (SWEP)

6.1 - Further studies

ISF also recommends the following programs are considered for their potential to provide further water savings.

Alternative supply options

- Recycled water and aquifer recharge options.
- Optimising rainwater tank design and operation.

Network options

- Pressure management.

Irrigation efficiency options

- Review of soil profiles and drainage in conjunction with the irrigation efficiency program.

Residential demand management options

- Washing machine replacement for customers facing financial hardship.
- Including WELS four-star rated showerhead transition under the WSUD fixtures changes.
- Evaporative cooler maintenance and efficiency programs.

Non-residential demand management options

- Long-term maintenance contract review for government, schools and social housing plumbing contracts to incentivise water efficiency opportunities.
- Requiring and supporting NABERS ratings for certain building types.

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Appendix 1: Risk ratings

The scores for each of the options reviewed from the four feasibility reports are listed in Table 15. Rationale has been provided where appropriate as justification for the given scores.

Table 15: Ease of implementation of options (risk ratings)

ID	Program	Reliability of savings	Reliability of costs	Feasibility of option	Institutional complexity of option	Weighted Score
IRR1	Irrigation upgrades at top 20 parks (by opportunity to save water)	2	1	1	1	1.4
		Savings assume best practice				
IRR2	Irrigation upgrades at second 20 parks (by opportunity to save water)	2	1	1	1	1.4
		Savings assume best practice				
IRR3	Irrigation upgrades at third 20 parks (by opportunity to save water)	2	1	1	1	1.4
		Savings assume best practice				
IRR4	Irrigation at parks 61-109 (by opportunity to save water)	3	2	2	1	1.4
			A large amount of different parks	Difficulty of implementation increased across all parks		
SWH 1	Lake Tuggeranong Stormwater Harvesting Scheme	3	4	3	4	3.4
		Large amount of uncertainty				
SWH 2	INRN expansion - Stormwater harvesting scheme	4	4	4	4	4
		Current scheme isn't effective		Uncertain that water capacity is in aquifer	Uncertainty over approvals, timing and pump rates	

WSU D 1	75% Roof Water Collection	2	2	2	4	2.4
		Well modelled, but tanks are not well maintained	Common technology	Code change required	Code adjustment required	
WSU D 2	Rainwater tanks for small blocks <250m2	2	2	2	4	2.4
		Well modelled, but tanks are not well maintained	Common technology	Harder on smaller blocks + market challenges	New option in code	
WSU D 3	Certification of installation of rainwater tanks	3	1	2	3	2.4
		Well modelled but not done before	Market not developed. Certification and audit process understood for other building issues	Not previously undertaken for tanks, but building compliance done for other aspects	New option in code	
WSU D 4	Ongoing monitoring and repair of rainwater tanks	3	2	3	3	2.8
		Well modelled but not done before	Limited existing market for maintenance of tanks	Untested - pilot in Sydney	New option in code, plus engaging and managing contract	
WSU D 5	Outdoor water efficiency taps<12l/s	2	1	1	3	1.8
		Reliable savings, unsure of growth			Regulatory change	
WSU D 6	Indoor efficient fixtures 4star (not showers)	2	1	1	3	1.8
		Reliable savings, unsure of growth			Regulatory change	
WSU D 7a	Apartment appliances water efficient	2	2	1	3	2
		Uncertain savings for appliances	Costs of appliances are		Regulatory change, issues	

		and slow growth	well understood		around social housing	
DM1	Education program	3	3	1	1	2.2
		Uncertainty in report. Savings Overstated.	Costs understated	Easy to implement		
DM21	Digital metering	2	1	2	3	2
		Relatively uncertain	Certain		High if Icon Water are well-advanced	
DM7	Residential showerhead swap	1	1	1	1	1
		Savings easily estimated and low	four-star showerheads not included and $/kL high	Administratively simple	Administratively simple	
DM14	Residential retrofits	1	1	2	2	1.4
				Getting contracting finalised		
DM18	Public housing retrofit program	1	1	2	2	1.4
			Costs unusually high	Difficult area		
DM4	Non residential smart metering	1	1	2	2	1.4
		50% uncertainty - HARC, low uptake assumption		Implementation easy, uptake more challenging		
DM5	Non residential best practice guidelines	2	4	2	2	2.4
		HARC 20%, Low savings assumed	Costs don’t include customer or BP guideline costs.	Difficulties with delivery for ACT (as opposed to Icon Water)	Better done by another agency	
DM13		1	2	2	3	1.8

	Non residential WEMPS (over XML/yr)	ISF to include as marginal, low assumptions	Low costs but didn't include costs for actioning savings		Regulatory change. Significant politics	
DM20	Voluntary non residential audit program	1	3	1	2	1.6
		.	Costs are low. Unlikely to include customer costs			
DM9	Asian restaurant efficiency	1	1	2	2	1.4
		Restaurants and WS clearly understood. Previously done		Discussion required to implement		
DM10	Smart rinse retrofit	1	1	2	2	1.4
		Restaurants and WS clearly understood. Previously done		Discussion required to implement		
DM11	Government Buildings Audits	2	3	1	3	2.2
			Costs look too low. May not include implementation		Complexity with fed governments involved	
DM16	Commercial laundry washing machine rebate	1	1	2	2	1.4
		Restaurants and WS clearly understood. Previously done		Discussion required to implement		
DM17	Schools audit program	1	1	1	2	1.2
		50% uptake assumed			Easier for ACT to achieve	

Minimal impact was observed from shifting these weightings. However, for completeness, the following alternative weighting scenarios were investigation to further understand the impact of prioritising different considerations.

- 100% savings weighting scenario
- 100% cost weighting scenario
- 50% feasibility and 50% institutional complexity scenario

Impact of the savings uncertainty

The spread of water savings and levelised cost when reliability of savings was weighted at 100% is shown in Figure 27 below.

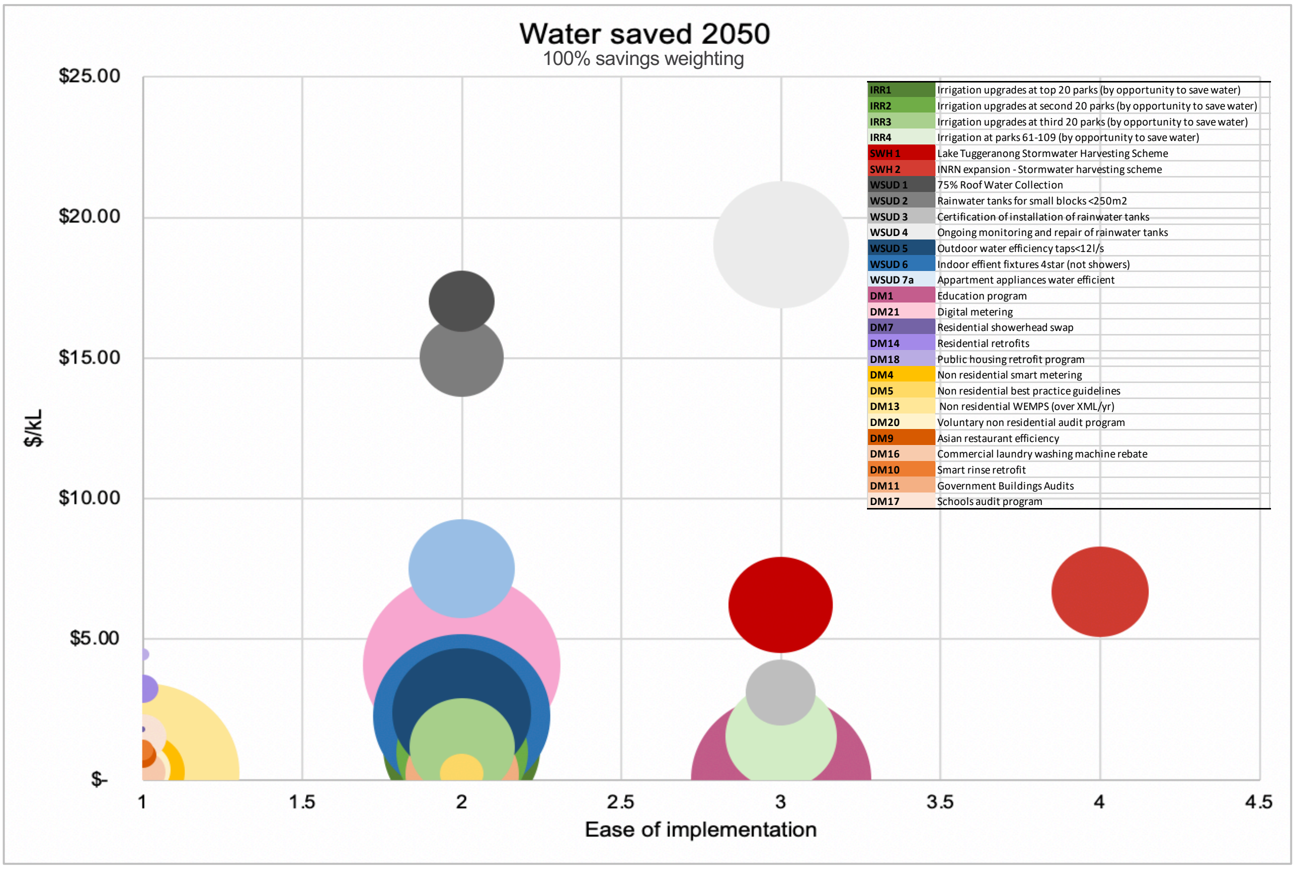

Figure 27: Water Saved 2050 - 100% savings weighting scenario

Impact of the cost uncertainty

The spread of water savings and levelised cost when reliability of costs was weighted at 100% is shown in Figure 28 below.

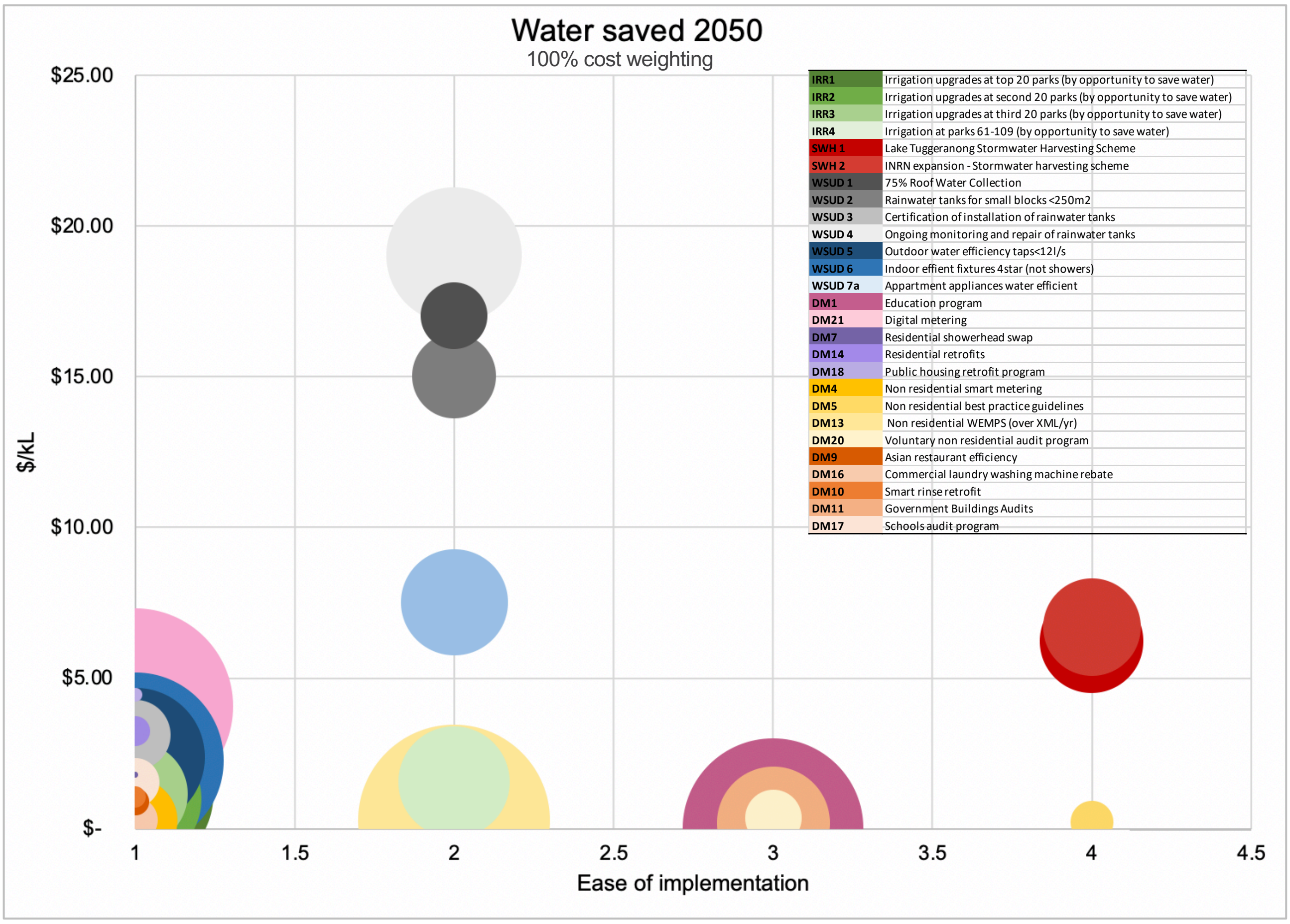

Figure 28: Water Saved 2050 - 100% cost weighting scenario

Impact of the feasibility and institutional complexity uncertainty

The spread of water savings and levelised cost when feasibility and institutional complexity were both weighted at 50% is shown in Figure 29 below.

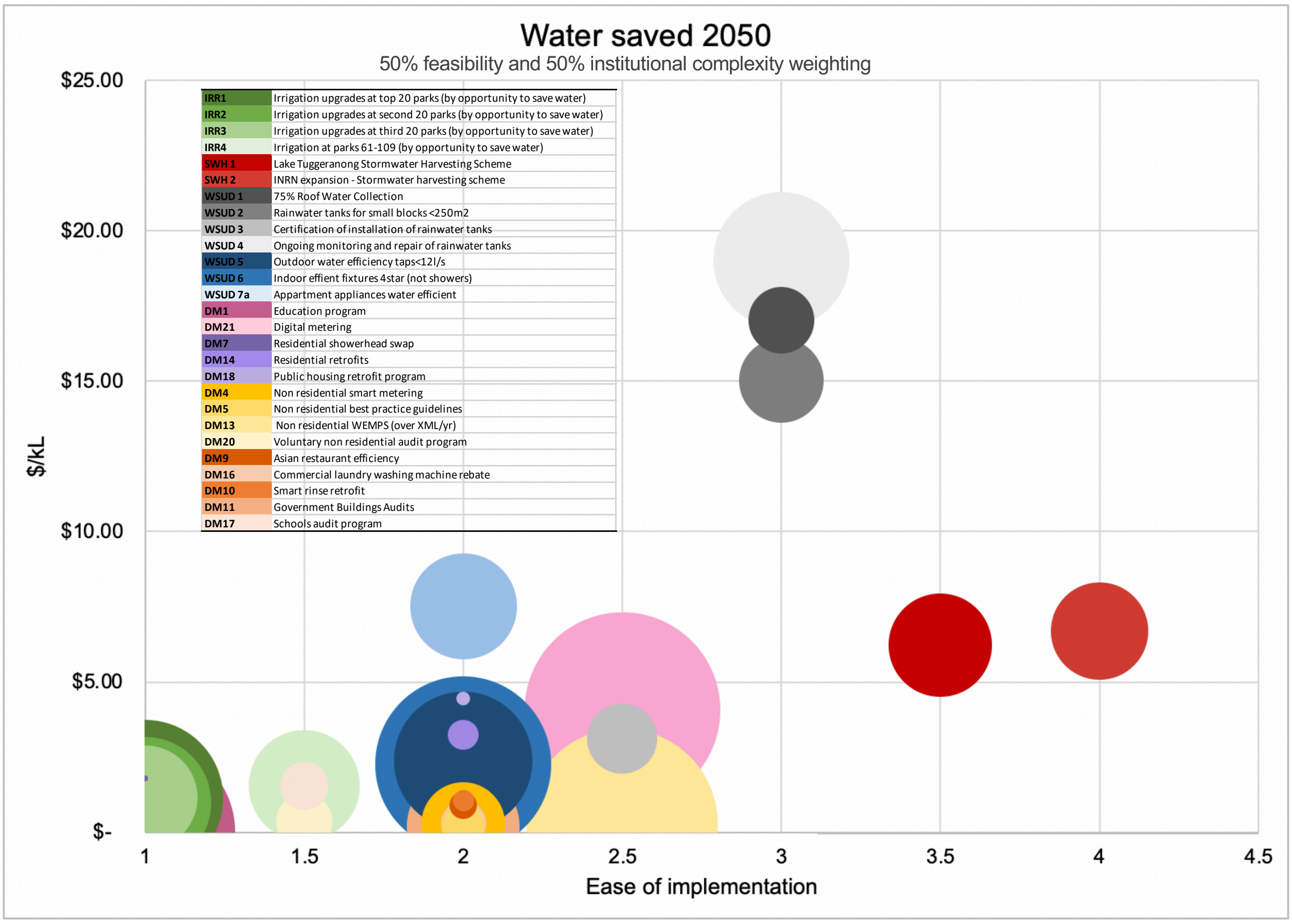

Figure 29: Water Saved 2050 - 50% feasibility and 50% institutional complexity weighting scenario