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ALICE SPRINGS WATER EFFICIENCY STUDY STAGE III

Implementation – Feasibility Study May 2007

Institute for Sustainable Futures

UNIVERSITY OF TECHNOLOGY SYDNEY

ALICE SPRINGS WATER EFFICIENCY STUDY STAGE III

Implementation Feasibility Study

Final Report

For NT Government

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Institute for Sustainable Futures

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EXECUTIVE SUMMARY

This Study aims to build on the Stage I and II work carried out by the Institute for Sustainable Futures and KBR in 2003 in which a detailed projection for water demand was developed together with a suite of potential water efficiency options. The overarching aim of the initial work was to determine how much water will be needed in the future, determine how to reduce the rate of depletion of the groundwater resources in Alice Springs through water efficiency, reduce effluent overflow to Ilparpa Swamp and the need for water services infrastructure augmentation.

Stage III expands the work carried out by broadening the suite of options developed and assessed from water efficiency to other options including source substitution (use of rainwater tanks and greywater systems) and the expanded use of the non potable Town Basin water supply and reuse. As part of the assessment review of the whole of society costs and quantifiable benefits have been considered, provisional assessment of ‘who pays’ and cash flow, assessment of the potential distribution of costs and benefits to the community and financial implications to the utility together with associated potential price modifications. In addition a broad level implementation work plan has been developed identifying the key elements of work required for a Water Efficiency Program in Alice Springs. The ultimate aim of these investigations is to inform the Alice Springs Urban Water Management Strategy Reference Group and NT Government decision makers on a range of possible Water Efficiency Programs (Scenarios) that could be considered for implementation.

The Stage III analysis demonstrates that a comprehensive cost effective Water Efficiency Program (WEP) can and should be implemented in Alice Springs. When broader societal benefits are considered the analysis shows that nearly all the 31 options developed could be implemented providing the community of Alice Springs with significant net benefits including extending the life of the current water resources and deferring the need to develop a new source. With the current strong community support for a WEP, implementation should commence soon to build on this enthusiasm.

Four Scenarios have been developed from the 31 options considered. These Scenarios have total whole of society costs (including Government, utility and customers) ranging from $1.86 M (average unit cost of $0.26 /kL and potable water savings of 831 ML/a by 2030) to $12.9 M (average unit cost of $0.67 /kL and potable water savings of 2,935 ML/a by 2030). The options, Scenarios, modelling tool used to conduct the analysis and the internationally recognised best practice assessment framework used (Integrated Resource Planning) aim to give the NT Government the building blocks and tools to provide a more complete picture and aid decision making. It is ultimately up to the NT Government to choose which combination of the 31 options (and extension of these) to take forward for implementation.

From the analysis it is recommended that a suite of options similar to Scenario 3 (total present value cost of $5.05 M, average unit cost of $0.30 /kL and potential savings of 2,370 ML/a by 2030) are taken forward for further consideration and implementation. This is due to the relatively low cost and significant benefits that can be attained by society as a whole ($4.34 M for avoided costs of reduced water and sewage supply and management, $0.94 M for reduction in greenhouse gases and $2.44 M for reduction in customer energy bills). This Scenario includes a number of options that are important in terms of equity and constitutes a Scenario where the overall benefits significantly outweigh the costs.

To maximise uptake of these program elements a large proportion of the costs required will be borne by the NT Government and the utility (PW). This will require some form of direct investment, a CSO payment or a pass though in the water price. The current analysis is based on a conservatively low estimate of the marginal cost of water. On this basis, to ensure PW remains revenue neutral a small price pass through will be necessary which can either be shared amongst all PW NT customers (2¢ /kL for a single price change with the recommended scenario) or if pricing policy in the NT is modified, isolated to Alice Springs customers (6.5¢ /kL).

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ASUWMS	Alice Springs Urban Water Management Strategy
AWA	Australian Water Association
AZRI	Arid Zone Research Centre
C/I	Commercial/industrial
CSAT	Centre for Sustainable Arid Towns
CO2-e	carbon dioxide equivalent
DAF	Dissolved Air Flotation
DCP	Development Control Plans
DPC	Desert Peoples Centre
DIPE	Department of Infrastructure, Planning and Environment
DPWS	Department of Public Works and Services
EUM/OM	End use model/options model
GHG	greenhouse gas
hh	households
ISDPP	Integrated supply demand planning model
IRP	Integrated resource planning
ISF	Institute for Sustainable Futures
KBR	Kellogg Brown & Root
kL/hh/a	Kilolitres per household per annum
kL/hr	Kilolitres per hour
km	kilometers
kWh/ML	Kilowatt hours per megalitre
L/con/day	Litres per connection per day
LCP	Least cost planning
m	meter
M	millions
MC	Marginal cost

ML/a	Megalitres per annum
MR	multi residential
MWEPS	Minimum water efficiency performance standards
MWh	Megawatt hours
NRETA	Department of Natural Resources, Environment and the Arts
NRW	non revenue water
NT	Northern Territory
PH	Public housing
PV	Present value
PW	Power and Water Corporation
SKM	Sinclair Knight Mertz
SR	Single residential
SWC	Sydney Water Corporation
t	tonne
TRC	Total resource cost
UARL	Unavoidable annual real losses
UFW	Unaccounted for water
WA	Western Australia
WEP	Water Efficiency Program
WES	Water Efficiency Study
WSAA	Water Services Association of Australia
WSP	Water Stabilisation Ponds
WWTP	Wastewater Treatment Plant

SUMMARY

Background

In July 2002 the NT Government commissioned the Institute for Sustainable Futures (ISF) and Kellogg Brown & Root Pty Ltd (KBR) to carry out the '*Alice Springs Water Efficiency Study - Stages I & II*' (Turner et al, 2003), as part of the Alice Springs Urban Water Management Strategy (ASUWMS). Stages I & II involved development of a water demand forecasting model and options model (EUM/OM) and design of a suite of water efficiency options to assist in achieving specified targets for reduction of average and peak water demand and wastewater production.

After completion of Stages I & II, it became apparent that a number of issues needed to be addressed before the NT Government could consider moving to Stage III of the project – full planning and implementation of the Water Efficiency Program (WEP). Hence, in May 2005 ISF was commissioned by the Department of Natural Resources, Environment and the Arts (NRETA) and Power and Water Corporation (PW), to undertake a Feasibility Study into implementation of the WEP '*Stage III – Implementation of the Alice Springs Water Efficiency Program – Feasibility Study*' – WES Stage III - to form the foundation of the rest of Stage III and provide confidence in proceeding with investment in an appropriate Alice Springs WEP.

This Study, the WES Stage III Feasibility Study, has primarily focussed on:

- Review of the water efficiency options developed in 2002/03 in light of independent investigations carried out in Alice Springs over the last two years and expansion of options to include source substitution such as rainwater tanks, reuse and use of the Town Basin.
- Development of a broad level implementation work plan that identifies key elements of the work required for a WEP in Alice Springs such as pilot studies, working with trade allies, setting up a program team and recommends key roles and responsibilities of various stakeholders.
- Review and analysis of the whole of society costs and benefits of the options, consideration of 'who pays', analysis of avoided costs, development of cash flow for various stakeholders and comparison of the WEP with the 'reference case' scenario. In addition investigations have focused on both the economic benefits to the community of Alice Springs and the financial implications to the utility.

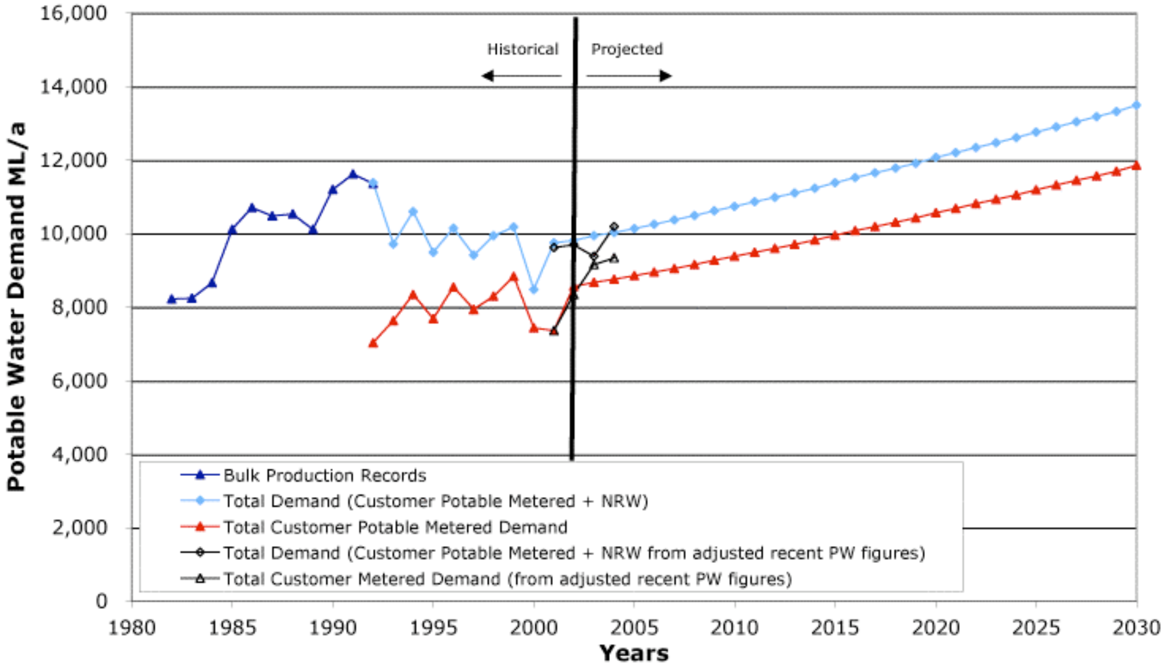
The ultimate aim of these investigations is to inform the ASUWMS Reference Group and NT Government of a range of possible WEPs (Scenarios) that can be considered for implementation. In addition the investigations aim to enable the NT Government to determine how they might implement the preferred WEP including consideration of a price pass through that ensures revenue neutrality for the water utility (PW) and sharing of benefits across the community.

Findings

Demand

As part of the investigations the demand forecasting model (end use model - EUM) has been reviewed and extended to 2030 to enable a 25 year period of analysis. Figure 1 shows the revised reference case demand. The Stage III analysis identifies that under a reference case scenario (do nothing approach) water demand could reach approximately 13,500 ML/a by 2030.

Figure 1 - Revised Demand Forecast (Reference Case Demand)



Note – The historical bulk production figures (dark blue) and total demand (light blue) both represent total potable water production but were taken from two different data sets during WES Stages I & II.

This will affect both:

- the length of time that the current resource will be able to supply Alice Springs before a new borefield is required (currently being investigated by NRETA as part of the Alice Springs Water Resources Strategy); and
- the capital expenditure required for replacing and deepening bores and the ongoing operating costs (as annually investigated by PW).

The reference case demand determined as part of the WES Stage III analysis differs from that identified by PW according to the most recent Asset Management Plans and subsequent discussions with PW staff. While the WES Stage III analysis indicates average water demand is forecast to rise to 13,500 ML/a under the reference case demand, PW anticipate reference case demand will be maintained at approximately 10,000 ML/a until at least 2020. This has consequences for both the time period the resource will last and in terms of capital and operating expenditure requirements for PW. Under the PW reference case the anticipated expenditure will be PV$ 26 M. However, under the revised projections from WES Stage III the expenditure requirement is likely to be closer to PV$ 29 M. The difference being due to the additional capital costs required to deepen the bores and operating costs required to provide the larger volume of water each year compared to that currently projected by PW.

Options

As part of the Stage III analysis a total of 31 water efficiency and source substitution options have been developed for analysis. Many of these have been based on those developed as part of WES Stages I & II. For the purpose of assessing the cost effectiveness of options, the costs and benefits have been assessed from the combined perspective of the utility, government and customers, that is, including costs to all stakeholders. This is called the total resource cost, and the approach used is consistent with internationally recognised best practice. This economic analysis method has been used to initially rank the options according to their unit cost. The unit costs of the options developed range from as low as $0.06 /kL for minimum water efficiency performance standards (MWEPS) to $22 /kL for a rainwater tank rebate program for single residential households.

Table 1 provides details of the costs of the options categorised by type, and also shows the potential yield (water saved) in 2010, 2020 and 2030. If all the options were implemented, a saving of approximately 3,000 ML/a could potentially be achieved by 2030, as illustrated in Figure 2. Under the mix of options and participation rates considered, average demand could potentially be maintained at the current level until approximately 2024, that is, growth in demand would be offset by the implementation of these options.

Figure 2 – Potential Savings

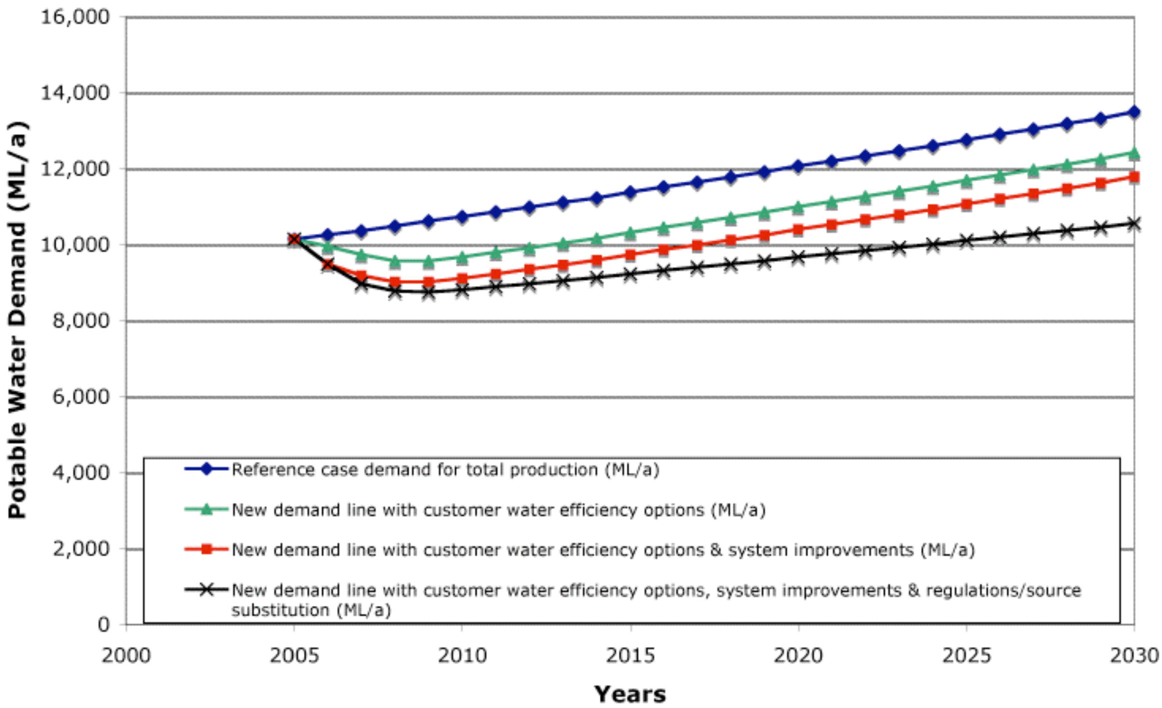


Table 1 – Summary of Options

Options	No. of Participants	Total PV Cost of Options (PV$)	Unit Cost (PV$/ PVkL)	Yield 2010 (ML/a)	Yield 2020 (ML/a)	Yield 2030 (ML/a)
Customer Water Efficiency Options						
Indoor (SR) retrofit program	1,851	278,684	0.59	53	53	53
Indoor (MR) retrofit program	713	134,789	1.27	12	12	12
Indoor (SR) toilet retrofit program	370	102,790	1.08	11	11	11
Indoor (MR) toilet retrofit program	143	40,510	1.83	2	2	2
Washing machine rebate program	768	142,033	1.12	16	16	16
Public housing indoor retrofit program	833	133,108	0.78	18	18	18
Public housing toilet retrofit program	167	47,241	1.34	4	4	4
Outdoor garden (SR general) program*	1,296	501,050	0.51	121	121	121
Garden outdoor (high user targeted) program*	185	129,980	0.21	65	65	65
Pool cover rebate program	334	227,497	1.04	27	27	27
Cooling Alice residential program	3,111	489,408	1.78	34	34	34
Cooling Alice public housing program	833	135,558	1.76	9	9	9
Pine Gap (SR) program	230	230,661	0.31	76	76	76
Town Camps program	9	133,514	0.66	24	24	24
General C/I water efficiency program	222	240,783	0.62	53	53	53
High Users C/I water efficiency program	32	454,326	0.47	113	113	113
Hotel program	14	305,514	0.34	107	107	107
Institutional retrofit program	97	522,105	0.46	140	140	140
Hospital program	1	141,472	0.11	130	130	130
Schools program	9	230,696	0.50	50	50	50
Sub Total $		**4,621,720**				
Sub Total Savings (ML/a)				**1,066**	**1,066**	**1,066**
System Options						
Leakage reduction program	1	779,404	0.19	397	439	481
Pressure management program	1	451,489	0.30	163	163	163
Sub Total $		**1,230,893**				
Sub Total Savings (ML/a)				**561**	**602**	**644**
Regulations & Source Substitution Options						
MWEPS	13,827	43,978	0.06	12	147	332
Residential DCP	1,307	161,971	0.30	23	104	195
Non-Residential DCP	162	103,781	0.36	10	58	108
New Smart growth	1,207	1,241,031	1.51	15	171	344
Rainwater tank rebate (existing SR) program	601	2,512,430	21.54	14	14	14
Greywater rebate (existing SR) program	601	2,308,231	7.91	36	36	36
Town Basin (existing)	33	124,238	0.54	26	26	26
Town Basin (extend)	5	461,691	0.93	56	56	56
Reuse	4	88,060	0.09	114	114	114
Sub Total $		**7,045,411**				
Sub Total Savings (ML/a)				**305**	**727**	**1,225**
Totals		**12,898,023**		**1,931**	**2,394**	**2,935**

Note – Abbreviations – present value (PV), single residential (SR), multi residential (MR), commercial/ industrial (C/I), development control plans (DCP)

*The outdoor garden (SR general) program and garden outdoor (high user targeted) program are linked (i.e. the targeted program assumes that the general program would be run in parallel because some of the training and advertising etc. costs that would be needed by the targeted program are included in the general program). All other options are mutually exclusive and therefore can be considered separately.

Figure 3 shows the options ranked according to their PV unit costs and assists in illustrating their contribution to savings in 2030. The two highest unit cost options (greywater rebates with unit cost $7.91 /kL and rainwater tank rebates with unit cost $21.54 /kL) have been omitted from the diagram to enable the detail of the lower unit cost options to be compared.

Figure 3 also shows an estimate of the minimum level of the marginal cost of water in Alice Springs ($0.29 /kL). A number of options, including MWEPS, reuse, the hospital program, leakage reduction and the garden outdoor (targeted) program[1] all have unit costs of less than the marginal cost of water. These five options alone could potentially provide a saving of over 1,100 ML/a by 2030.

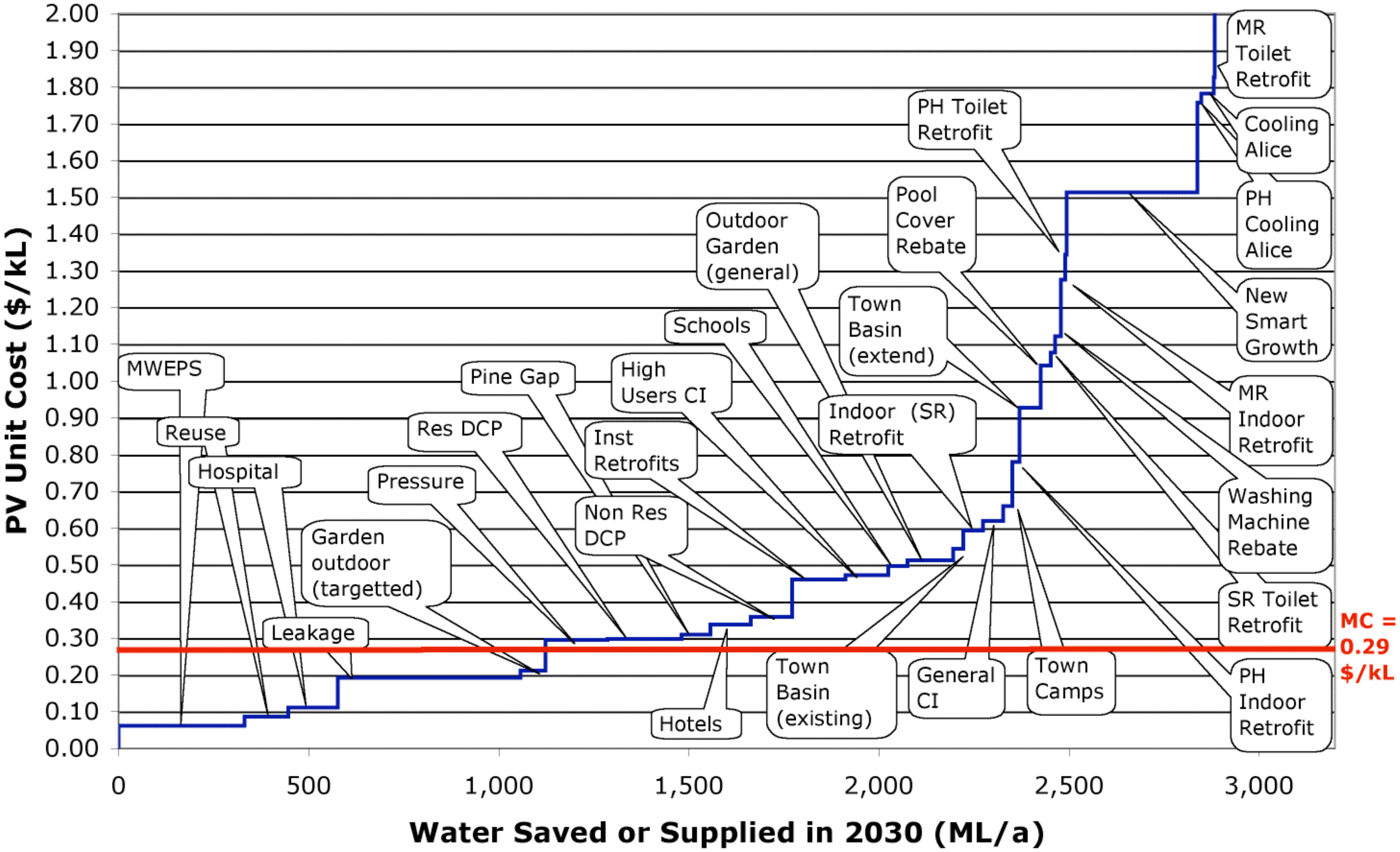
During the investigations undertaken for WES Stage III, PW were unable to provide details of the marginal cost of water in Alice Springs. Hence the Study Team, with assistance from PW, has determined the estimate of $0.29 /kL. This marginal cost is low compared to other urban centres around Australia, reflecting the absence of an imminent need for major new infrastructure in Alice Springs. Details of how the marginal cost has been calculated are provided in Section 4.3 of this Report. A summary of the components, which have been able to be included is provided in Table 2.

Table 2 – Estimates of the Marginal Cost of Water for Alice Springs

Cost	Estimated value (PV $/ML)	Notes
Marginal operating cost	196	Levelised unit cost using WES Stage III projection
Marginal capacity cost	53	
Carbon shadow price	28	
Sewage costs	10.5	Assumes approximately one third of total unit cost of sewage for each ML of water used.
Total MC	**287.5**	

[1] Note, the outdoor (high user targeted) program and outdoor garden (SR general) program are linked (i.e. the targeted program assumes that the general program would be run in parallel because some of the training and advertising etc. costs that would be needed by the targeted program are included in the general program). Hence to obtain the savings indicated for the targeted program general program would need to be run in parallel. All other options are mutually exclusive and therefore can be considered separately.

Figure 3 - Unit Costs and Water Saved or Supplied in 2030



Scenarios

To assist in identifying which options to take forward, four Scenarios have been developed. These Scenarios have been developed by taking into consideration the net costs and benefits of each option. Table 3 shows the PV$ value of the costs and benefits for each of the ranked options. Three sets of benefits have been considered in the analysis. These include: the avoided costs of reduced water and wastewater supply (columns A & B); the estimated value of greenhouse gas emissions (GHG) reduction associated with reducing energy in both water supply and hot water usage for customers (columns C & D); and customer energy bill savings associated with reducing hot water usage (column E). An additional column (column F) shows the PV$ value of reduced potable water bills to customers based on the current price of water (677 $/ML). This is not included in the analysis on costs and benefits discussed below as it is merely a transfer payment between the utility and customers. This transfer payment is assessed later as part of the revenue implications to the utility in the narrower financial analysis considered.

Table 3 shows the costs and benefits of the full suite of options, which have been ranked by unit cost. This Table assists in illustrating that although the total costs (from the combined perspective of the utility, government and customers) of all the options developed is $12.9 M, if the benefits are considered in the analysis (columns A to E equating to $8.9 M) the option costs from the combined perspective of all stakeholders is reduced to $4.0 M.

Hence in terms of choosing the most appropriate WEP for Alice Springs both the total costs and benefits must be considered to ensure the total benefits to the community actually outweigh the total costs of the WEP. Each of the Scenarios have been chosen as the point at which the cumulative PV$ value of the benefits still outweigh the cumulative PV$ value of the total costs of the ranked options.

Table 3 – Ranked Options Costs and Benefits

Options	Option Total Cost PV$	Unit Cost PV$/ PVkL	Yield 2010 (ML)	Yield 2020 (ML)	Yield 2030 (ML)	Rank No.	(A) Water Saving Benefits (Utility) PV$	(B) Sewage Saving Benefits (Utility) PV$	(C) GHG Saving Benefits (Utility) PV$	(D) GHG Saving Benefits (Customer) PV$	(E) Energy Saving Benefits (Customer) PV$	(F) Water Saving Benefits in Reduced Bills (Customer) PV$	In Scenario
MWEPS	43,978	0.06	12.18	147.05	331.86	1	189,575	24,888	24,029	73,009	398,209	481,406	2,3,4
Reuse	88,060	0.09	114.21	114.21	114.21	2	253,673	-	28,716	-	-	688,548	2,3,4
Hospital Program	141,472	0.11	130.48	130.48	130.48	3	317,212	29,156	40,815	85,530	466,503	867,644	2,3,4
Leakage program	779,404	0.19	397.29	438.52	480.86	4	1,008,726	-	114,585	-	-	-	1,2,3,4
Garden outdoor (high user targetted) progra	129,980	0.21	65.46	65.46	65.46	5	152,273	-	17,307	-	-	414,981	1,2,3,4
Pressure Reduction	451,489	0.30	163.37	163.37	163.37	6	380,018	-	43,192	-	-	-	1,2,3,4
Residential DCP	161,971	0.30	22.54	104.37	194.90	7	142,943	3,414	15,890	12,519	68,280	368,012	2,3,4
Pine Gap (SR) program	230,661	0.31	75.93	75.93	75.93	8	184,602	7,831	22,302	28,716	156,625	504,929	2,3,4
Hotel program	305,514	0.34	106.66	106.66	106.66	9	226,526	18,183	28,437	66,673	363,653	612,637	2,3,4
Non-Residential DCP	103,781	0.36	9.51	58.05	107.88	10	76,472	3,041	8,661	4,461	24,330	196,088	2,3,4
Institutional retrofit	522,105	0.46	140.48	140.48	140.48	11	285,367	19,880	35,232	58,319	318,085	769,084	2,3,4
High Users C/I water efficiency program	454,326	0.47	113.43	113.43	113.43	12	240,907	10,105	28,777	14,821	80,840	651,531	2,3,4
Schools Program	230,696	0.50	49.63	49.63	49.63	13	115,440	6,763	14,194	9,919	54,101	314,601	2,3,4
Outdoor Garden (SR general) program	501,050	0.51	121.14	121.14	121.14	14	246,082	-	27,660	-	-	663,208	1,2,3,4
Town Basin (existing)	124,238	0.54	25.65	25.65	25.65	15	56,963	-	6,448	-	-	154,614	3,4
Indoor (SR) retrofit program	278,684	0.59	52.57	52.57	52.57	16	117,044	16,433	15,865	60,256	328,653	317,855	3,4
General C/I water efficiency program	240,783	0.62	53.17	53.17	53.17	17	98,409	4,083	11,626	5,988	32,660	263,225	3,4
Town Camps Program	133,514	0.66	23.83	23.83	23.83	18	50,618	3,539	6,271	5,190	28,309	136,895	3,4
Public housing indoor retrofit	133,108	0.78	18.23	18.23	18.23	19	42,413	5,976	5,769	21,912	119,512	115,585	3,4
Town Basin (extend)	461,691	0.93	56.00	56.00	56.00	20	124,382	-	14,080	-	-	337,612	4
Pool cover rebate	227,497	1.04	27.01	27.01	27.01	21	54,864	-	6,167	-	-	147,864	4
Indoor (SR) toilet retrofit program	102,790	1.08	10.70	10.70	10.70	22	23,819	3,344	3,229	-	-	64,684	4
Washing Machine Rebate	142,033	1.12	15.67	15.67	15.67	23	31,839	4,436	4,283	13,013	70,979	85,808	4
Indoor (MR) retrofit program	134,789	1.27	11.84	11.84	11.84	24	26,357	3,700	3,573	13,569	74,008	71,576	4
Public housing toilet retrofit	47,241	1.34	3.76	3.76	3.76	25	8,742	1,232	1,189	-	-	23,825	4
New Smart growth	1,241,031	1.51	14.60	171.05	344.12	26	218,085	7,179	24,304	26,323	143,572	555,419	4
Cooling Alice Public Housing program	135,558	1.76	9.09	9.09	9.09	27	19,311	-	2,178	-	-	52,228	4
Cooling Alice residential program	489,408	1.78	33.96	33.96	33.96	28	68,993	-	7,755	-	-	185,940	4
Indoor (MR) toilet retrofit program	40,510	1.83	2.48	2.48	2.48	29	5,529	776	750	-	-	15,016	4
Greywater rebate (existing SR)	2,308,231	7.91	36.07	36.07	36.07	30	73,264	13,781	10,423	-	-	197,453	
Rainwater tank rebate (existing SR)	2,512,430	21.54	14.43	14.43	14.43	31	29,306	-	3,294	-	-	78,981	
Totals	**12,898,023**						**4,869,754**	**187,739**	**577,002**	**500,218**	**2,728,319**	**9,337,247**	

The four Scenarios considered are:

- **Scenario 1 -** A program that includes leakage reduction, pressure management and an outdoor garden program both general and targeted. The outdoor garden options have been included at the request of PW/NRETA as part of the Scope of Works for this Study. The Study Team have also included the leakage reduction and pressure management options as these will not have an impact on PW revenue and have relatively low unit costs.

  This Scenario would have a total cost of $1.86 M, average unit cost of $0.26 /kL and save approximately 831 ML/a by 2030. Total benefits include $1.79 M for avoided costs of reduced water and sewage supply and $0.20 M for reduction in GHG[2].

- **Scenario 2** – A program that includes the above options and all those options up to and including those that have a unit cost of $0.50 /kL. This selection has been chosen to include avoided costs of reduced water and sewage supply. The Outdoor Garden (general) program ($0.51 /kL) has been added to this suite of options as it is required for the Outdoor Garden (targeted) option.

  This Scenario would have a total cost of $4.14 M, average unit cost of $0.27 /kL and save approximately 2,196 ML/a by 2030. Total benefits include $3.94 M for avoided costs of reduced water and sewage supply, $0.80 M for reduction in GHG and $1.93 M for reduction in customer energy bills.

- **Scenario 3** – A program that includes all options up to and including those that have a unit cost of $0.78 /kL. This selection has been chosen to include avoided costs (as in Scenario 2) plus the GHG benefits. This Scenario includes a number of options that are important to consider from an equity point of view (i.e. General C/I, Town Camps and Public Housing indoor).

  This Scenario would have a total cost of $5.05 M, an average unit cost of $0.30 /kL and save approximately 2,370 ML/a by 2030. Total benefits include $4.34 M for avoided costs of reduced water and sewage supply, $0.94 M for reduction in GHG and $2.44 M for reduction in customer energy bills.

- **Scenario 4** – A final Scenario has been considered that includes all the options up to and including those that have a unit cost of $1.83 /kL. This selection has been chosen to include avoided costs and GHG benefits (as in Scenario 3) plus the customer energy bill savings. The higher unit costs of greywater and rainwater tank rebates options have also been added to this Scenario to test (in terms of lost revenue to the utility) the implications of adding higher unit cost options.

  This Scenario would have a total cost of $12.90 M, an average unit cost of $0.67 /kL and save approximately 2,935 ML/a by 2030. Total benefits include $5.06 M for avoided costs of reduced water and sewage supply, $1.08 M for reduction in GHG and $2.73 M for reduction in customer energy bills.

All the Scenarios, except for Scenario 4, are cost effective when considering the total costs and benefits to the community.

The savings associated with each of these Scenarios are shown in Figures 4 to 7.

[2] If the general and targeted outdoor programs are separated from the leakage and pressure management programs in Scenario 1 the total cost of the two outdoor programs would be $0.63 M. They would have an average unit cost of $0.40 /kL and save 187 ML/a by 2030. Total benefits would include $0.40 M for avoided costs of reduced water and sewage supply and $0.04 M for reduction in GHG.

Figure 4 – Savings associated with Scenario 1

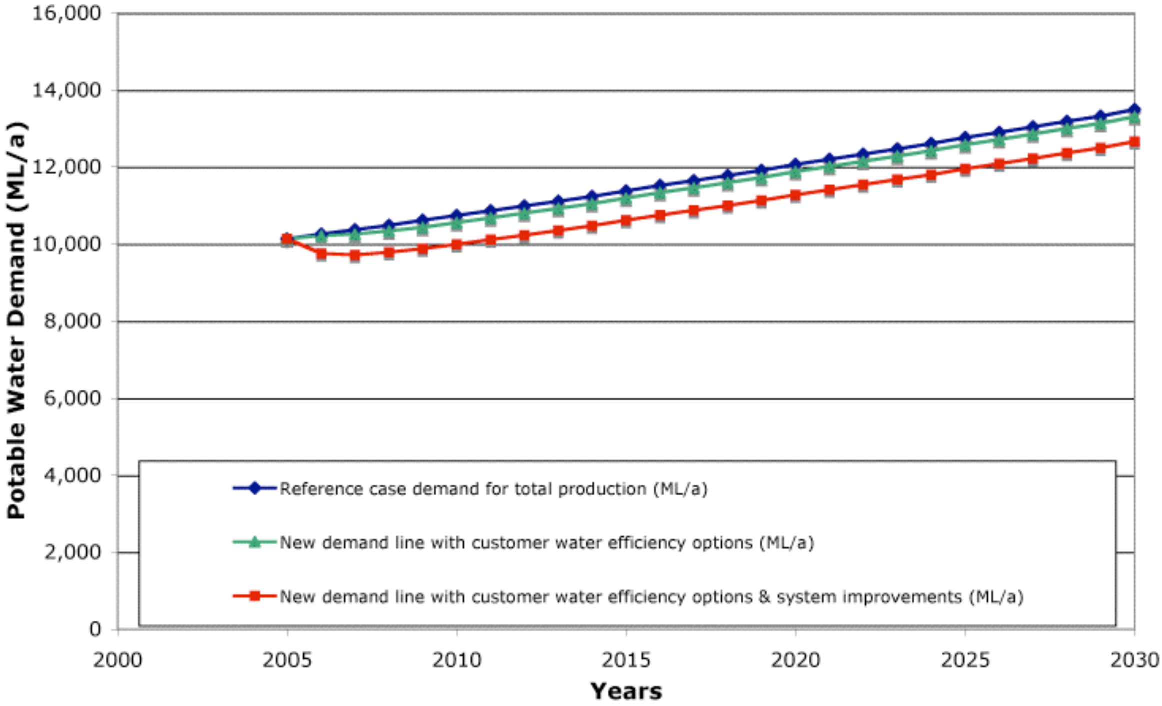


Figure 5 – Savings associated with Scenario 2

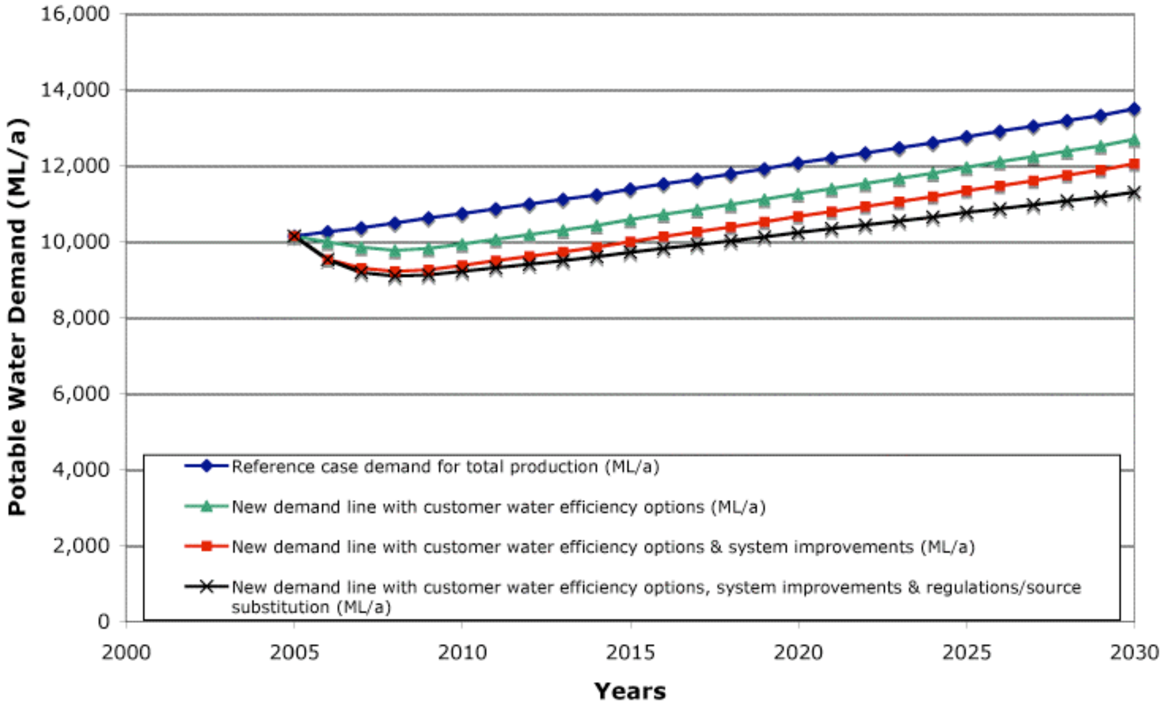


Figure 6 – Savings associated with Scenario 3

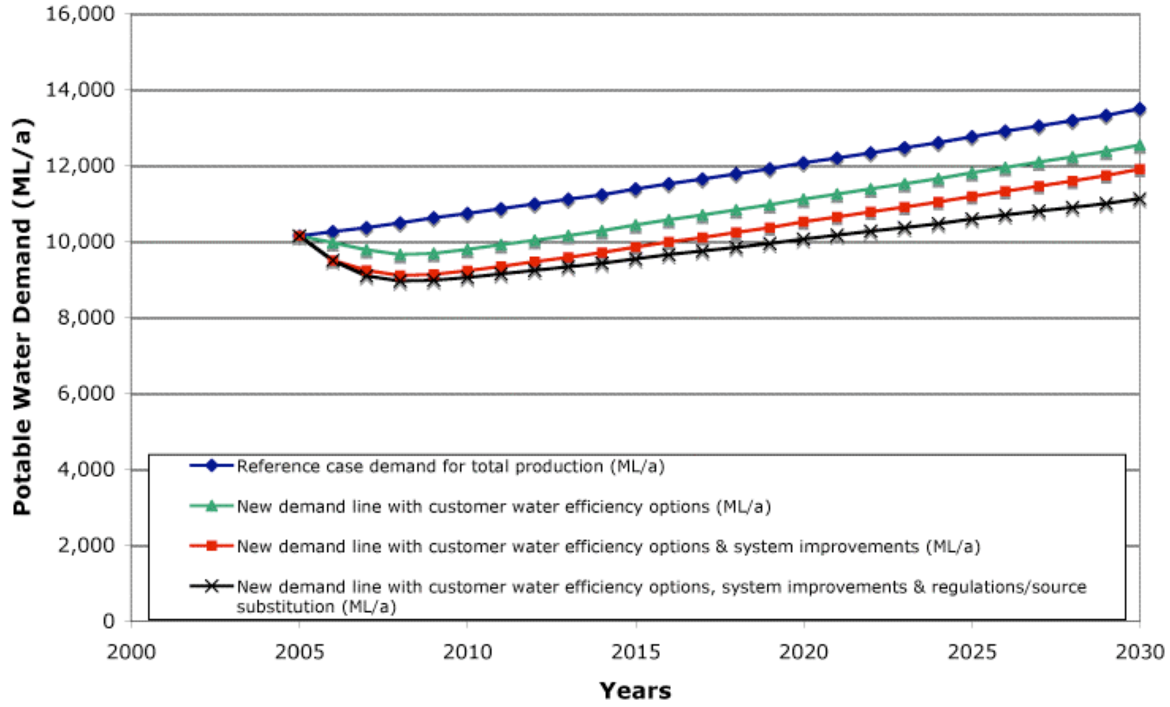
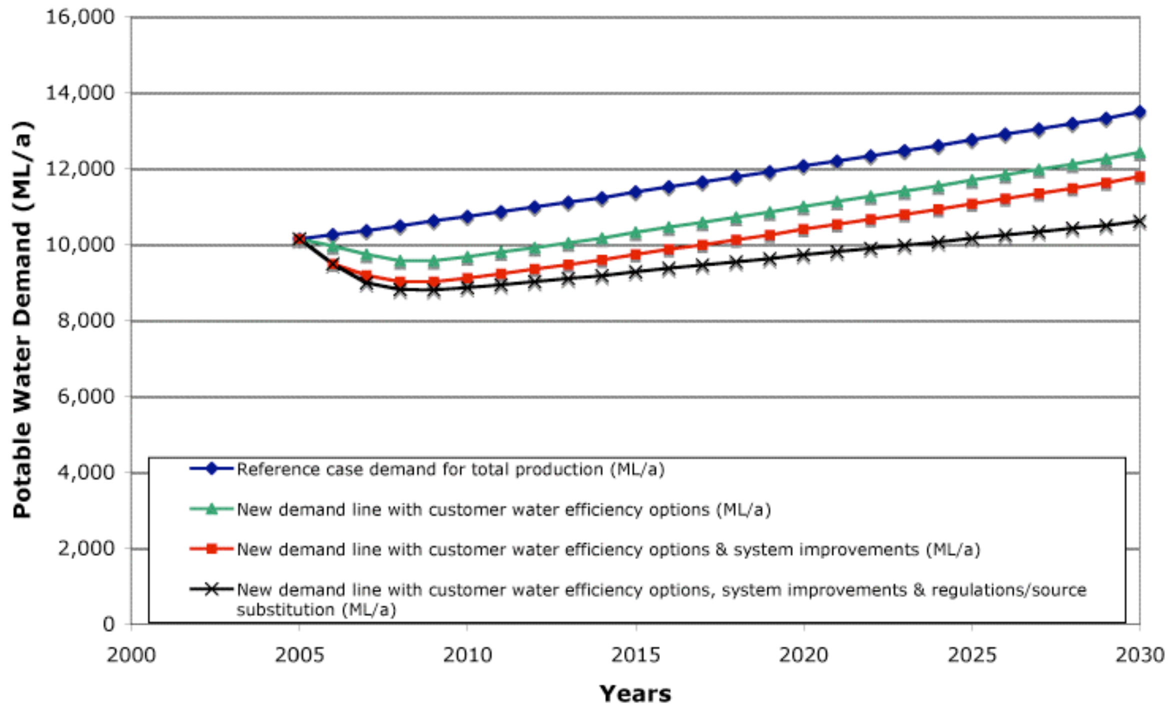


Figure 7 – Savings associated with Scenario 4



Revenue Implications of the WEP and Potential Price Pass Through

To assist in determining the revenue implications for PW of the four Scenarios a preliminary assessment of 'who pays' has been considered. This has been split into PW, NRETA, other (i.e. other government agencies) and customers. Table 4 shows the preliminary split for each stakeholder group for each of the Scenarios.

Table 4 – Preliminary Assessment of 'Who Pays' for each Stakeholder Group

Stakeholder	Scenario 1 PV$ M	Scenario 2 PV$ M	Scenario 3 PV$ M	Scenario 4 PV$ M
NRETA	0.11	0.64	0.84	1.26
PW	1.72	2.35	2.77	4.90
Other*		0.92	1.14	1.30
Customer	0.03	0.23	0.30	5.44
Total	**1.86**	**4.14**	**5.05**	**12.90**

* - 'Other' are generally other Government (often institutional organisations) such as public housing, Town Camps, general institutional customers, the hospital, schools and Pine Gap that are likely to be funded by Government to maintain their properties.

Having estimated the contribution by PW for each of the WEP Scenarios, the PW cash flow and potential price change needed for revenue neutrality over a 25 year period has been assessed, taking into account the foregone revenue from PW's perspective. The foregone revenue is a result of the difference between the marginal cost (approximately 30¢/kL) and the marginal price (approximately 67¢/kL) in Alice Springs. Table 5 shows the net cash flow and the price pass-through that would be required for each of the four Scenarios, based on the assumption that the revenue shortfall would be met by a price increase for the Alice Springs customers alone. This would require differential pricing, which is not the current policy of the NT government

Table 5 - Net Cash Flow and Price Pass Through

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
Year	Cash flow for utility ($ M)	Price pass through ($/kL)	Cash Flow for utility ($ M)	Price pass through ($/kL)	Cash Flow for utility ($ M)	Price pass through ($/kL)	Cash Flow for utility ($ M)	Price pass through ($/kL)
2006	-0.25	-0.03	-0.36	-0.04	-0.44	-0.05	-0.50	-0.06
2007	-0.20	-0.02	-0.85	-0.10	-1.08	-0.13	-2.19	-0.26
2008	-0.11	-0.01	-0.73	-0.09	-0.93	-0.11	-1.52	-0.18
2009	-0.14	-0.02	-0.47	-0.05	-0.61	-0.07	-1.16	-0.13
2010	-0.08	-0.01	-0.41	-0.05	-0.56	-0.06	-0.72	-0.08
2011	-0.08	-0.01	-0.42	-0.05	-0.49	-0.05	-0.66	-0.07
2012	-0.08	-0.01	-0.42	-0.05	-0.50	-0.05	-0.67	-0.07
2013	-0.08	-0.01	-0.43	-0.05	-0.50	-0.05	-0.69	-0.08
2014	-0.07	-0.01	-0.44	-0.05	-0.51	-0.05	-0.70	-0.08
2015	-0.07	-0.01	-0.44	-0.05	-0.51	-0.05	-0.71	-0.08
2016	-0.07	-0.01	-0.45	-0.05	-0.52	-0.05	-0.72	-0.08
2017	-0.07	-0.01	-0.45	-0.05	-0.52	-0.05	-0.73	-0.08
2018	-0.06	-0.01	-0.46	-0.05	-0.53	-0.05	-0.75	-0.08
2019	-0.06	-0.01	-0.47	-0.05	-0.54	-0.05	-0.76	-0.08
2020	-0.06	-0.01	-0.47	-0.05	-0.54	-0.05	-0.77	-0.08
2021	-0.06	-0.01	-0.48	-0.05	-0.55	-0.05	-0.78	-0.08
2022	-0.05	-0.01	-0.49	-0.05	-0.55	-0.05	-0.80	-0.08
2023	-0.05	0.00	-0.49	-0.05	-0.56	-0.05	-0.81	-0.08
2024	-0.05	0.00	-0.50	-0.05	-0.56	-0.05	-0.82	-0.08
2025	-0.05	0.00	-0.50	-0.05	-0.57	-0.05	-0.83	-0.08
2026	-0.04	0.00	-0.51	-0.05	-0.57	-0.05	-0.84	-0.08
2027	-0.04	0.00	-0.51	-0.05	-0.58	-0.05	-0.85	-0.08
2028	-0.04	0.00	-0.52	-0.05	-0.58	-0.05	-0.86	-0.08
2029	-0.03	0.00	-0.53	-0.05	-0.59	-0.05	-0.88	-0.08
2030	-0.03	0.00	-0.53	-0.05	-0.60	-0.05	-0.89	-0.08

Each Scenario has different costs and benefits, cost impacts on PW and therefore different implications for price. Table 6 illustrates the necessary price changes for each scenario to ensure revenue neutrality for PW. This has been considered for both the price change necessary for Alice Springs customers only, and also if the price change was borne by all PW customers in the NT, which would be required under the current territory wide pricing structure.

Table 6 – Potential Price Changes

Scenario	Once Only Price Rise Equivalent for Alice Springs Customers c/kL	Once Only Price Rise Equivalent for all NT Customers c/kL
1	1	<1
2	5.5	1.5
3	6.5	2
4	10	3

These prices represent a once only price rise. However, price rises could be staged over the 30 year time period, and/or prices could include an inclining block tariff to reflect higher prices for higher water users, or alternatively the fixed charge could be increased.

Conclusions

The WES Stage III analysis demonstrates that a comprehensive cost effective Water Efficiency Program (WEP) can and should be implemented in Alice Springs. When broader societal benefits are also considered the analysis shows that nearly all the 31 options developed could be implemented providing the community of Alice Springs with significant net benefits including extending the life of the current water resources and deferring the need to develop a new source. With the current strong community support for a WEP, implementation should commence soon to build on this enthusiasm.

A number of stakeholders will need to take part in the implementation of the WEP. Hence, an implementation work plan that uses experience from other areas around Australia has been developed to assist in identifying some of the key tasks that will be needed, including those required in the short term (i.e. before next summer).

To maximise uptake of these program elements a large proportion of the costs required will be borne by the NT Government and PW. This will require some form of direct investment, a CSO payment or a pass though in the water price. The current analysis, is based on a conservatively low estimate of the marginal cost. On this basis, to ensure PW remains revenue neutral a small price pass through will be necessary which can either be shared amongst all PW NT customers (less than 3¢ /kL for a single price change even with the highest cost scenario) or if pricing policy in the NT is modified, isolated to Alice Springs customers (less than 10¢ /kL).

Recommendations

A series of recommendations have been made throughout this report. These relate to each specific Section and are summarised below. These recommendations assist in setting the direction of actions required to implement a WEP in Alice Springs.

Recommendation 2.1

Although the EUM/OM has been advanced for the purposes of the Stage III analysis it is recommended that the Alice Springs EUM/OM be transferred into the Water Services Association of Australia (WSAA) software package, the Integrated Supply Demand Planning (ISDP) Model, which ISF together with CSIRO have assisted in developing. By transferring the end use and options data into the WSAA ISDP software package in the future, this will enable the NT Government representatives to obtain further model functionality and be able to obtain WSAA modelling advancements being made across Australia on an ongoing basis. In addition, this will enable easier linkage with other models being used or developed by the NT Government representatives such as the PW borefield model and the NRETA groundwater resource model.

Recommendation 2.2

To assist in ensuring assumptions used in the EUM/OM reflect the situation in Alice Springs, it is recommended that a survey is designed and conducted to gain a statistically valid sample on the issues that need further assessment. Information such as the flow rate of non-efficient and AAA-rated showerheads and water usage of evaporative air conditioners needs to be collated. This will assist in both refining the demand forecasting and options assessment. It is also recommended that this survey be combined with a pilot program (e.g. residential indoor retrofit), in (say) an infrastructure constrained area, to reduce the costs of the survey and maximise potential water saving outcomes.

Recommendation 2.3

PW is currently using a reference case for assessing bulk water abstraction (and thus borefield augmentation) based on a borefield model that has not been updated since 1999. It is recommended that the detailed demand forecast developed as part of Stage III and the associated EUM is linked to the borefield model to ensure that bulk production forecasts and scheduling of the need for new bores uses the most up to date information available. This will assist in more accurate scheduling of costs for the provision of water services in Alice Springs.

Recommendation 2.4

Further to Recommendation 2.3, PW and NRETA should take advantage of the WES Stage III analysis in finalising the Alice Springs Water Resource Strategy, by using the Stage III detailed reference case demand in calculation of the current resource capacity. In addition the scenarios developed as part of Stage III could also be used to determine the benefits of introducing a WEP (i.e. extending the life of the current resource). The NRETA investigations of the resource capacity, PW calculations of bore replacement scheduling and ISF analysis into reference case demand and WEP Scenarios need to feed into each other (including linking of models) to ensure consistent assumptions are used and the best outcomes identified.

Recommendation 2.5

A number of investigations into water efficiency, source substitution and reuse are currently being undertaken in Alice Springs. Many of these investigations are being funded by a variety of sources. Due to this fragmentation in funding and implementation there also appears to be fragmentation in the co-ordination of the design of the independent studies and collation of findings, which is causing barriers in identification of a clear strategy and way forward. It is recommended that the ASUWMS Reference Group, including members of NRETA and PW, take the opportunity to use the outcomes of WES Stage III to re-evaluate the overall direction of investigation and actions required for Alice Springs. The Stage III Study is using a Least Cost Planning (LCP)/Integrated Resource Planning (IRP) approach, which is considered best practice internationally. This approach will assist in clarifying total costs of options, environmental and social benefits and who might be required to pay. By using an IRP approach, assumptions are clearly stated and an adaptive management plan presented. The use of this IRP approach will assist the ASUWMS Reference Group (primarily NRTEA and PW) to approach the NT Government to assist in providing adequate funding for a WEP and associated studies/investigations.

Recommendation 3.1

Although options relating to leakage detection and pressure reduction have been developed as part of Stage III of this Study, there is little data on the potential costs and savings of such programs in Alice Springs and therefore data from other Australian cities has been used to provide preliminary costs and savings. Considering the potential of these options, it is recommended that PW undertake an investigation of the leakage detection and pressure reduction costs and savings specifically for Alice Springs, as a matter of priority.

Recommendation 3.2

As required under the brief for WES Stage III, a number of source substitution options have been analysed using available data/information to determine their potential costs and savings. Much of this data is limited, and therefore these represent preliminary estimates only. Considering a number of these options have the potential to provide significant water savings, it is recommended that further investigation is undertaken to refine potential costs and savings prior to implementation as follows:

- Smart Growth – Further investigate the potential costs and savings of Smart Growth by working with developers of the current and planned land release areas to pilot ESD concepts and use other literature available on costs and savings as it becomes available.
- Town Basin Supply – Investigate the demand of the residential and non residential properties adjacent to the existing Town Basin reticulation system and associated extension, and increase the accuracy by interrogating the PW customer water meter database.

Effluent Reuse – Similarly, investigate the demand of the large non residential properties adjacent to the new effluent reuse pipeline more accurately by interrogating the PW customer water meter database. Although not part of the scope of work for Stage III, this has been done to a limited extent by the Study Team with the available customer meter readings. Further interrogation of the database would assist in refining estimated costs and savings.

Recommendation 4.1

To ensure all water service options are considered using a robust economic assessment method, it is recommended that the ASUWMS Reference Group and PW and NRETA ensure that all future cost assessments undertaken are based on the internationally recognised best practice process of Least Cost Planning/Integrated Resource Planning. Options should be assessed using a total resource cost test and where possible societal cost test, rather than a utility perspective only.

During assessment of previous cost estimates undertaken for the ASUWMS Reference Group, the WES Study Team has noted considerable inconsistency in economic assessment methods used, which causes significant difficulty when trying to compare options from different studies. Using an agreed approach will assist in minimising ambiguity in future.

Recommendation 4.2

Data on the current marginal cost of water has been difficult to obtain for WES Stage III. It is recommended that PW investigate the detailed breakdown of the marginal cost of water as a matter of priority including using the WES Stage III projection assumptions. The current marginal cost of water calculated as part of WES Stage III has been used to determine which WEP options should be taken forward for implementation. If, as is suspected, the marginal cost of water is actually higher than currently estimated this might result in WEP options being deleted from the program unnecessarily, which will be to the detriment of the Alice Springs community.

Recommendation 5.1

It is recommended that a suite of options similar to Scenario 3 (total PV cost of $5.05 M, average unit cost of $0.30 /kL and potential savings of 2,370 ML/a by 2030) is taken forward for further consideration and implementation considering the relatively low cost and significant benefits that can be attained by society as a whole.

Recommendation 6.1

By using the LCP/IRP unit cost analysis for Alice Springs and inclusion of various benefits we are able to show which options and Scenarios are a sensible investment based on the combined perspective of all stakeholders – the ‘total resource cost test’. Depending on the marginal cost of water, which in the WES Stage III analysis is considered to be a conservative estimate, a number of the Scenarios are cost effective from the total resource cost perspective and represent sensible investment decisions. If these options are not implemented this will mean PW will actually spend more under the reference case Scenario compared with these Scenarios because the advantage of the avoided costs of reduced water and wastewater supply has not been realised. Over the time period considered (25 years) these Scenarios will pay for themselves.

From the broader perspective of the community (which includes benefits such as customer energy bills and the estimated value of GHG reduction associated with reduced water and wastewater supply energy usage and customer hot water usage), all Scenarios except Scenario 4 (which contains the two highest unit cost options) provide worthwhile investment decisions. Again, if the options are not implemented this will mean that the community as a whole will incur greater costs, direct and indirect, than under the reference case Scenario.

From the viewpoint of the utility, the use of transfer payments (using price changes) will ensure that any of the Scenarios developed can be implemented while leaving the utility revenue neutral. Average customer bills will still be lower than before.

It is recommend that, as undertaken as part of this Study, water efficiency options and supply options should be analysed from the combined perspective of PW, NT Government and the customer and that both this perspective (full economic perspective) for the purpose of ranking and choosing options, as well as the financial (cash flow from perspective of the utility only) are presented for decision making. This transparency of analysis will enable PW to make the case to the NT Government to allow price pass through to customers or for Government to fund the shortfall directly. Considering the significant benefits associated with each of the Scenarios at least Scenario 3 should be recommended to the NT Government for consideration.

Recommendation 7.1

Considering the significant community benefits and support for water efficiency initiatives as demonstrated by the WES Stage III analysis and recent customer survey (McGregor Tan, 2004) it is recommended that a WEP similar to Scenario 3 is taken forward for implementation in 2007 for a core period of 5 years.

Recommendation 7.2

It is also recommended that a number of short term actions are taken forward in the short-term, including set up and or development of: a Detailed Implementation Plan, Stakeholder Workshop, Detailed Budget Plan, PW Board Paper, Cabinet Submission, Communication Strategy & Training Plan, Joint Research Plan, Phase 1 Pilot Study and Survey, Evaluation and Monitoring Plan and set up and recruitment of WEP Team.

1 INTRODUCTION

1.1 Background

In July 2002 the NT Government commissioned the Institute for Sustainable Futures (ISF) and Kellogg Brown & Root Pty Ltd (KBR) to carry out Stages I & II of the '*Alice Springs Water Efficiency Study'* (Turner et al, 2003), as part of the Alice Springs Urban Water Management Strategy (ASUWMS). The main aim of the Water Efficiency Study (WES) was to identify the most cost effective, and socially and environmentally appropriate options for reducing both water demand and the production of wastewater effluent in Alice Springs. This was principally to:

- reduce the need for augmentation of the Roe Creek Borefield, which will be required if the groundwater level continues to fall at the current rate of approximately 1.5 to 2 m per year (90 m below surface level in 1964 and more than 145 m below in 2000 (SKM, 2000c, p9)) and at 152m in 2004, according to Figure 1.1;

Figure 1-1 Historic Reduction in Water Level at Roe Creek Borefield

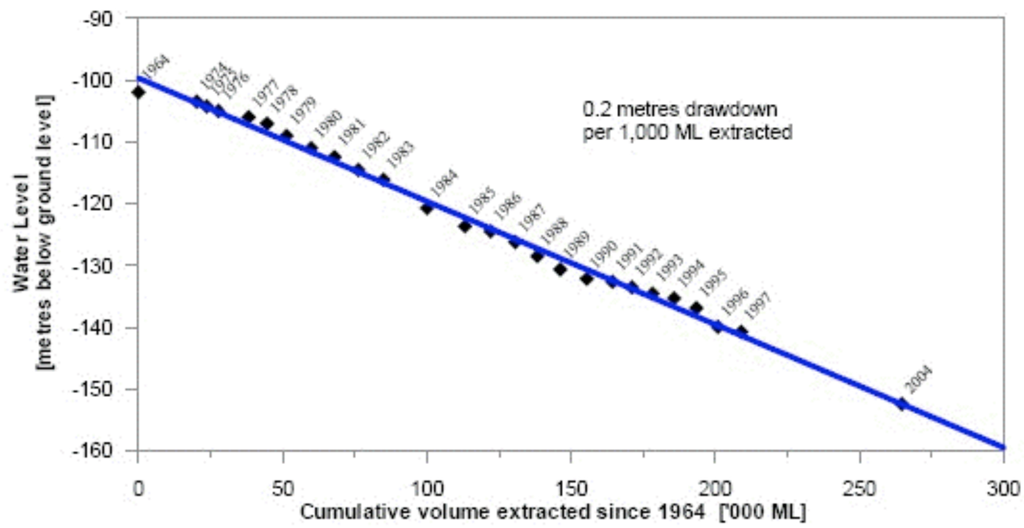


Figure 6 Decline in groundwater level in Roe Creek bore RN5731 compared to the cumulative extracted volume pumped from the borefield.

(Source – P Jolly et al, 2005)

- reduce the rate of depletion of the groundwater source, which is being used more rapidly than it is being replenished;

- reduce the need for augmentation of the reticulation system because of future population growth; and

- reduce the volume of effluent overflow from the wastewater treatment plant (WWTP) passing to Ilparpa swamp during winter months of low evaporation and subsequently reduce mosquito breeding issues and assist in returning the swamp to its original ecological state.

Stages I & II of the Study (Turner et al, 2003) were completed in July 2003 with each stage focussing as indicated below:

- Stage I – Review of existing data, reports and information associated with historical water use and wastewater production, and development of models that satisfactorily reflect historical patterns and project future demand.

- Stage II – Evaluation of water efficiency options appropriate to Alice Springs to achieve nominated target levels for reduction of annual and peak day water demand and wastewater production.

Since completion of Stages I & II, it has become apparent that a number of issues need to be addressed before the NT Government representatives, the Department of Natural Resources, Environment and the Arts (NRETA)[3] and the Power and Water Corporation (PW), can consider moving to Stage III of the project – full planning and implementation of the comprehensive Water Efficiency Program (WEP). Hence, ISF have been commissioned by the NT Government representatives, to undertake a Feasibility Study into implementation of the WEP:

- *Stage III – Implementation of the Alice Springs Water Efficiency Program – Feasibility Study,*

which will form the foundation of the rest of Stage III and provide confidence in proceeding with investment in an appropriate Alice Springs WEP[4].

1.2 Stage III – Implementation Feasibility Study

This report summarises the Implementation Feasibility Study investigations. The three core components of work are summarised as follows:

- Review of program – Review of WEP developed under Stage II to ensure individual options proposed and timing are still appropriate; eliminate some options, and expand other options to include others such as: rainwater tanks, grey water reuse, non revenue water and new subdivision source substitution; and to identify revised whole of society costs and benefits. This work will be undertaken as a high level analysis, using results obtained from other sources, including for example work by Alice Springs consultants on water management in new developments, and recent analysis of costs of effluent reuse.
- Implementation work plan – Development of a broad level implementation plan for a) a comprehensive WEP and b) an outdoor only WEP that: identifies key elements of the work required (i.e. pilot studies, other studies identified as part of the Stage II recommendations, working with trade allies, setting up a program team); utilises implementation experience from other areas; recommends key roles and responsibilities of various stakeholders; and suggests timing. This will involve the development of a work plan and cash flow for NRETA, PW and other stakeholders as required.
- Financial and avoided cost analysis – Review and analysis of the whole of society costs and benefits of the options, consideration of 'who pays', identification, review and analysis of avoided costs that can be identified, development of cash flow for various stakeholders and comparison of the WEP with the 'reference case' scenario. This component of the work provides the business case for the NT Government for investment in the WEP.

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[3] Formerly the Department of Infrastructure Planning and Environment (DIPE)

[4] This work represents a revision of the proposal '*Alice Springs Water Efficiency Study: Proposal for Next Steps*' (ISF, 2003), prepared by ISF in September 2003 and is based largely on the needs identified in a workshop held in Alice Springs on 9 February 2005, with representatives from NRETA, PW and ISF.

1.3 This Report

The structure of this report is outlined as follows:

- Executive Summary
- Summary
- Introduction
- Water Efficiency Study Stages I & II
- Revised Forecasts and Options
- Financial and Avoided Cost Analysis
- Option Costs and Benefits
- Program Costs & Revenue Neutrality
- Implementation Work Plan
- Conclusions & Recommendations
- Appendices

2 WATER EFFICIENCY STUDY STAGES I & II

This section summarises the findings of the Stage I & II Water Efficiency Study, conducted in 2002/2003 (Turner et al, 2003) and identifies a number of events, factors and initiatives that have occurred subsequent to the Study, such as investment in the reuse plant and the customer survey on community attitudes to water use. By considering the results of the previous Study and subsequent events, factors and initiatives the Stage III Study (and associated options and implementation plan) can be designed more effectively and make use of the most current information.

2.1 Stages I & II Summary

The executive summary from the Stage I and II Report (Turner et al, 2003) is provided in Appendix A. The full report can be found on:

http://www.nreta.nt.gov.au/whatwedo/waterwise/study.html; or

http://www.isf.uts.edu.au/publications/turner.html

Stages I and II of the Study developed two key outputs:

- A water demand forecast for Alice Springs, based on an end use model approach, which indicated that, for the base case (reference case), the average water demand is expected to increase from the historical average over the last 10 years of approximately 10,000 ML/a to around 12,500 ML/a by 2021 due primarily to the population rise which is estimated to be 20% over the period assessed (27,000 in 2001 to 32,500 in 2021). Models for peak water demand and wastewater flows were also developed.
- A range of water demand management/water efficiency options were also developed, which when combined form a comprehensive demand management or water efficiency program (WEP). Using the water and wastewater reference cases developed in the end use model it was possible to assess how individual options affect the projected average annual and peak water demand and wastewater production. The investigations showed how the suite of options could be tailored to assist in achieving the required goal at the lowest cost to society by considering the present value unit cost ($ per kL of water saved) for each individual option. Importantly the options analysis in Stages I & II used the internationally recognised best practice approach of Least Cost Planning (LCP)/Integrated Resource Planning (IRP)[5] which considers the whole cost of each option from the perspective of all stakeholders (i.e. the utility, government and customer).

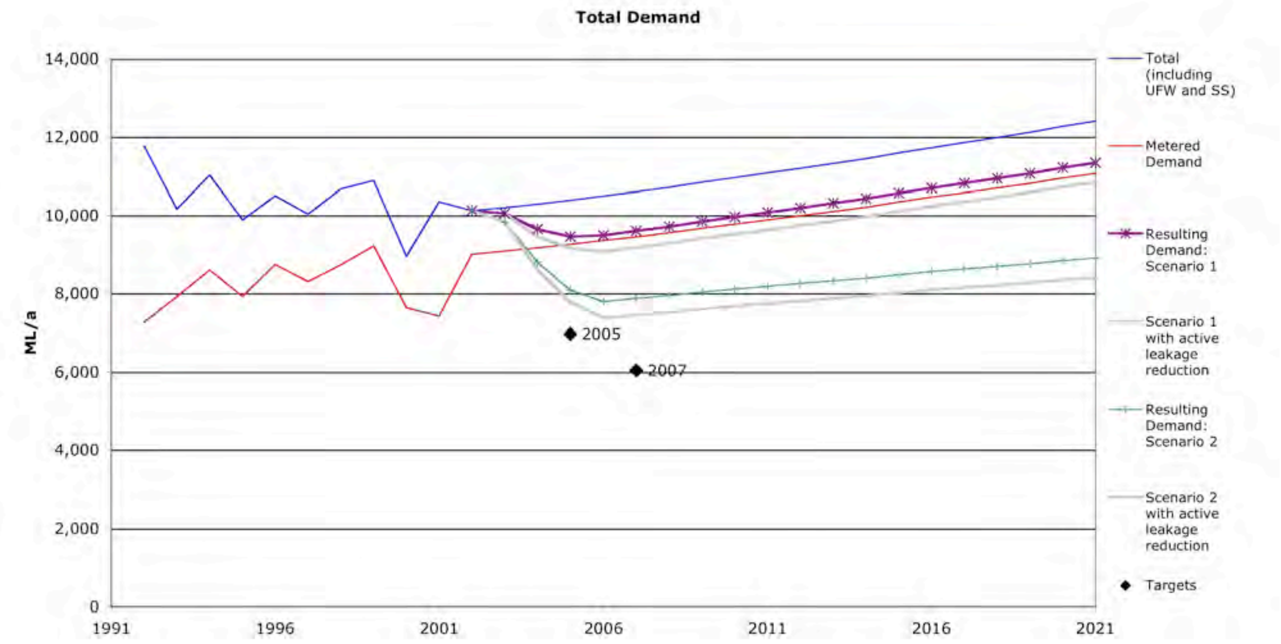
Prior to Stages I & II of the Study, PW and NRETA (in consultation with the Alice Springs community through the ASUWMS Reference Group) identified preliminary targets of:

- a 25% reduction in total annual water demand over the first three years, with a further 10% reduction in the following two years;
- a 10% reduction in peak day demand over the first three years, with a further 5% reduction in the following two years; and
- a reduction in inflows to the waste stabilisation ponds (WSP) from 8 ML/d to 7 ML/d.

[5] LCP which sits within the broader IRP framework is a process whereby, for example, a water service provider determines a range of options that at lowest cost provide their customers with the water related service they require rather than the water itself. This process recognises that customers do not necessarily want more water, rather they want the services that water provides such as aesthetically pleasing landscapes, sanitation and clean clothes. LCP/IRP aims to investigate the whole of society costs and benefits to highlight the most economically, environmentally and socially appropriate solution (Turner et al, 2003b).

During the development of the Stage II options, it became evident that the preliminary targets identified would be difficult to achieve through the use of demand management options alone. Two scenarios were considered with estimated total present value costs of $3.8 M and $10.2 M and savings of approximately 1,100 ML/a and 3,400 ML/a respectively by 2021. In Scenario 1 participants of a retrofit program for example might be assumed to be 50% of all available households. In Scenario 2 these were assumed to be considerably more (i.e. 75%). As shown in Figure 2.1, even the more intensive WEP under Scenario 2 could not achieve the identified targets.

Figure 2-1 Stage I & II Water Efficiency Program Modelled Scenarios



Source – Turner et al, 2003

Hence it was recommended as part of the Stage I & II report that other options such as reduction in non revenue water (NRW) (e.g. leakage reduction and pressure control), source substitution (e.g. rainwater tanks and greywater systems), larger scale reuse and alternative sources (i.e. the Town Basin supply) should also be considered alongside the water efficiency options developed and compared using the same LCP/IRP assessment framework. By comparing a broader suite of options (i.e. not considering water efficiency options in isolation) the most appropriate suite of options for implementation and achievement of the targets may be identified.

2.2 Stage II Proposed Water Efficiency Options

Stage II involved the development of a suite of options covering a number of sectors and customer types. These options were chosen based on analysis of the individual sectors and interviews carried out with various specialists on specific issues (i.e. evaporative air conditioners, swimming pools, plumbing, gardening) and discussions with customer types (i.e. public housing, Pine Gap, Town Camps). Through assessment of the water conservation potential of various sectors and customer types and analysis of costs, a suite of water efficiency options was developed. The preliminary options were then discussed with PW/NRETA and members of the ASUWMS Reference Group and refined.

The options were divided into the following categories:

- residential indoor programs (residential indoor retrofit, washing machine rebate, public housing retrofit);

- residential outdoor programs (outdoor water efficiency visit, targeted outdoor visit, pool cover rebate, cooling Alice evaporative air conditioning program);
- other residential programs (Pine Gap, Town Camps & Aboriginal Communities);
- commercial/industrial programs (general commercial/industrial auditing/retrofits, hotels program);
- institutional programs (general institutional buildings audit/retrofit, hospital program, schools program);
- new developments (residential building controls, non residential building controls); and
- other options (leakage and pressure reduction) although this was not fully investigated under Stages I & II as it was not part of the scope of the Study.

These options have been taken as the basis of the Stage III analysis but have been reviewed and expanded as required by the project brief.

2.3 Assumptions and Options Review for Stage III

During the intervening period between release of the Stage I & II WES Report (Turner et al, 2003) and the Stage III analysis summarised in this report a number of events, factors and initiatives have occurred that need to be taken into consideration.

2.3.1 Development and use of demand forecasting/options models

The development and application of demand forecasting/options models has progressed over the last two to three years. Based on these improvements the original Alice Springs model has been condensed in Stage III into two distinct parts: the demand forecasting or end use model (EUM) and the options model (OM). The EUM/OM has also been modified and extended to enable a broader spectrum of options to be considered and provide a higher level of usability in terms of modifying options.

Recommendation 2.1

Although the EUM/OM has been advanced for the purposes of the Stage III analysis it is recommended that the Alice Springs EUM/OM be transferred into the Water Services Association of Australia (WSAA) software package, the Integrated Supply Demand Planning (ISDP) Model, which ISF together with CSIRO have assisted in developing. By transferring the end use and options data into the WSAA ISDP software package in the future, this will enable the NT Government representatives to obtain further model functionality and be able to obtain WSAA modelling advancements being made across Australia on an ongoing basis. In addition, this will enable easier linkage with other models being used or developed by the NT Government representatives such as the PW borefield model and the NRETA groundwater resource model.

2.3.2 Assumptions in the EUM affecting the demand forecast

Over the last two years ISF has been involved in a number of water efficiency studies across Australia which have advanced the knowledge base in terms of end use assumptions, options development, implementation issues and evaluation of programs (i.e. development of the Melbourne EUM, recalibration of the Sydney Water Corporation (SWC) EUM, assistance in the development and assessment of options for the ACT Water Strategy, review of the WA Water Corporation Water Efficiency Program and evaluation of the water savings of the SWC Every Drop Counts residential retrofit program). Where appropriate this new knowledge has been included in the Stage III analysis.

Details of revised assumptions for the EUM are provided in Appendix B. Key assumption changes include:

- **Toilets** - Improved measurement of flush volumes and new technology has refined data collection which indicates a small reduction in flush volumes for each type of toilet. Enhanced data collection of behaviour is showing less flushes per person than originally estimated. In addition improved data collection suggests toilet leakage has fallen to 2.3% of toilets leaking (Roberts, 2004).

- **Showers** – ABS indicates there has been a decline in the stated ownership proportion of AAA showerheads (ABS, 2004).

  Flow rates of both inefficient and efficient (i.e. AAA rated) showerheads may be higher than currently modelled. Measurement of showerhead flow rates in Alice Springs conducted by the Centre for Sustainable Arid Towns (CSAT) indicates significantly higher flow rates than those currently assumed (pers com Glenn Marshall). Considering shower usage is one of the main end uses in indoor household demand, the flow rates for Alice Springs should be determined through a survey to assist in refining the modelling assumptions for both demand projections and anticipated savings,

- **Washing machines** - Recent survey and ABS data indicates that washing machine usage has declined from 300 to 260 washes per household per year (Roberts, 2004).

- **Dishwashers** - Dishwasher ownership in NT has increased from 15% in 1994 to 26% in 2004 (ABS, 2002).

- **Population** – No detailed demographic updates have been prepared by ABS or the NT Government since those used in the Stage I & II WES Report (Turner et al, 2003). PW is using a population growth estimate of 1 to 1.5% in the next 5 years (PW, 2005) but no details of actual population projections have been provided by PW to the Study Team. Hence the detailed projections identified in the Stage I & II WES Report have been used as the foundation of the Stage III analysis.

Projected demand is now expected to be approximately 12,200 ML/a by 2021, similar to the Stage I & II WES Report projections.

As part of the Stage III analysis the projections have been extended to 2030 to enable a 25 year analysis period. The 2030 projection for potable water demand (excluding source substitution) is approximately 13,500 ML/a. Source substitution from the Town Basin provides a limited number of customers with non potable water for irrigation as detailed in Table 2.1.

PW have indicated that bulk water abstraction will remain at current levels of approximately 10,000 ML/a even with the expected population increase and that this forms the basis of the current borefield model, which assists in scheduling of investment in new bores due to the dropping water levels in the aquifers. PW have indicated that the assumptions and input data to the borefield model have not been updated since 1999 (Don Pidsley, PW, e-mail 5/12/05). PW have also indicated that it is assumed the bulk water production levels will be maintained at current levels through the use of some form of WEP (pers com Don Pidsley/ Cherie Jones 24/10/05 and Don Pidsley e-mail 5/12/05).

One of the key aims of the Stage I & II and Stage III analysis is to compare the options that have been developed against the 'reference case demand', which assumes no interventions (e.g. water efficiency or reuse initiatives) have taken place. Hence, the PW demand forecast of maintaining 10,000 ML/a by *using some form of demand management* cannot be considered a reference case. The reference case used in the Stage III analysis is therefore based on the detailed EUM developed as part of the Stage I & II WES and revised as part of the Stage III WES. The implications of using the EUM reference case demand rather than that of the PW assumed constant demand are further discussed in Section 4.0 with respect to the anticipated deepening of bores required and the associated increase in the marginal cost of water.

Recommendation 2.2

To assist in ensuring assumptions used in the EUM/OM reflect the situation in Alice Springs, it is recommended that a survey is designed and conducted to gain a statistically valid sample on the issues that need further assessment. Information such as the flow rate of non-efficient and AAA-rated showerheads and water usage of evaporative air conditioners needs to be collated. This will assist in both refining the demand forecasting and options assessment. It is also recommended that this survey be combined with a pilot program (e.g. residential indoor retrofit), in (say) an infrastructure constrained area, to reduce the costs of the survey and maximise potential water saving outcomes.

Recommendation 2.3

PW is currently using a reference case for assessing bulk water abstraction (and thus borefield augmentation) based on a borefield model that has not been updated since 1999. It is recommended that the detailed demand forecast developed as part of Stage III and the associated EUM is linked to the borefield model to ensure that bulk production forecasts and scheduling of the need for new bores uses the most up to date information available. This will assist in more accurate scheduling of costs for the provision of water services in Alice Springs.

2.3.3 Initiatives in Alice Springs affecting the options

A number of initiatives in Alice Springs may affect water efficiency, including the choice of options that are developed or the assumptions used in the Stage III analysis. Although the WEP as a whole has not advanced since the release of the Stage I & II WES Report, a number of individual activities have occurred as described below.

Community Awareness

The NRETA web site provides a number of fact sheets and resources on water efficiency, resource issues and licence and permit information for non-potable water. In addition, the PW website provides similar information on PW related water saving activities.

These and other similar websites will assist in raising community awareness when other information generated during the implementation phase of Stage III is underway. This form of community awareness forms an essential ‘foundation program’ to the rest of the WEP.

Customer Survey

NRETA commissioned a recent survey (McGregor Tan, 2005) to determine attitudes to water use in Alice Springs. The main objectives of the research were to determine:

- the perception of Alice Springs residents with regard to water use;
- what water efficiency actions/measures the community prefer;
- perception of impact on residents in relation to water restrictions;
- community support of possible pricing structure changes;
- residents likely support in relation to water restrictions;
- the community support for a comprehensive WEP to be introduced in Alice Springs; and
- residents opinions on who should be responsible for paying for a WEP.

When examining a WEP, the key finding was that overall support for the water conservation measures tested was high, suggesting residents would favour a comprehensive WEP.

In particular, residents supported the following (on a rating of 1 – 5 with 3.5, 4 and 4.5 representing relatively high, very high and 4.5 extremely high support, respectively):

- discounts/incentives/rebates on water efficient appliances (average rating of 4.7);
- regulations that require new dwellings to be water efficient (average rating of 4.5);
- business WEP (average rating 4.3);
- provision of water efficiency information – brochures, fact sheets, web site, talks, posters etc. (average rating 4.2);
- waterwise advertising campaign TV, radio, print media etc to raise awareness of water efficiency (average rating 4.1);
- home visits by a water efficiency expert to help respondents to save water (average rating 3.9);
- some type of compulsory water restrictions or permanent water conservation measures (average rating 3.7); and
- changes to the pricing structure of water to encourage more efficient water use (average rating 3.7).

Importantly, respondents indicated a clear concern about water usage in Alice Springs, and an openness to conservation measures, preferably voluntary. Those surveyed also indicated their willingness to improve current practices. Eighty percent of respondents supported a two tier pricing system and 89% supported the introduction of water efficiency measures in Alice Springs with 69% specifying they strongly agreed with these measures.

Hence, it appears there would be significant support for a WEP by the community if implemented in Alice Springs.

Waterwise NT Schools Program

There has been considerable activity in developing and advancing the Waterwise NT Schools Program (pers com Robbie Henderson and email 18/08/05) including:

- Four schools are registered and fully engaged in the program working towards accreditation as Waterwise NT Schools.
- More than 15 schools are using Waterwise NT resources. However, these schools are not working towards accreditation at this stage.
- Three schools have received Waterwise NT funding for action projects - $3,000 each for Bradshaw Primary School (PS) for an indoor retrofit of toilets and taps; Sadadeen PS replacing approximately 250 m^2 of lawn with paving and arid zone plants; and Araluen Christian School developing a permaculture garden incorporating water harvesting techniques. All three projects are still in progress and are yet to be completed. Each project has received extra support from the school communities: the Araulen project is probably worth over $20,000 due to in kind labour such as grading, design and development by Charles Darwin University and donations of mulch from the Alice Springs Town Council; and Bradshaw PS has produced a TV commercial which has been running on Imparja TV between 2pm - 4pm daily, focussed on residential water savings.

- A water audit workshop was conducted and attended by representatives from seven schools. The workshop focused on how to conduct an audit, involve students, identify solutions to water efficiency problems and build a business case within the school to save water. It is planned to gather data from each school after the audits.

The plans for the Waterwise NT Schools Program in 2005 include:

- Increased number of schools registered and fully engaged in program to six by end of 2005 and 10 by the end of 2006.

- Target to expand the number of schools receiving $3,000 funding for action projects by three for each 6 month semester (i.e. three more by end of 2005).

- Six schools are currently preparing to apply for Australian Government community water grants (some independently, some as partnerships involving more than one school).

- The Water Audit Workshop served as a good opportunity to inform planning of projects. A planning meeting is currently organised to bring school applicants and organisations together that can provide support. Future training opportunities for schools will include a focus on methods to increase community involvement in school projects (e.g. Araluen plan to promote their projects through community open garden days etc).

The current Waterwise Schools Program is progressing well. There is however significant opportunity to add to the program by providing additional funding for: structural changes to complement the limited or in-kind contributions for structural changes and behavioural changes that have been achieved to date; and paid time for an ongoing WEP team member to maintain liaison with individual schools, measure water savings achieved and assist in embedding water efficiency activities into the school maintenance programs and environmental curriculum. During the Department of Public Works and Services (DPWS) audit in 1998 (refer to Turner et al, 2003, Appendix E) significant base flow leakage was found at five schools/colleges audited, ranging from 2 to 42 %. Hence other measures involving embedding regular checking for leaks in management procedures could be a highly beneficial water efficiency activity.

The Desert Peoples Centre

The Desert People's Centre (DPC) is being designed and constructed for Batchelor College and the Centre for Appropriate Technology, in association with Desert Knowledge. The Centre aims to achieve very high standards in terms of sustainable arid design, including water efficiency and reuse. Documentation on the proposed design of the DPC was not available to inform the analysis being undertaken as part of WES Stage III.

Reuse Scheme

A Waste Discharge Licence was issued by DIPE/NRETA in January 2003. According to this licence PW are required to cease all dry weather discharges from the Waste Stabilisation Ponds (WSPs) to Ilparpa Swamp by December 2005. PW are in the process of achieving this licence requirement through the construction of an effluent treatment, storage and reuse system at the Arid Zone Research Institute (AZRI) (PW, 2005).

The 6.2 km reuse pipeline from the WSPs to the AZRI has already been constructed. The Stage 1 Dissolved Air Flotation (DAF) plant, which has a capacity of 6 ML/day is to be tendered in early 2006 and should therefore be operational by the end of 2006. This plant is expected to provide approximately 600 ML/a of treated effluent, which will be available for new irrigated agriculture purposes in the vicinity of the AZRI. However, these new irrigated agriculture customers have not yet been secured. The amount of effluent actually treated to enable 600 ML/a to be available at the AZRI aquifer recovery area is currently unknown and as such the Stage 1 DAF plant is being considered as a pilot to test the system (pers com Mark Skinner). The cost of the reuse system including the Stage 1

DAF plant is approximately $9.4 M (between $4.5 M and $5 M for the DAF plant). The 6 ML/day plant will be capable of treating approximately 1,800 ML/a. The operating cost of such a plant (energy and chemicals but excluding staff) will be approximately $0.21/kL[6]. An additional 6 ML/day DAF plant will be constructed if a treatment capacity of more than 1,800 ML/a is required (pers com Mark Skinner).

The Desert Peoples Centre (DPC), currently under design/construction, is adjacent to the proposed location of the aquifer storage and therefore provides an opportunity to tap into this available resource if the Centre connects a reticulation system to the new bore already constructed by PW and offered to the DPC for their use. In addition, a number of properties are located adjacent to the reuse pipeline passing between the WSPs and the AZRI, such as the race course, Yirara College, Garden Cemetery, Old Timers and the RSPCA. A number of these properties are large potable water users with significant outdoor water demand (pers com Mark Skinner).

There are therefore significant opportunities to offset potable demand with the Class A[7] reuse water through the connection of the properties adjacent to the reuse pipeline and the DPC.

Non potable use

Non potable demand is currently available to a small number of properties through the PW operated Town Basin system and six privately operated bores. Demand for Town Basin supplies has averaged just under 770 ML/a over the last 6 years, with demand dropping in wet years (2000 and 2001) as shown in Table 2.1. Key customers include (Turner et al, 2003):

- the Alice Springs Town Council (average approx. 150 ML/a 1996 to 2001which represents 35% of the Town Council total potable and non potable demand, 451 ML/a), and
- schools – Gillen PS, Traegar Park PS, Ross Park PS, Bradshaw PS, Alice Springs High School, Sadadeen College, Our Lady Sacred Heart College and Philips College (approx. 127 ML/a 1997 to 2001 which represents 29% of the school sector total potable and non potable demand, 434 ML/a demand, excluding St Philips School with its own bore).

Table 2-1 Town Basin Demand

Ownership	Current Equipped Capacity L/s	Current Effective Capacity L/s	Groundwater Abstraction (ML/a)							
			97	98	99	00	01	02	03	04
PW – Traegar	8.4	7	60	34	62	52	53	13	0	49
PW – Hockey	10	10	131	145	139	116	122	139	134	111
PW – Sturt	4	3	52	41	25	20	10	29	55	43
PW – CAFL	10	10	106	102	119	110	91	161	179	158
PW – Pacific	2.8	2.8	12	28	32	2	7	19	31	20
PW – Baseball	7.8	7	39	41	54	78	81	73	72	66
Private – Golf Course	15	9			78	29	34	35	38	39
Private – Golf Course	15	9			285	197	120	144	220	250
Private – Golf Course	15	9			74	36	58	91	111	103
Private–St Philips Sch	3	1.8			23	19	-	-	6	9
Private – Det 421	2	1.2			7	5	4	7	5	3
Private – Casino	1.5	0.9			37	15	n/a	n/a	n/a	n/a
Totals	**94.6**	**70.7**			**935**	**679**	**580**	**711**	**851**	**851**

Source – Luke Diddams, NRETA, e-mail 24/10/05 & Alan Whyte, PW, CD 24/10/05

[6] Calculations indicate that for 1,200 ML/a it will cost approximately $250,000 in energy and chemical costs, excluding staffing costs (pers com Mark Skinner).

[7] http://www.powerwater.com.au/powerwater/aboutus/water_reuse/faq.htm [accessed 16/12/05]

A report produced in 2001 (SKM, 2001) investigated both the yield and options for increased use of the Town Basin resource to offset potable demand. It is understood that this is the last detailed analysis undertaken on potential customer demand and the sustainable yield (1,040 ML/a) and is still considered appropriate (pers com John Childs). Hence there appears to be significant opportunity to increase the demand from this resource to the identified sustainable yield of 1,040 ML/a.

Two schools are planned to come on line in 2006, Sadadeen PS and the Catholic High School[8] (e-mail Alan Whyte, 2/10/05). In addition, there are also potential plans to connect up the power station radiator system. Estimated use is 28kl/hr peak or 14kl/hr average, resulting in a potential non potable demand for the power station of 123 ML/a (e-mail Alan Whyte 2/10/05).

PW and NRETA are currently in the process of submitting a proposal to the National Water Commission for an activated carbon and membrane filtration system to treat the Town Basin resource to potable supply quality. This approach is being considered to (e-mail John Childs, 16/12/05):

- allow maximum use of renewable resources in an arid environment currently reliant on a non-renewable groundwater supply;
- allow much greater flexibility and diversity of uses to harvest water for allowing management of the Town Basin for both water supply and environmental outcomes; and
- allows supply diversification in the event of a major emergency impacting on the ability to supply water from the main potable supply system.

The project is anticipated to cost approximately $7 M.

Recognising the principle of providing water of a quality that is ‘fit for purpose’, the significant opportunity to use the Town Basin resource with its current non potable water quality and the high cost of this proposed option, the Study Team have not considered this option in the options developed for Stage III but lower cost options that use the resources current water quality.

Reduction in losses from non revenue water/unaccounted for water

Between 1997/98 and 1999/00 reported system losses[9] were 205, 244 and 228 L/connection/day respectively. In 2000/01, these reported losses rose significantly to 472 L/connection/day and according to the PW 2001/02 Asset Management Plan (PW, 2002) the current annual real losses (CARL)[10] rose further to 537 L/connection/day while unavoidable annual real losses (UARL) were 76 L/connection/day (Turner et al, 2003, p43).

Due to the significant rise in losses and the associated lost revenue, a series of actions were undertaken by PW in 2002/03 to reduce the non revenue water (NRW)[11]. These included actions such as: replacement of customer meters, analysing the customer meter database for meter errors/anomalies, pipe reconfiguration of larger meters (>50mm) to maximise performance, visual inspection of mains routes above ground and inspection of tanks. During this time a number of leaks were found including

[8] The Catholic High School is also known as Our Lady Sacred Heart College. In 2003, it was believed this property was already linked to the Town Basin supply, however, both Alan Whyte in recent discussions and the SKM 2001 report (p61) indicate this property is not currently linked.

[9] Reported losses under the AWA publication (AWA, 2002) are those not accounted for by metered and estimated uses or meter error.

[10] CARL accounts for losses due specifically to joint weeps, leaks, breaks and apparent losses averaged over the total number of connections. UARL, which are a component of CARL, are classified as those losses that are unavoidable considering the network, supply pressures and number of joint connections.

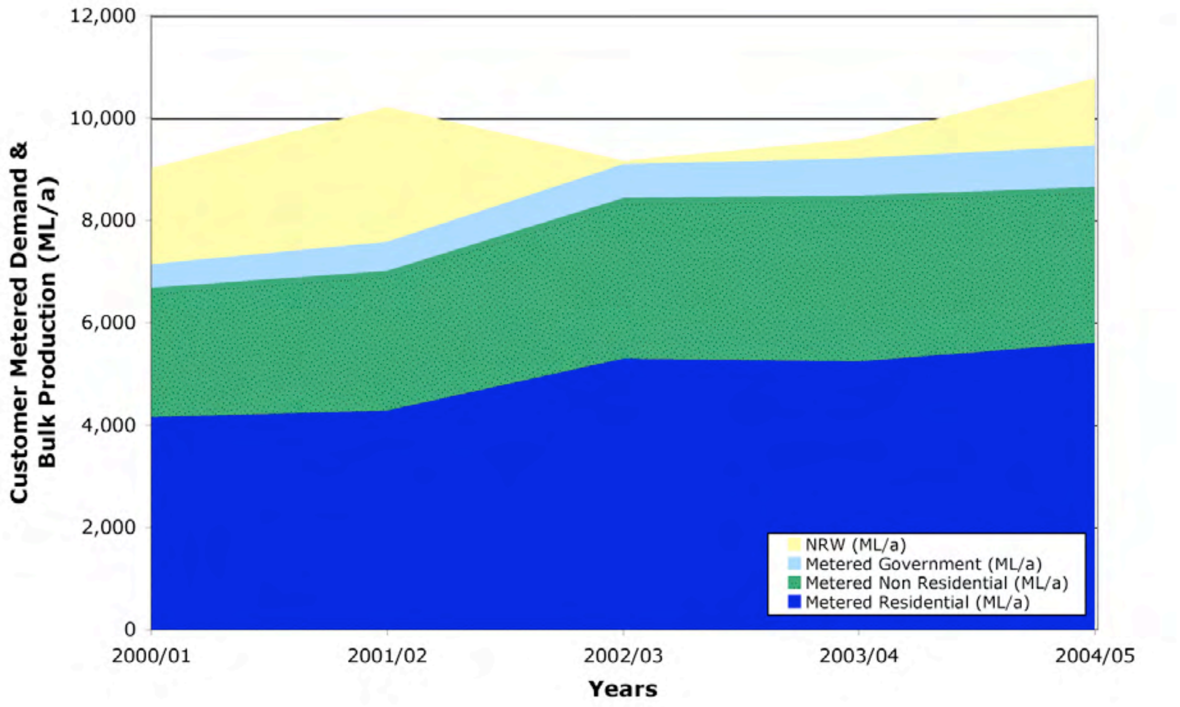
[11] NRW is the difference between the bulk water production and customer metered demand.

a major leak in Ilparpa Swamp in February 2003. Theft of water still continues but all hydrants are now located underground (work finished early in 2004).

For leakage detection, it is planned that a Darwin mobile leak detection unit (van) will assist in leak detection in Alice Springs twice a year. This van was operating in Alice Springs for 2 weeks during 2004. For pressure reduction, only one pressure reduction valve (PRV) is currently in place in the system (in the Gap), which has been in position since the 1990s. Current water pressure in the system is approximately 45m (pers com Mark Skinner and Alan Whyte, PW).

Although a significant effort was directed in reducing leakage during 2002/03 no systematic active leakage program and pressure reduction program currently exists in Alice Springs and it appears losses may be increasing again. Figure 2.3 illustrates the recorded customer metered demand and NRW for the last 5 years.

Figure 2-2 Non Revenue Water



(Source – Nuno de Castro, PW, e-mail 18/10/05)

The UARL calculated by PW is still considered to be approximately 76 L/connection/day (PW, 2005). However, figures for 2002/03 and 2003/04 indicate that CARL were actually less than UARL (e-mail Nuno De Castro, PW, 18/10/05). This anomaly may be associated with a time shift between the bulk water production and customer metered demand figures, although PW calculations attempt to allow for this. For projection purposes and for assessment of potential leakage and pressure reduction water efficiency options, an average of the L/connection/day has been taken over the 5 year data set provided to average out this anomaly and take into consideration that although leakage actions were undertaken in 2002/03, an ongoing program is not currently in place. Hence NRW is currently calculated to be approximately 462 L/connection/day with UARL at 76 L/connection/day.

Considering the relatively high level of NRW over the last few years, the fact that no active systematic leakage detection program is currently in place and pressure in the system is higher than required, with only one PRV in place, there appears to be significant opportunity to reduce NRW through active leakage and pressure reduction programs.

Investigations into Rainwater Tanks and Greywater Systems

The potential use of both rainwater tanks and greywater systems in a WEP can be influenced significantly by climate and local factors. Hence CSAT have undertaken a number of independent investigations into issues such as the yield, costs and uptake of rainwater tanks and greywater systems in Alice Springs. These investigations have been used to assist in the development of the proposed WEP rainwater tank and greywater system options. Summary details of these investigations are available from CSAT.

Investigations into augmentation of supply

NRETA are currently investigating the long-term yield of the water resources in the Alice Springs region under various population/abstraction increase scenarios, as part of the '*Alice Springs Water Resources Strategy*'. These investigations, which are nearing completion, will assist in setting the longer-term PW abstraction licence agreement and determining when a new resource (i.e. abstraction at Rocky Hill) may be required due to reasons associated with, water quality, water quantity and the limits in current abstraction technology and costs.

As indicated in Section 2.3.2, PW are currently using a borefield model to assist in planning augmentation of bores associated with supplying the current water resources. This model has not been updated since 1999 and thus the augmentation scheduling required as part of the annual reporting in the PW Asset Management Plans are having to be adjusted accordingly. In addition, the modelling and scheduling does not take into consideration the detailed EUM/OM reference case demand developed as part of the WES Stage I & II (and reviewed as part of WES Stage III) and in fact assumes demand will remain at current demand levels of 10,000 ML/a over the next 15 years, which is well below the demand modelled under the WES.

To ensure those involved in investigations of the Alice Springs Resources Strategy and PW Asset Management Plans use consistent assumptions, PW and NRETA should take advantage of the detailed EUM/OM developed as part of the WES. This will assist in ensuring the organisations involved in determining the resource abstraction capability and how to provide water from those resources, use the same modelling assumptions. This will also enable the impacts and benefits of both the reference case demand and proposed WEP Scenarios, developed as part of WES Stage III, to be tested in the NRETA and PW investigations respectively. All three investigations are directly related and should not be considered independently.

PW Independent Investigations into Water Efficiency Options

Darwin has recently experienced lower than average rainfall conditions resulting in poor recharge of the Darwin River Dam during the 2004/05 wet season. This combined with competing pressures for access to future ground and surface water resources has resulted in PW having commenced considering setting up a WEP for Darwin, which can be rolled out into other areas across the NT, mainly major urban centres, including Alice Springs. Appendix C provides details of the PW draft Water Use Efficiency Plan for the NT, considered to date.

The Plan has some similar programs to those recommended in the Stage I & II Study, utilises many of the characteristics of other initiatives being implemented across Australia (i.e. SWC and Water Corporation, WA) and cuts across the major sectors. However, the draft Plan appears to concentrate mainly on behavioural changes and provides minimal investment in structural changes (i.e. the business program). A combination of structural and behavioural measures and economic incentives to assist customers to implement structural measures often results in the most significant savings. Investment in behavioural changes alone often leads to short term minimal savings and as experienced in Alice Springs in the past, the use of audits in isolation leads to little if any investment in structural changes (i.e. DPWS audits, refer to Section 6.3.4, Turner et al, 2003).

There are significant benefits in considering a Territory wide WEP, however, the characteristics of Darwin and Alice Springs in terms of climate and other factors are significantly different. The Stage I

& II and Stage III analysis looks specifically at what water efficiency options make sense in Alice Springs, taking into consideration the total costs (the combined perspective of the utility, government and customer), savings and environmental and social factors. Hence, the results of the Stage III analysis should be used to inform any PW Plan being made for Darwin or other major urban centres in the NT and various stakeholders need to work together to ensure the best outcomes (i.e. NRETA assist in regulatory changes that will assist in the long term saving of water in the NT).

Recommendation 2.4

Further to Recommendation 2.3, PW and NRETA should take advantage of the WES Stage III analysis in finalising the Alice Springs Water Resource Strategy, by using the Stage III detailed reference case demand in calculation of the current resource capacity. In addition the scenarios developed as part of Stage III could also be used to determine the benefits of introducing a WEP (i.e. extending the life of the current resource). The NRETA investigations of the resource capacity, PW calculations of bore replacement scheduling and ISF analysis into reference case demand and WEP Scenarios need to feed into each other (including linking of models) to ensure consistent assumptions are used and the best outcomes identified.

Recommendation 2.5

A number of investigations into water efficiency, source substitution and reuse are currently being undertaken in Alice Springs. Many of these investigations are being funded by a variety of sources. Due to this fragmentation in funding and implementation there also appears to be fragmentation in the co-ordination of the design of the independent studies and collation of findings, which is causing barriers in identification of a clear strategy and way forward. It is recommended that the ASUWMS Reference Group, including members of NRETA and PW, take the opportunity to use the outcomes of WES Stage III to re-evaluate the overall direction of investigation and actions required for Alice Springs. The Stage III Study is using a Least Cost Planning (LCP)/Integrated Resource Planning (IRP) approach, which is considered best practice internationally. This approach will assist in clarifying total costs of options, environmental and social benefits and who might be required to pay. By using an IRP approach, assumptions are clearly stated and an adaptive management plan presented. The use of this IRP approach will assist the ASUWMS Reference Group (primarily NRTEA and PW) to approach the NT Government to assist in providing adequate funding for a WEP and associated studies/investigations.

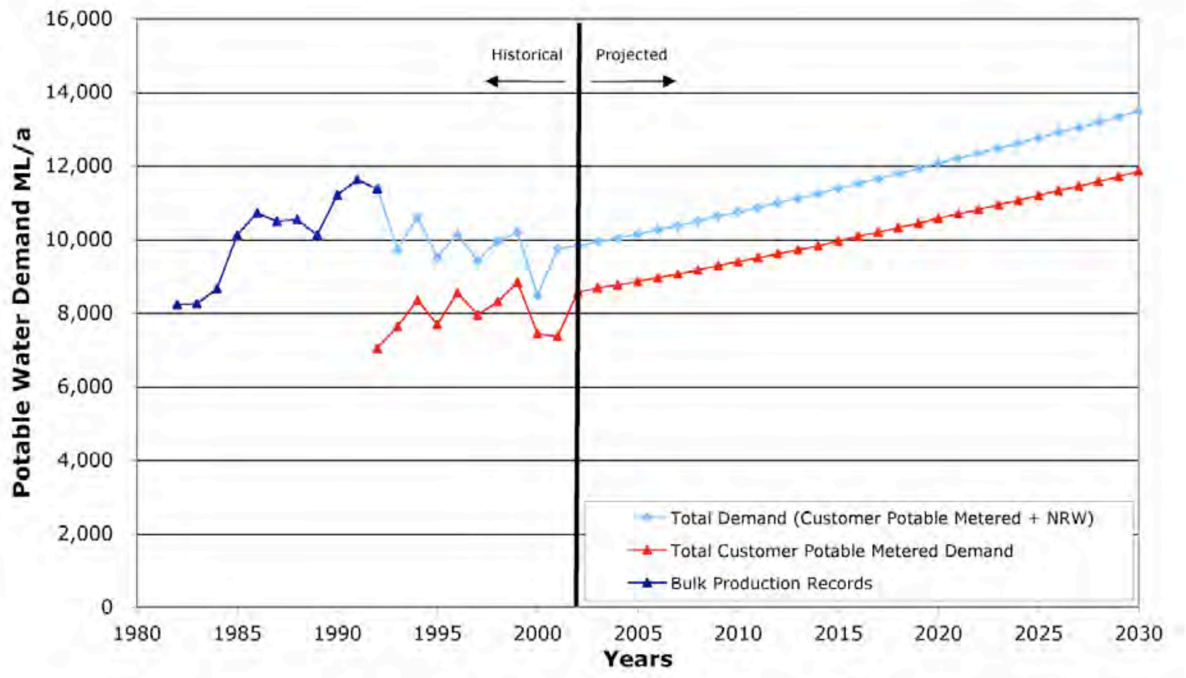
3 Revised Forecasts and Options

This section provides details of the revised water demand forecast (the reference case) and the broader suite of options that have been taken forward for assessment of costs and benefits.

3.1 *Revised Demand Forecast*

After incorporating a number of revised assumptions in the EUM/OM, the revised reference case demand for potable water is as shown in Figure 3.1. Sewage demand is expected to remain at approximately a third of potable water demand without interventions such as a WEP.

Figure 3-1 Revised Demand Forecast (Reference Case Demand)



3.2 *The Options*

As a result of the collation of information identified in Section 2.3.3 a number of options have been revised and a number of additional options designed. The revised suite of options are detailed below.

The options have been considered under the following headings:

Water Efficiency

- Residential indoor
- Residential outdoor
- Other residential
- Commercial/Industrial
- Institutional

The System

- Leakage control and pressure management

Regulations & Source Substitution

- Regulations & Building Controls
- Source Substitution

3.3 Water Efficiency

3.3.1 Residential Indoor (existing households)

Indoor Retrofit Programs

The retrofit program would be similar to that implemented in Sydney on over 300,000 households to-date and would involve a qualified plumber: visiting the house; replacing inefficient showerheads with a AAA-rated water efficient showerhead (additional showerheads could be purchased separately); installing tap flow regulators and stainless steel seatings on kitchen and bathroom basin taps; installing a toilet displacement device in single flush toilets (to reduce the single flush volume); and checking for leaks around the home (including leakage from pressure relief valves on water heaters, which could potentially be an issue in Alice Springs). The plumber would also provide advice on maintenance and checking for leaks, and provide information including a leaflet on tips and tricks for saving water around the home. To maximise the uptake of the initiative only a small charge would be made to the householders. In Sydney this service is offered free of charge to those that can provide evidence of low income (e.g. health care card).

This option has been spilt into a program for:

- single residential households (Indoor SR retrofit program); and
- multi residential households (Indoor MR retrofit program).

SR households are likely to save more than MR households due to the higher level of occupancy. In addition the participation rate of SR households may be higher due to the proportion of owner-occupiers in SR households compared to flats and the fact that MR households do not generally pay for their water (i.e. no individual metering) and thus lack a key incentive to participate in the program.

Evaluation of the retrofit program in Sydney has revealed that an average saving of 21 kL/hh/a can be achieved for SR households[12] (Turner et al, 2005). With the higher occupancy rate in Alice Springs and potential to save water associated with other leaks (e.g. pressure relief valves on water heaters) a potential saving of 28 kL/hh/a has been assumed. For MR, with a lower occupancy ratio than SR, a saving of 17 kL/hh/a has been assumed.

Two additional associated options have been considered:

- Indoor SR toilet retrofit program; and
- Indoor MR toilet retrofit program

To maximise potential savings a dual flush toilet retrofit could be offered to those households visited during the indoor retrofit. Instead of fitting the toilet displacement device, a full toilet replacement would be offered. This option would be more expensive because of additional capital and labour costs. The Alice Springs Show survey found that around 80% of households already have at least one dual flush toilet. Although it should be noted that a high proportion of these dual flush units are likely

[12] The savings take into account that participants of the program included households that had nothing installed to those that had all offered fittings installed. Hence this represents an average saving per household for the program implemented.

to be 11/6 litre or 9/4.5 litre models rather than the 6/3 litre models or recently released more efficient 4.5/3 litre models.

Savings of 29 kL/hh/a and 17 kL/hh/a have been assumed for SR and MR households respectively[13].

Public Housing Retrofit

Public housing represents 8.4% and 22% respectively of the SR and MR housing stock in Alice Springs and analysis has revealed that these properties have an average water demand only slightly lower than the average in the SR sector and a higher average in the MR sector (Turner et al, 2003, p57). Given the advantages of dealing with one property manager and the potential to reach a large proportion of the SR and MR houses in Alice Springs, two separate options have been considered:

- Public housing indoor retrofit; and
- Public housing toilet retrofit

These two options would be similar to the general residential indoor retrofit options but would combine all SR and MR households and would have a higher participation rate as the Government effectively has control over the equipment in these households as part of ongoing maintenance.

Average potential savings are estimated to be 22 kL/hh/a for the 'indoor retrofit' allowing for the occupancy ratio of SR and MR households and potentially higher savings associated with leaks etc. and 23 kL/hh/a for the toilet retrofit[14].

Washing Machine Rebate

This option is similar to a program implemented by the Water Corporation, WA, where more than 80,000 washing machine rebates have been provided. A rebate credited on the water bill on the purchase of a new AAAAA-rated water efficient washing machine would be offered to customers[15]. The option seeks to increase the sales and thus the proportion of AAAAA-rated machines in households. These machines can provide on average a 50% reduction in water demand for this end use (i.e. reduce water demand from approximately 140 L per load to 75 L per load). Unpublished investigations have shown that savings of approximately 24 kL/hh/a can be achieved (pers com Frank Spaninks, SWC). Similar initiatives implemented elsewhere have effectively paid for the difference in the purchase price between efficient and inefficient models (approximately $150). In some locations the program has been so successful in shifting the proportion of efficient machines purchased that this price differential has been further reduced (Turner et al 2005). To maximise the impact of this option, a 'trade-in' scheme should be considered to ensure removal of inefficient machines from stock.

[13] This assumes single flush 11 L toilets are replaced with the new 4.5/3 L toilet dual flush toilets and 3.5 flushes per person per day. In households taking up the indoor retrofit and toilet retrofit programs the savings are likely to be marginally less than the 28 kL/hh/a plus 29 kL/hh/a (for a SR household) which are the savings for the two independent programs. This is because the 28 kL/hh/a savings for the indoor retrofit includes a level of savings associated with a toilet displacement device.

[14] As for the general indoor retrofit and toilet retrofit program (see above footnote) the savings for the combination of public housing retrofit programs are likely to be marginally less than 22 kL/hh/a plus 23 kL/hh/a for those households participating in both programs.

[15] It is recommended that only AAAAA-rated machines are considered for rebate as some AAAA-rated machines can only achieve such a rating when certain washing programs are used and thus there is a risk that full savings may not be achieved.

3.3.2 Residential Outdoor (existing households)

Outdoor Garden Program

Considering the high outdoor water demand in Alice Springs, it will be essential to set up an outdoor program. Two residential outdoor garden options have been considered:

- Garden outdoor (SR general) program; and
- Garden outdoor (high users targeted) program (which will rely on the set up of the 'SR general' program)

Similar to the outdoor water efficiency initiative set up by the Water Corporation in WA, the 'SR General' program will include the set up of a foundation program that seeks to raise public awareness on outdoor watering practices and suitable plant species. The foundation program would involve close liaison with the existing local garden industry to tap into available expertise and enable the creation of consistent up to date information on how to save water in an arid zone. A demonstration garden would be set up either in a prominent position such as the centre of town (e.g. on Alice Springs Town Council, ASTC, maintained land), at a series of locations in town to provide an arid garden trail (which could potentially reach more people), or adjacent to existing garden interest areas such as garden centres. Two existing demonstration gardens are located in relatively remote locations, the airport and the power station, with the power station demonstration garden having fallen into disrepair. A more centrally located, informative demonstration garden/s could reach more local people including home owners, tenants, school children and tourists, thus raising general awareness and interest in water efficiency.

A number of schools are currently involved in setting up water efficient outdoor areas (refer to Section 2.3.3 ' Water Wise NT Schools Program'), which could be incorporated into the foundation program. In addition, water efficiency tips/brochures/promotions could be provided at key locations such as ALEC, the Olive Pink Botanical Gardens, garden centres, PW/DIPE offices, the ASTC offices and irrigation specialists' centres with at least one member of staff being able to provide additional advice to interested customers having participated in a specialised accredited training session. Additional information on changing watering regimes/water efficiency tips/latest promotions could also be posted in the local newspapers, on the radio and provided by letter drop at specific times of the year. The foundation program would require general restrictions to be implemented such as complete bans on the use of irrigation systems during peak evaporation times during the day in the summer months. Such restrictions would need to be enforced by using fines or other penalties.

As part of the 'SR General' Program customers would be offered a low cost visit to their home by a water efficiency landscape advisor. The advisor would visit the home at the beginning of the hot season and together with the owner complete an inspection of the garden. The major points to note would include the type of watering system (e.g. fixed, pop up) and any water saving devices (e.g. tap timers). Where these devices are in place the advisor would confirm with the owner how they currently use the item and together they would carry out routine maintenance including flushing of lines and unclogging of drip lines. Where these are not in place, the advisor could provide free devices including tap timers, drip irrigation system components, and rebate vouchers for the purchase of native plants, mulch and moisture sensors up to a maximum value per household. A second shorter visit would be offered at the end of the hot season to assist customers to for example readjust their irrigation equipment and to further discuss water saving practices. The customer would also be provided with a brochure on water saving in the garden and to maintain savings over time would be sent a voucher annually for water saving equipment.

It is assumed this option could achieve savings of 20% of current outdoor garden demand (a saving of approximately 93 kL/hh/a).

The 'High Users Targeted' Program would be similar to the 'SR General' Program but specifically target high water using SR properties. With this targeted approach, it is reasonable to assume that savings will be significantly higher because of the higher average demand and participation would be higher due to a more active approach in approaching the customers (e.g. calling individuals and identifying the significant financial savings they could obtain by participating in the program). In this option higher value vouchers would be provided during the first visit and in each year to maintain savings.

A saving of 25% of outdoor garden demand has been assumed. When looking at the demand of the top 20% of customers from available customer meter readings provided in the Stage I & II analysis, a saving in the order of 350 kL/hh/a could potentially be achieved.

Pool Cover Rebate

This option offers a subsidised pool cover and communicates the advantages of using a cover, especially during the summer months, to reduce evaporation losses. To reduce costs for this option, the rebate would be offered to those participating in the two outdoor garden programs. This would also minimise the risk of 'free riders' (participants who already have a pool cover and who wish to replace it).

A saving of approximately 80 kL/hh/a has been assumed.

Cooling Alice Evaporative Air-conditioner Program

The 'Cooling Alice' Option involves a communications campaign to encourage residents to use their evaporative air conditioner in the most efficient and effective way possible. The communications strategy would involve developing a brochure detailing maintenance steps for managing an air conditioner, including simple steps such as providing adequate ventilation by opening doors and windows at appropriate times. The brochure would be sent to all households with their pre-summer water bill together with a voucher for a subsidised air conditioner maintenance service visit (to be redeemed before Christmas). The service technicians visiting each household would be trained to use the opportunity to talk to residents about how regular maintenance will save them water and cool their houses more effectively.

An additional option considered will be to target all Public Houses in a similar way. This assumes full participation due to the Government incorporating the visit into standard maintenance practices of existing properties. The Public Housing maintenance crew already adjust air conditioners at the beginning of each season (Turner et al, 2003, Vol II p16) in their MR properties. The maintenance procedures, bleed off setting and advice given to householders would be reviewed as part of this option.

A saving of approximately 20% of evaporative air conditioner usage is assumed (a saving of approximately 11 kL/hh/a).

3.3.3 Other Residential (existing properties)

Pine Gap

Similarly to public housing, Pine Gap manages a substantial number of the SR and MR houses in Alice Springs (4.6% and 10% respectively, Turner et al 2003) and thus provides an opportunity to deal with one property manager responsible for a large number of houses. Analysis in the Stage 1 & II report revealed that the SR Pine Gap properties have a significantly higher water demand than the average SR demand (which may be in part due to higher than average occupancy ratios according to Pine Gap representatives, Turner et al 2003 App I) and thus provide a greater opportunity for savings.

It is suggested that targets be established for these SR and MR properties and steps taken to ensure that demand is reduced to equal or less than the average demand per property in Alice Springs. Funds would be provided on a per property basis in an individualised manner to achieve these savings through innovative steps as deemed necessary by audits. It is likely that although some devices have been fitted in the Pine Gap households, they are not achieving the anticipated result for a number of reasons. For example, it is known that many of the Pine Gap households have been fitted with flow controllers on the showerheads, which restrict flows to approximately 10 L/min. However, research indicates that when such devices are fitted on a standard efficiency showerhead (designed for flows up to 21 L/min) that the quality of the shower is often compromised and customers may resort to removing the device. It is often better to invest in well designed AAA-rated water efficient showerheads (designed for lower flows). These will generally be more acceptable to householders and are more difficult to remove once installed. Another example is when automatic irrigation systems are installed in gardens. When well designed and used efficiently such systems can dramatically reduce outdoor water demand. However, if set up and managed incorrectly they can lead to significant water demand increase.

This option would be designed so that the WEP Team would consult with Pine Gap housing management representatives and investigate what has been implemented and what needs to be done to achieve a target level of less than average Alice Springs household demand in terms of both indoor and outdoor water demand. Details of the analysis of individual households undertaken during the Stage I & II analysis, could be provided to the Pine Gap housing managers to assist in indicating households with above average demand. These households could then be targeted by the Pine Gap housing managers for both structural changes (e.g. retrofitting of devices) and behavioural changes (e.g. discussions with the residents on how water is currently being used in the home and discussion around how to reduce this). The Pine Gap housing managers would then ensure that all new houses and refurbishment of houses use the most appropriate water efficiency devices, all new residents receive information on water efficiency practices, outdoor water efficiency is regularly checked and modified and on going review of water records becomes embedded in the management of the Pine Gap housing managers management planning.

An average saving of approximately 330 kL/hh/a has been assumed for Pine Gap households.

Town Camps & Aboriginal Communities

This option would see the WEP Team liaising with groups already working in the Town Camps and the surrounding Aboriginal communities of Amoonguna and Iwupataka. Given that established relationships exist between advisors and residents in the camps, it is recommended that funding is provided directly to those groups undertaking the maintenance work following training in water efficiency and the objectives of the overall WEP. The funding should be put into a combination of water efficiency measures including retrofitting high quality and robust water efficient devices and used in education/communication initiatives, as determined by both the long-term advisors in the area and the WEP Team following informed discussion. PW assistance with leakage detection and rectification in the more remote locations of Amoonguna and Iwupataka would also be required.

The option would require submissions from property managers or groups already working in the Town Camps to the WEP Team. The submissions would need to include details of what is proposed and the evaluation steps to be undertaken after implementation. To assist in evaluation, PW would need to establish effective metering before implementation. Considering the difficult social issues in many of the Town Camps and Aboriginal Communities, the WEP Team and property managers would need to work closely to assess the immediate and ongoing effectiveness of the program and how to modify the program to achieve ongoing savings that may require further investment.

Savings associated with the program are estimated to be approximately 10% of current demand. It is assumed that the collaborative nature of this option would enable embedding of water efficiency management practices in the management of the individual Town Camps and Aboriginal communities.

3.3.4 Commercial/Industrial (C/I)

From assessment of the customer water meter database three separate programs from the C/I sector have been developed: a general program; a program concentrating on the top 40 high water users; and a program specifically for the hotel sector, which is large in Alice Springs. These three programs are mutually exclusive and can therefore be considered independently.

General C/I Water Efficiency Program

For the general C/I sector there are currently over 600 properties using on average approximately 1 ML/property/a (Turner et al, 2003). This option would involve a broad water efficiency advertising and education campaign, development of water efficiency brochures and training of water efficiency staff to conduct audits and structural modifications in individual properties (e.g. retrofits and outdoor garden modifications). The program would tap into both structural and behavioural water savings through ongoing liaison with the customers and assistance in the investment of structural changes. Management and action plans would need to be developed for each property to enable sign off after implementation and to assist in evaluation of savings. Savings of between 20 and 40% are often obtained when both structural and behavioural measures are used in the C/I sector and combined with economic instruments such as incentives.

A relatively conservative saving of 25% has been assumed for this option.

High Users C/I Water Efficiency Program

The top 40 C/I properties with the highest average annual demand in Alice Springs represent 40% of water demand in the general C/I sector and use on average 10 ML/a per property (Turner et al, 2003). Many of these properties have high seasonal water demand variation indicating high outdoor water use. Targeting these top 40 properties could provide significant savings.

This option would involve the large water users being contacted and an arrangement made to conduct an indoor and outdoor audit to identify high water using practices. In consultation with the property manager an action plan would be developed to reduce both indoor and outdoor water demand. Subsidies would be provided for work required with sign off necessary following implementation. Ongoing liaison would be required with these participants to ensure the savings are evaluated and maintained.

A saving of 35% of the top 40 C/I properties participating has been assumed for this option.

Hotels Program

Of the 50 tourist accommodation establishments in Alice Springs, 17 represented 82% of the hotel sector water demand (564 ML/a) between 1993 and 2000 (Turner et al, 2003). By targeting this relatively small number of properties, a significant volume of water and wastewater could be saved.

This option would combine indoor and outdoor water efficiency and involve establishing management level sign off of an action plan developed in consultation with the hotel. The plan would include aspects of staff training (e.g. laundry, cleaning, kitchen practices, ongoing leak detection), indoor efficiency, retrofits of showers/taps/toilets (e.g. displacement devices), outdoor garden advice and subsidies for equipment and materials and communication strategies and materials for guests. This option would result in the need for significant long-term commitment from hotel management. Hence, continued liaison/signoff with the individual hotels would be required to ensure the ongoing checks and training were effective. A mail-out of standard brochures would also be sent to all other hotels (over 30 other properties). These properties would be invited to send participants to a hotel staff training course on how to conserve water in hotel properties.

PW would need to identify the outdoor water meter in the customer database to assist in evaluation of savings or install one if separate meters do not exist. Many of the hotels already have additional outdoor meters and many are in the process of installing them to clarify the outdoor component of their water demand to enable them to reduce their trade waste charges. Outdoor meters are not currently compulsory and those meters on the PW customer meter system are not clearly identified. Hence during the auditing process these meters could be identified and the customer meter database updated accordingly.

A water saving of over 7 ML/property/a has been assumed for this option together with an additional 5% additional saving from the other smaller properties not fully participating in the program.

3.3.5 Institutional

The institutional sector represents nearly 14% of total potable demand and most of the Town Basin non potable demand. Customers include the hospital, schools, ASTC, the airport, gaol and various government offices, which are amongst the largest water users in town. Many of these properties/customer types are known to have leaks, inefficient appliances and large outdoor water usage and thus provide a significant opportunity for saving water. They also present the benefit of only needing to approach a limited number of property managers and ease of implementation due to the potential ownership of the buildings concerned. A further benefit is that the government reaps the water and energy savings in terms of expenditure on a per property basis as a customer and from the point of view of supplying water and energy as a service provider. Government owned premises also present an opportunity to lead by example in terms of reducing water and energy demand and fitting or modifying appliances such as waterless urinals, 4.5/3 L dual flush toilets and efficient AAA-rated showerheads, which introduce the public to new appliances ultimately raising awareness of water efficiency and new technology available.

From assessment of the customer water meter database three separate programs from the Institutional sector have been developed: a general program; the hospital program (the largest water user in Alice Springs); and a program specifically for schools which builds on a program already being implemented in Alice Springs. These three programs are mutually exclusive and can therefore be considered independently.

General Institutional Audit/Retrofit

This option would involve all government properties (average demand per property being 5.8 ML/a according to the WES Stage II analysis) being audited (both indoor and outdoor) and high water using practices identified. Action plans would be developed for each property to reduce both indoor and outdoor demand and retrofits of water efficient devices conducted where appropriate. Typical water saving actions might include: retrofitting of dual flush toilets/tap aerators/efficient showerheads/waterless urinals, replacement of irrigation systems, use of remote controlled water systems, removal of lawn, replacement of plants with arid species, use of additional meters to check leaks, monitoring of evaporative air conditioner/cooling towers, use of bleed off and training of staff managing and working in government buildings to save water. The WEP Team would need to maintain ongoing liaison with the individual property managers to ensure savings are maintained and water saving practices are embedded in property management procedures through development and evaluation of management plans.

The general institutional properties could be one of the first sectors to be targeted in order to trial the auditing and retrofitting procedures and test the effectiveness of promotional materials/brochures/ water saving tips given to staff. Feedback from staff on such materials could significantly improve the effectiveness of materials circulated in the wider community as part of a full WEP.

Hospitals Program

As the single largest water customer (using approximately 134 ML/a according to WES Stage II analysis), the hospital would be targeted for specific assistance. A DPWS audit was conducted on the site in 1998, which identified significant opportunities to reduce base flow and improve both internal and outdoor water efficiency. However, it is believed that little if any of these recommendations have been implemented since the audit took place. This property therefore provides significant potential in terms of providing both indoor and outdoor water savings.

As with the general institutional option, indoor and outdoor end uses would be investigated and retrofitting or modification carried out where necessary on end uses such as taps, showers, toilet and washing machines as part of an action plan. Leaks would be investigated and the current management practices associated with cleaning, laundry facilities, outdoor irrigation practices and cooling maintenance would also be investigated. A management action plan would be set up to ensure management is in line with best practice and ongoing liaison and evaluation would be undertaken between the hospital and WEP Team to ensure savings are maintained and can be evaluated. The use of sub metering and recording of sub metering on such a large property would be advantageous to manage the significant base flow which was found to be 24% during the 1998 audit.

A saving of 25% has been assumed for this option. Additional potential savings associated with reactivating the onsite Town Basin bore have been considered under the Town Basin options discussed in Section 3.5.2.

Waterwise NT Schools Program

As indicated in Section 2.3.3 a number of the 18 or so schools and colleges in Alice Springs are currently participating (to varying degrees) in the existing Schools Program where funds of up to $3,300 (including GST) have been provided by government to each school participating in the program to assist in water efficiency initiatives. A number of schools have also been able to obtain additional funds from other sources and in-kind support. The schools program developed as part of this Study would aim to build on the NT Waterwise program by allowing additional funds to be made available.

A number of audits were conducted by DPWS in 1998 (refer to Appendix E of Turner et al 2003). These audits identified significant potential savings associated with high base flows (indicating leaks), inefficient equipment and high outdoor water demand. Although such potential savings were identified little implementation was carried out to achieve these potential savings, which is likely to be due mainly to a lack of government investment to assist individual schools.

In this option the WEP team would continue establishing a relationship with all schools and colleges in Alice Springs. Audits would be conducted to identify where potential savings are available and retrofits undertaken on taps, single flush toilets and inefficient urinals etc. where appropriate. Average potable demand for outdoor water use in schools is estimated to be as high as 50% with additional outdoor water demand being satisfied by Town Basin supplies. This demonstrates significant demand and illustrates a need for efficient watering practices. As part of the program a garden specialist would visit each site to advise on efficient watering practices (duration, timing and frequency), equipment such as moisture sensors would be provided and advice on reducing lawn area, use of native plants and mulch etc. provided. To avoid leaks, sub meters could be installed and regularly read and monitored on end uses such as air conditioners/cooling towers and outdoor end uses. The audit, retrofits and associated actions would be developed as part of an ongoing management action plan to enable sign off on actions and ongoing evaluation and monitoring of savings.

In addition to structural and management changes, develop of a curriculum package to assist in further student/staff behavioural changes would also be beneficial. For example at least one class in each school each year could undertake a project on water efficiency around the school with activities including: monitoring meters around the school associated with irrigation systems, evaporative air conditioners, kitchen usage; and assessing trends to observe seasonal variation and identify leaks. This would raise awareness in the school and allow children to discuss water efficiency with their friends and parents at home having gained practical knowledge around school. There is currently a drive to incorporate more environmental issues into the school curriculum (pers com Robbie Henderson, NRETA) and thus this represents an opportunity to embed water and energy efficiency into the curriculum.

Savings for this option have been estimated based on current average potable demand per property. Savings of approximately 5.5 ML/property/a have been assumed based changing both indoor and outdoor appliances. It is likely that savings could also be achieved through increased efficiency in the use of non potable Town Basin supplies resulting in the limited Town Basin supplies being able to offset additional potable water demand at both those sites that are already linked and those that could potentially be linked to the Town Basin system. Options considering further use of the Town Basin for this customer type are discussed in Section 3.5.2.

3.4 The System

3.4.1 Leakage Control and Pressure Management

Active leakage control and pressure management are emerging as one of the most cost effective water efficiency options for urban water management. In addition, local and international experience indicates these two aspects need to be considered in tandem. The potential for reduction in demand from these options is highly dependent on local circumstances, including age and condition of reticulation assets, pressure and pressure variation and existing maintenance programs.

Establishing the level of non revenue water (NRW) is a key aspect of understanding the level of losses and ultimately ascertaining the potential for leakage reduction and pressure management. As discussed in Section 2.3.3, during 2002/03 there was a significant program of meter replacement in Alice Springs, which has reduced the level of NRW, and should allow an improved assessment of real losses. Also during this period there was activity in relation to leakage detection, including a visit by a specialist from Darwin, although no report or data is available from this activity.

The limited availability of reports or data on the analysis of NRW makes estimates of the costs and benefits of a leakage reduction and pressure management program difficult. However, this is an important area, with significant potential, and therefore a preliminary assessment has been included in the analysis. Estimates of the cost and yield of such a combined program have been based on example data from Sydney and the Gold Coast. It is recommended that further detailed assessment is undertaken for to determine appropriate values specifically for Alice Springs.

In Sydney, as part of the leakage control program, a total of 56 zones and 8,405 km of mains were tested over a four year period to 2002/03, representing 38% of the overall system of 22,000 km (SWC 2003, p27). The total cost was approximately $440/km of main tested, and the cumulative water savings up to that point were estimated at 12,373 ML/a (SWC 2003, p70). To maintain savings from an active leakage detection program requires continual investment, to keep checking mains. Therefore if a similar program were conducted in Alice Springs, after the initial investment to check all 372 km of mains (say, approximately $200,000) there would need to be an ongoing investment sufficient to cover checking the entire mains, say, every four years, equivalent to approximately $50,000 per year.

Pressure management in the Gold Coast region is estimated to cost $550,000 (Wide Bay Water 2005, p5), which on a pro-rata basis of connection numbers would cost less than $35,000 in Alice Springs. Similarly, a large scale pressure management program in Sydney is planned to cost $7 M per year over the next 6 years (SWC 2003, p47). Again on a pro-rata basis of connection numbers this would cost less than $35,000 per annum. Pressure management is highly dependent on topography and context, and Alice Springs has a relatively simple system configuration and medium pressure of 45m. Assuming a pressure reduction program was rolled out in Alice Springs over 2 years and using similar figures to those for Sydney and Gold Coast, that generally have more complex systems, this could potentially result in a cost of approximately $200,000 as an initial investment. It is also assumed approximately 10% of this cost would be required as an ongoing investment per annum and management would be required on an ongoing basis for both the leakage detection and pressure reduction programs.

Savings of approximately 35% and 15% of CARL minus UARL (i.e. savings of approximately 380 ML/a and 163 ML/a, refer to Section 2.3.3 for further details on current CARL and UARL) have been assumed for these two programs respectively. Both the costs and savings need to be investigated in more detail for Alice Springs. These costs and savings are preliminary estimates only and thus to be considered as 'place-holders' while further investigations are undertaken by PW.

Recommendation 3.1

Although options relating to leakage detection and pressure reduction have been developed as part of Stage III of this Study, there is little data on the potential costs and savings of such programs in Alice Springs and therefore data from other Australian cities has been used to provide preliminary costs and savings. Considering the potential of these options, it is recommended that PW undertake an investigation of the leakage detection and pressure reduction costs and savings specifically for Alice Springs, as a matter of priority.

3.5 Regulations and Source Substitution

3.5.1 Regulations & Building Controls

Minimum Water Efficiency Performance Standards (MWEPS)

Minimum water efficiency performance standards (MWEPS) for appliances are one of the most comprehensive, far reaching and cost effective means of securing appliance water efficiency. MWEPS ensure that all appliances and plumbing products purchased and installed in new and refurbished households are water efficient and that no appliances below a specified water efficiency level can be bought or installed. These standards can be used for appliances such as showerheads, tap regulators, toilets, washing machines, dishwashers and garden irrigation systems. Mandatory labelling of some water using appliances and fixtures (showerheads, toilets, washing machines, dishwashers, taps and urinals) came into effect nationally in 2006. This will need to be extended to mandatory standards at a national level to have the required effect. The NT Government, as with the other States and the ACT, can take a role in pursuing this objective at the national level.

This option assumes that MWEPS are in place for showerheads, tap regulators, toilets and washing machines by 2010 and thus capture all new houses constructed after this date, as well as all those houses that are refurbished. For modelling purposes and to ensure no double counting of savings is included, the MWEPS option currently only includes the savings associated with washing machines, which have been assumed to save approximately 24 kL/hh/a (pers com Frank Spanninks, SWC). Some of the savings associated with showers, taps and toilets are included in individual options such as the residential indoor retrofit programs. As individual fixtures put in under the retrofits are replaced over time (appliance life expectancy of between 10 and 14 years) the MWEPS ensures that they will be replaced with efficient equipment in the future, thereby locking in savings for the residential retrofit type options.

Residential Building Controls

A major opportunity for more innovative steps to reduce water use is available to the community in the form of new developments. Planning controls are now in place in NSW under the Building Sustainability Index (BASIX) in which regulations are used to enforce water efficiency in new buildings. The NSW State Government is now currently in the process of extending the regulations to existing households at point of sale[16]. In addition to BASIX various councils have implemented water

[16] NSW State Government has recently introduced the Building and Sustainability Index (BASIX), which requires energy and water efficiency savings (40% reduction compared to average for single residential households) in all new homes (NSW Government, Energy Directions Green paper, December 2004, p16). Similar requirements are being imposed on multi residential properties and on all residential alterations (RetroFIX) and additions throughout NSW by 2006. BASIX is a web-based planning tool that measures the potential performance of new residential dwellings against a range of sustainability indices and enables individuals developing a property to choose which measures they wish to implement (http://www.basix.nsw.gov.au/information/about.jsp).

saving requirements within their jurisdictions. There is therefore significant opportunity to use some form of regulation in the NT, and if necessary at the localised level of Alice Springs, to ensure that stipulated water efficiency and energy efficiency levels are required for all new properties and if possible at point of sale.

In this option for example a planning control would be developed and/or the building codes modified[17], requiring the installation of water efficient fixtures in all new residential developments. The control would likely include a requirement for AAA-rated showerheads, flow regulators in taps, 4.5/3 litre dual flush toilets. Other areas of water efficiency that could be combined would be mandatory annual evaporative air conditioner maintenance by an accredited service agent and as part of the design of a household, the positioning of the evaporative a/c units to minimise exposure to full sun and take into consideration accessibility for maintenance. In addition, a requirement for the installation of a water efficient washing machine (usually applicable only in a MR context where laundries may be part of the development) or a minimum efficiency points score attained, based on a landscape plan submitted to the regulatory authority where the principles of xeriscape are utilised. Inspection of plans and the constructed property would be required by the NT Government to ensure the proposed water efficiency measures are incorporated.

A saving of approximately 150 kL/hh/a has been assumed for this option based on both indoor and outdoor water savings (assumes a 25% reduction in outdoor demand though better design of outdoor space). A participation rate of 50% has been used for this option to enable the costs of a ‘Smart Growth’ option to be compared (refer to section 3.5.2).

Non Residential Building Controls

A similar non residential planning control could be developed in Alice Springs involving a points system. The system could be designed to require new developments to prove that they have incorporated water efficiency measures, saving 40% relative to current per property demand of similar establishments. A system where the NT Government provides advice at the planning stage could be adopted to assist in ensuring that water efficiency is incorporated at the planning stage. Qualified inspectors would then visit each property after construction to ensure the water saving equipment and design proposed has been incorporated.

3.5.2 Source Substitution

New Smart Growth

With the recent release of land for residential blocks as part of Larapinta Stage 4, approval for the subdivision of two lots on Ragonesi Road, south of Heavitree Gap and future planned land releases there has been a push to incorporate sustainability into residential developments (NT Govt Discussion Paper on ESD). The term ‘ecological sustainable development’ has a variety of definitions, encompassing a number of broad concepts. The creation of ESD guidelines for the arid region will assist developers in the design and construction of new residential developments that incorporate ESD principles specifically for an arid zone.

A full assessment of how water efficiency and source substitution (use of rainwater tanks, greywater systems, third pipe reuse and Town Basin supplies) in new subdivisions/large developments to minimise potable water demand and effluent production is not currently available for Alice Springs. Hence a preliminary estimate of water savings and typical costs has been developed from other limited available sources. Further investigation into the potential of this option is required especially when considering how properties that reduce the quantity of potable water required and effluent entering the PW system could be used in constrained areas such as the northern section of Alice Springs.

[17] The NT Government would need to determine the best regulatory method to achieve the desired outcomes. Significant benefits can be attained by considering both water and energy savings in tandem.

ISF are currently involved in a project under the CRC for Water Quality that is assessing the costing methodology of new developments using the principles of ESD, such as Aurora, Pimpama Coomera, Morsen Lakes. The results of this Study will be available in 2007 and are likely to include case study summaries that identify typical costs and savings in such developments. Depending on timing this information could be useful to Alice Springs.

A preliminary estimate of savings for SR households of approximately 285 kL/hh/a has been assumed at a marginal extra cost of $2,500.

Rainwater Tanks (existing households)

Due to the low rainfall in Alice Springs yield from rainwater tanks is relatively low compared to other locations around Australia. Recent modelling undertaken by CSAT indicates that an average yield of less than 25 kL/hh/a might be expected for a 9 kL rainwater tank with a typical connected roof area of 150 m^2 and at least one indoor connection. Due to the low yield and high cost of fitting a rainwater tank this option will have a high unit cost and is not recommended for implementation. The use of rainwater tanks in new developments in combination with other water efficiency measures will both increase the yield and decrease the costs of this option. This analysis has been included in the 'smart growth' options. To assist in comparison with other options an option for rebates provided to existing households has been included in the analysis.

This option involves the provision of a rebate to existing customers to encourage them to buy a rainwater tank and capture the limited runoff from their available roof area. To maximise potential yield the rainwater tank would be required to be connected to a number of end uses in addition to outdoor water usage to assist in optimising tank yield.

Greywater Systems (existing households)

Again CSAT has considerable experience in the use and installation of greywater systems in arid climates and have collected the limited data relevant to Alice Springs.

This option involves providing a rebate to customers for retrofitting greywater systems in existing single residential households to enable greywater from the house to be captured, treated and reused for outdoor purposes. In this option it has been assumed that a greywater system would be able to supply approximately 60kL/hh/a of outdoor demand. This assumes an efficient household in terms of shower and toilet appliances providing the greywater and an efficiency of less than 75% in terms of actually using the greywater produced.

Town Basin Supply

As indicated in Section 2.3.3 there appears to be considerable scope to increase the use of the Town Basin non potable resource to offset potable demand. Two options have been considered:

- Town Basin (existing) – connection of properties to the existing reticulation system.
- Town Basin (expand) – extension of the current system to connect additional properties.

In terms of the existing system, SKM identified a number of domestic and non domestic properties adjacent to the existing pipeline system that could be connected. The WES Stage III Study Team checked available meter readings for the non residential properties to assess the accuracy of the assumptions[18] used by SKM. Only a proportion of the properties could be identified and these have been used for the options developed.

[18] Note, an error was found in the Appendix E table (SKM, 2001), which identifies the assumed non potable water use. The error underestimates the offset of potable water demand.

As mentioned in Section 3.2.5 the hospital (the largest water user in Alice Springs using 130 ML/a[19]) has a bore, which does not appear to be used. Offsetting part of the irrigation component of the hospital demand with the current non potable system or reconnecting the hospital bore could provide significant potential to offset potable demand (65% of the hospital water demand goes to sewer, Turner et al 2003 p 65, hence up to 35% of outdoor demand could potentially be considered for offsetting potable demand).

The 'Town Basin Existing' option includes:

- connection of 27 residential properties (assumed to offset 353 kL/hh/a which assumes that a reduction of 25% of outdoor water demand has been achieved through efficiency initiatives);
- connection of 5 non residential properties (assumed to offset 878 kL/property/a found to be the outdoor component of the properties identified by SKM[20]); and
- reconnection of the hospital bore to enable a conservative estimate of 25% of the hospitals outdoor demand to be met by the Town Basin resource.

Cost estimates for connecting these properties have been taken from the SKM report (SKM 2001) for the residential and non residential properties and the DPWS report (DPWS, 1998, App B) for the hospital. An allowance of 25% has been added to these costs to provide a conservative estimate of costs.

In terms of expanding the current Town Basin system, two schools are planned to come on line in 2006, Sadadeen PS and the Catholic High School[21] (e-mail Alan Whyte, 2/10/05). From available meter reading records, Sadadeen PS and the Catholic High School used approximately 26 ML/a and 20 ML/a in 2000/01 and 2001/02 respectively (considered relatively wet years and thus below average demand). The SKM report (SKM, 2001) mentioned both of these properties when considering potential extension to the current Town Basin system. In addition, SKM also mentioned Centralian College (off Grevillea Street), which available meter reading records indicate had demand of approximately 18 ML/a in 2000/01 and 2001/02. Conservatively assuming 50% of this demand is associated with irrigation[22], these three properties alone have significant potential to offset potable demand. SKM also identified Undoolya Park and Frank McEllister Community Park with estimated irrigation use of 11 ML/a and 15 ML/a as potential areas for extending the current system (SKM, 2001, p61).

The "Town Basin Extend' option therefore includes:

- 5 properties with anticipated savings of approximately 11 ML/property/a

The costs to connect each property are based on the assumptions presented by SKM (SKM, 2001 p61). As with the 'existing' option an additional 25% has been added to these costs to provide a more conservative estimate.

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[19] Unfortunately the SKM report did not mention this as a potential because it indicates the total potable demand is only 31 ML/a (SKM, 2001, p59).

[20] The SKM report (SKM, 2001) assumed that outdoor savings of 2 ML/a could be achieved for properties adjacent to the Town Basin reticulation system. However, from assessment of meter readings made available to the Alice Springs WES team in 2003 the outdoor water demand of the properties identified appears to be less than half of that assumed by SKM.

[21] The Catholic High School is also known as Our Lady Sacred Heart College. In 2003, it was believed this property was already linked to the Town Basin supply, however, both Alan Whyte in recent discussions and the SKM 2001 report (p61) indicate this property is not currently linked.

[22] The DPWS audits (DPWS, 1998) generally show a higher proportion of irrigation although this is complicated by the fact that high base flows due to leakage were also identified (Turner et al, 2003, App E) and it is not understood whether these are still active in the 2000/01 and 2001/02 data.

Each of the new properties connected to the system would be metered to measure consumption and encouraged to utilise the Town Basin resource in preference to potable supplies where possible for outdoor demand.

From investigations undertaken as part of the Stage I & II WES it appears many of the existing customers connected to the Town Basin system still have potential to obtain water savings in outdoor water irrigation through water efficiency measures (Turner et al 2003, p67). Hence increased irrigation efficiency of all existing and potential new customers would enable the 1,040 ML/a Town Basin sustainable yield to be shared across even more customers in the long term. These potential savings together with potential for offsetting other non potable uses such as toilet flushing should be investigated further.

Effluent Reuse

As indicated in Section 2.3.3 there is significant potential for a number of properties adjacent to the reuse pipeline to be connected to the effluent reuse system to offset potable demand. Properties such as: the Desert Peoples Centre (DPC), currently under design/construction and located adjacent to the proposed location of the aquifer storage; and the race course, Yirara College, Garden Cemetery, Old Timers, Blatherskite Park and the RSPCA adjacent to the reuse pipeline passing between the WSPs and the AZRI.

By assessing available water meter readings a number of these properties were found to have large outdoor water demand. Four properties were identified that appear to have outdoor demand ranging from approximately 10 to over 60 ML/property/a.

Hence the ‘reuse’ option assumes that 90% of the outdoor water demand can be met by the Class A reuse water. Connection costs for the adjacent properties will be dependent on the distance of the property from the reuse pipeline and on which side of the road. However, on average the cost to connect such properties is expected to be between $10,000 and $20,000 (pers com Mark Skinner). An average of $15,000 has been used for the connection cost together with $6,500 per property for internal connection to the irrigation system (SKM, 2001, App E assumption plus 25%). Further investigation into connection of these properties and the DPC is required.

Recommendation 3.2

As required under the brief for WES Stage III, a number of source substitution options have been analysed using available data/information to determine their potential costs and savings. Much of this data is limited, and therefore these represent preliminary estimates only. Considering a number of these options have the potential to provide significant water savings, it is recommended that further investigation is undertaken to refine potential costs and savings prior to implementation as follows:

- Smart Growth – Further investigate the potential costs and savings of Smart Growth by working with developers of the current and planned land release areas to pilot ESD concepts and use other literature available on costs and savings as it becomes available.
- Town Basin Supply – Investigate the demand of the residential and non residential properties adjacent to the existing Town Basin reticulation system and associated extension, and increase the accuracy by interrogating the PW customer water meter database.
- Effluent Reuse – Similarly, investigate the demand of the large non residential properties adjacent to the new effluent reuse pipeline more accurately by interrogating the PW customer water meter database. Although not part of the scope of work for Stage III, this has been done to a limited extent by the Study Team with the available customer meter readings. Further interrogation of the database would assist in refining estimated costs and savings.

4 FINANCIAL AND AVOIDED COST ANALYSIS

Before looking at the actual costs and benefits of the Alice Springs WEP in detail it is essential to ensure the economic assessment methodology that will be used and the way in which benefits will be incorporated, is fully understood. It is also imperative that the marginal cost of water for the reference case demand is calculated in order to enable the costs of the individual WEP options to be compared.

The economic assessment should initially be undertaken from the combined perspective of all stakeholders (utility, government and customers), called the total resource cost test. This is the appropriate method for assessing whether the program represents an appropriate investment.

The analysis of costs and benefits includes consideration of program costs, the avoided costs, customer costs, foregone revenue and reduced bills. From such analysis the cash flow for the utility, after implementing a WEP, can be identified. The impact on the cash flow for a utility is determined by the relative difference between the price and the marginal cost. By implementing a WEP an effective transfer payment will result from the utility to customers, which in some cases may need to be compensated for by either a price increase (price pass through), an increase in the fixed charge, a CSO payment or a combination of these measures. By examining the implications for cash flow, it is possible to define a price path that will ensure revenue neutrality for the utility and recover the transfer payment to customers.

Sections 4.0, 5.0 and 6.0 look at these issues in detail.

4.1 Economic and financial assessment methods in the urban water industry

The economic assessment of water service provision examines the costs and benefits from the combined perspective of all stakeholders, including specifically the water utility, government and customers. By identifying and analysing the impacts for all key stakeholders, including costs and benefits to users, suppliers and others involved in water provision such as government and the end users, this approach accurately reflects more cost effective allocations of resources. The quantified costs include the capital and operating costs, foregone revenue, along with costs to water users (residential, industrial, commercial, institutional), and where applicable, non-market costs to the environment, often referred to as externalities. The quantified benefits include the avoided costs from water saved including avoided costs for energy, sewage treatment and pumping costs, and water supply treatment and pumping costs. This is important because reduced water sales due to reduced water demand will lead to lower operating costs and deferred capital costs, which should be included to reflect the real costs and benefits to all involved.

In contrast, a financial assessment of water provision examines the revenue gained from billable water sales and the expenditure incurred by the utility from establishing, operating and maintaining water services. Revenue is a direct function of quantity of water supplied or purchased, and costs are either capital costs (establishment costs spent on water provision infrastructure, including a volume based component) or operating costs (costs over time based upon marginal water demand). The nature of the water provision industry is such that capital costs are often lumpy and occur close to the present, with a large sunk cost component; operating costs are often incurred in the future and are related to the level of water supplied and small. Interestingly, in Alice Springs, capital costs are less lumpy and distributed through time as they relate to augmentation of capital equipment (i.e. deepening of existing bores or drilling of new bores) rather than one-off large capital investments such as a dam.

Implicit in a financial analysis is the assumption that the role of the water business is to supply a commodity, ‘water’, so that increasing the level of supply is a driving consideration of the business by generating greater revenue. However, by recognising the utility as a ‘water service provider’, where demand is for the ‘services’ provided by each end use rather than merely supplying more water, the provision of services which use fewer resources is preferable and in this case reflects a more cost effective use of the community’s resources. By understanding that demand can be influenced through improved efficiency and by giving equal consideration to demand side and supply side options, an economically efficient and balanced suite of demand and supply options can be pursued. These assumptions about services and demand are key to an understanding the internationally recognised best practice principles of least cost planning (LCP) and integrated resource planning (IRP) frameworks.

IRP is an economic assessment method applied widely in utility planning (energy and water) to determine the most cost effective program for implementation. Programs developed as part of an IRP assessment typically include water service provision options that include both the augmentation of water supply and water efficiency programs that reduce demand. The principles of IRP examine the ability of water utilities to influence future demand in recognition of a high cost of supplying water or scarce resources and often highlight that source development through supply augmentation alone may not be the most cost effective solution because of constraints such as reliability, risk, and environmental impact (CUWCC, 2003). By focussing on the services that water provides (sanitation, showers, landscape), rather than the product provided, efficiency outcomes often mean that demand is satisfied with lower resource use, leading to a welfare improvement through greater producer and consumer surplus.

It is important to use the correct evaluation method because it:

- allows the utility to delay and/or reduce capital investment;
- reflects the total costs and benefits to the community of the utility's business operations;
- provides a strategy with the least cost for water service provision based upon the needs of customers; and
- allows for consistent consideration of water supply, reuse and water saving options

4.1.1 Ranking options by unit costs

In this study, options are initially ranked by their unit cost. Once ranked, assessment of the net present value (NPV) of the whole program, or scenario, is used to determine the cost effectiveness. Unit cost in this study is calculated using the metric of levelised cost. This technique enables both demand and supply side options to be compared using an equivalent metric, in terms of unit cost ($/ML, or $/kL). It is defined here in terms of present value $/kL as (White and Howe 1998):

$$L = \frac{PV(costs\ to\ WSP) + PV(costs\ to\ customers)}{PV(water\ saved\ or\ supplied)}$$

where:

- L = levelised or unit cost measured in $/kL
- WSP = water service provider and other stakeholders such as government
- PV (costs) = present value of costs ($) over a given period and at a given real discount rate
- PV (water saved or supplied) = present value of the water actually supplied by a source or saved by a water efficiency option over the same period and using the same discount rate, measured in kL

Calculating unit costs in this manner provides a consistent way of comparing options from the perspective of the utility and other stakeholders. The different perspectives include:

- utility cost (i.e. the costs borne by the utility),
- customer cost (i.e. the costs borne by the customer),

- total resource cost (i.e. the costs borne by the utility, customers and government – comprising of capital and operating costs), and
- societal cost (i.e. including the indirect costs, or externalities)

This cost analysis also includes benefits, such as avoided costs.

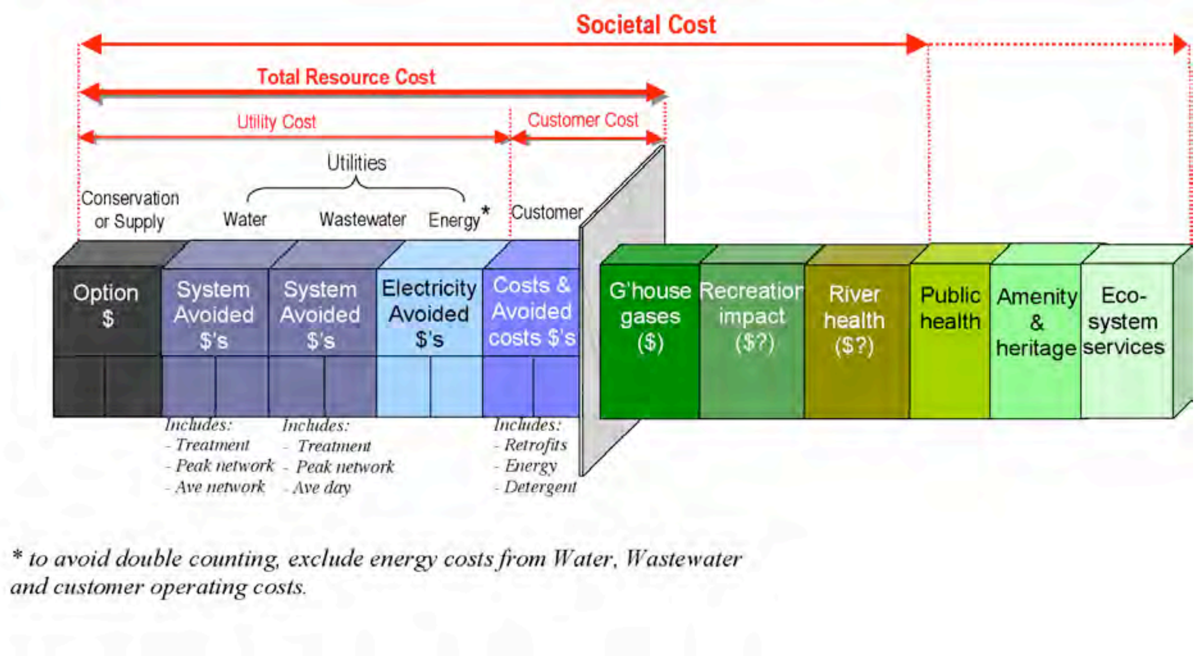
The total resource cost and societal cost tests are employed to assess the cost effectiveness of a supply or demand side/water efficiency option from a whole of community perspective. The total resource cost and societal cost differ in that the societal cost includes externalities.

Applied to water service provision options the levelised or unit cost represents the cost effectiveness of the option from the combined perspective of the utility, customers and government. This analysis allows a consistent comparison of options based upon the unit cost of alternatives in dollars spent to obtain an additional kL of water to meet demand. Since water efficiency options and new or expanded water supply are alternatives as a means of meeting demand, the cost effective approach is to select options with the next lowest unit cost, thereby maximising producer and consumer surplus.

4.1.2 TRC and Utility perspective

The total resource cost includes the financial costs to the utility, other agencies and the customer and is the appropriate method for ranking options and deciding the order in which they should be implemented to maximise cost-effectiveness. Calculating the unit cost from the utility perspective, however, requires measurement of the financial impact of each option or scenario on the utility, including the impact of foregone revenue from those options that reduce water sales and the associated avoided costs. When combined with customer costs, we can determine the total resource cost, and by including at least, a value for the GHG emissions figure we can obtain a minimum estimate of the societal cost. In WES Stage III, analysis has been conducted based upon the utility cost plus the customer cost that can be calculated (i.e. total resource cost) plus those externalities that can be quantified such as greenhouse gases (i.e. moving into societal cost). Figure 4.1 assists in illustrating the different cost tests and how far along the spectrum the WES Stage III has been assessed.

Figure 4-1 Cost Tests



Source – Fane et al 2004

4.2 Calculating the marginal cost of water

The marginal cost of water provision is equal to the marginal operating cost of water plus the marginal capacity cost (capital cost) of water. The marginal cost is the cost of one additional unit of water saved or supplied. The least cost path of water provision is determined by comparing the marginal cost of water supply with the marginal cost of water saving options.

The marginal cost is therefore a measure of cost related to an additional unit of water supplied or saved. It is a function of:

- System wide operating costs including:
  - electricity costs required for pumping water;
  - repairs and maintenance which are volume dependent (i.e. relating to pump hours rather than pump lifetime); and
  - treatment such as chlorine.
- System wide capital costs including:
  - new bores such as capital costs of new bores and deepening of bores to increase capacity at Roe Creek;
  - new mains such as any augmentation or duplication of mains from Roe Creek to Alice Springs; and
  - a new borefield such as Rocky Hill and associated main (Rocky Hill to Alice Springs) required after Roe Creek has reached a depth of approximately 300m.
- Sewage costs including:
  - transport costs associated with the total energy cost of pumping sewage to the wastewater treatment plant and within the lagoon system; and
  - treatment and reuse such as reuse costs that offset potable supply.
- Localised capital cost including:
  - new subdivision constraints on current system which require water and sewage upgrade, for example, the northern area expansion.

Not all of these costs have been able to be characterised and determined fully, which means that this represents a minimum marginal cost for water supply from a total resource cost perspective.

The marginal cost should also include costs that are incurred outside the market, such as externalities, which are more difficult to measure. The following costs should be considered, and where possible included:

- GHG emissions - A carbon shadow price can be used to calculate the cost of greenhouse gas (GHG) emissions generated from water provision.
- Groundwater dependent ecosystems - Groundwater dependent ecosystems associated with the Roe Creek bore fields have potential economic value. A lack of information about this value at this stage precludes estimates about the cost to society that the extraction of this resource creates. When information becomes available it should be considered.
- Resource rent tax - The extraction and utilisation of an exhaustible resource comes at a cost to future generations. Consequently, the use of a resource rent to compensate future generations can be applied to any exhaustible resource. According to Hotelling theory (Miller and Upton

1985; Smith 1981), the price path of the resource should reach a ‘choke price’ equal to the price of the alternative resource at the time of substitution.

To provide an indicative, ‘back of the envelope’ example of the calculation of resource tax rent and associated ‘choke price’, if the alternative resource is a desalination plant, we can calculate the marginal cost of water from the desalination plant, and the time at which this resource would be required due to increased salinity of the original resource, and based upon this information, determine the price path of the resource to exhaustion. An approximate marginal cost for a desalination plant is 0.95 $/kL. This estimate is based upon:

- a marginal capital cost of 0.75 $/kL (the estimated capital cost component of the desalination plant in WA is approximately 0.50 $/kL, we have assumed a diseconomy of scale);
- a marginal operating cost of about 0.17 $/kL (given the desalination of seawater in WA is approximately 0.55 $/kL at 4,000 kWh/ML – about 4 times the pumping requirements for Alice Springs; and 0.02 $/kL extra to get the water to the surface); and
- a GHG emission cost of 0.03 $/kL.

Using this indicative example, if we assume a desalination plant is required in 120 years from the start of extraction (1965) we can map a price path for the current resource to a choke price equal to the alternative (desalination plant) present value marginal cost of 0.95 $/kL. Based on a linear interpolation between 1965 and 2055, the current marginal price has a resources rent component of approximately 0.42 $/kL, which added to the marginal cost of at least 30 ¢/kL, gives a marginal price of over 70 ¢/kL. This is slightly higher than the current sales price in Alice Springs.

4.3 Marginal Cost of Water in Alice Springs

Data is not available for all components of the marginal cost in Alice Springs. Data was available for the operating cost (based upon energy costs of pumping water to the surface and pumping water across the system), marginal capacity cost (although this is currently estimated), imputed cost of greenhouse gas emissions, and sewage pumping costs. The calculation of these costs is documented below.

4.3.1 Marginal Operating Cost

The marginal operating cost is predominately a function of electricity costs from pumping water to the surface (weighted average of 157 m in 2005), and then pumping water 15 km into town. With respect to energy intensity, the PW AMP for 2003/04 (PW, 2005) quotes 1,100 kWh/ML, while previous performance monitoring reports for 2000/01 (AWA, 2002) quote 1,200 kWh/ML.

If we assume 1,100 kWh/ML, then the actual electricity use is more than double that calculated from first principles (about 426 kWh) for lifting one ML of water from a 157 m (weighted average) bore depth (PW 2005). We assume the difference to be pump efficiency (actual pump efficiency less than 100%) plus the transfer of water 15 km to town. Using 1,100 kWh/ML as the energy intensity required for pumping to the surface and distribution, the marginal operating cost for this component is $176/ML in 2005. This operating cost for each additional unit of water will increase over time proportionally to the increase in depth of pumping.

The marginal operating cost through time has been calculated for two reference cases, each starting in 2006 with a water demand of 10,525 ML/a (calculated using the Alice Springs end use model). The first reference case assumes water demand is a constant to 2030, based upon PW projections (PW, 2005). The second reference case projects water demand at a higher level to 2030 based upon the population and end use changes identified as part of WES Stage III. Two Tables are presented representing the two references cases. For each case, Tables 4.1 and 4.2, show: the pump depth, energy intensity (total, pumping to the surface and pumping to town), water demand, pumping costs required to pump water to the surface, the unit cost of pumping (to surface, to town, and total), and the levelised or unit cost (PV $/kL) of pumping.

Table 4-1 Marginal Operating Costs for Potable Water

Year	Depth (m)	Energy intensity of pumping (total) (kWh/ML)	Pumping to surface - energy intensity (kWh/ML)	Pumping to town - energy intensity (kWh/ML)	Costs of pumping to town ($)	Water demand (ML/a) PW	Pumping costs to surface ($)	Unit cost of of pumping to surface ($/ML)	Unit cost pumping to town ($/ML)	Unit costs of total water pumping ($/ML)	Levelised unit cost for pumping (PV $/ML)
2006	159	1,100	542	558	$914,878	10,252	$889,474	87	89	176	
2007	161	1,107	549	558	$914,878	10,252	$900,649	88	89	177	
2008	163	1,114	556	558	$914,878	10,252	$911,823	89	89	178	
2009	165	1,120	563	558	$914,878	10,252	$922,998	90	89	179	
2010	167	1,127	570	558	$914,878	10,252	$934,173	91	89	180	
2011	169	1,134	576	558	$914,878	10,252	$945,347	92	89	181	
2012	171	1,141	583	558	$914,878	10,252	$956,522	93	89	183	
2013	173	1,148	590	558	$914,878	10,252	$967,697	94	89	184	
2014	175	1,155	597	558	$914,878	10,252	$978,871	95	89	185	
2015	177	1,161	604	558	$914,878	10,252	$990,046	97	89	186	
2016	179	1,168	610	558	$914,878	10,252	$1,001,221	98	89	187	
2017	181	1,175	617	558	$914,878	10,252	$1,012,395	99	89	188	
2018	183	1,182	624	558	$914,878	10,252	$1,023,570	100	89	189	
2019	185	1,189	631	558	$914,878	10,252	$1,034,745	101	89	190	
2020	187	1,195	638	558	$914,878	10,252	$1,045,919	102	89	191	
2021	189	1,202	644	558	$914,878	10,252	$1,057,094	103	89	192	
2022	191	1,209	651	558	$914,878	10,252	$1,068,269	104	89	193	
2023	193	1,216	658	558	$914,878	10,252	$1,079,444	105	89	195	
2024	195	1,223	665	558	$914,878	10,252	$1,090,618	106	89	196	
2025	197	1,229	672	558	$914,878	10,252	$1,101,793	107	89	197	
2026	199	1,236	679	558	$914,878	10,252	$1,112,968	109	89	198	
2027	201	1,243	685	558	$914,878	10,252	$1,124,142	110	89	199	
2028	203	1,250	692	558	$914,878	10,252	$1,135,317	111	89	200	
2029	205	1,257	699	558	$914,878	10,252	$1,146,492	112	89	201	
2030	207	1,264	706	558	$914,878	10,252	$1,157,666	113	89	202	
PV					9,795,244	109,764	10,460,248				185

Table 4-2 Revised Marginal Operating Cost for Potable Water using Stage III projections

Year	Depth (m)	Energy intensity of pumping (total) (kWh/ML)	Pumping to surface - energy intensity (kWh/ML)	Pumping to town - energy intensity (kWh/ML)	Costs of pumping to town ($)	Water demand (ML/a) WES Stage III	Pumping costs to surface ($)	Unit cost of pumping to surface ($/ML)	Unit cost of pumping to town ($/ML)	Unit costs of total water pumping ($/ML)	Levelised unit cost for pumping (PV $/ML)
2006	159	1,100	542	558	$915,951	10,252	$888,374	87	89	176	
2007	163	1,114	555	558	$926,041	10,365	$920,573	89	89	178	
2008	167	1,127	568	558	$936,586	10,483	$953,341	91	89	180	
2009	171	1,141	583	558	$948,779	10,619	$990,315	93	89	183	
2010	175	1,155	597	558	$959,541	10,740	$1,025,171	95	89	185	
2011	179	1,169	611	558	$970,295	10,860	$1,060,820	98	89	187	
2012	183	1,183	625	558	$981,169	10,982	$1,097,551	100	89	189	
2013	188	1,198	639	558	$992,287	11,106	$1,135,680	102	89	192	
2014	192	1,212	654	558	$1,003,426	11,231	$1,174,731	105	89	194	
2015	197	1,228	670	558	$1,016,726	11,380	$1,219,849	107	89	197	
2016	201	1,244	686	558	$1,029,024	11,517	$1,263,639	110	89	199	
2017	206	1,259	701	558	$1,040,477	11,646	$1,306,344	112	89	202	
2018	210	1,275	717	558	$1,052,303	11,778	$1,350,956	115	89	204	
2019	215	1,291	733	558	$1,064,385	11,913	$1,397,246	117	89	207	
2020	220	1,309	750	558	$1,078,002	12,066	$1,448,704	120	89	209	
2021	225	1,325	767	558	$1,089,988	12,200	$1,496,923	123	89	212	
2022	230	1,342	784	558	$1,102,043	12,335	$1,546,393	125	89	215	
2023	235	1,359	800	558	$1,114,136	12,470	$1,597,049	128	89	217	
2024	240	1,376	818	558	$1,126,322	12,606	$1,649,075	131	89	220	
2025	245	1,395	836	558	$1,140,290	12,763	$1,707,549	134	89	223	
2026	251	1,412	854	558	$1,152,662	12,901	$1,762,497	137	89	226	
2027	256	1,430	872	558	$1,165,124	13,041	$1,818,895	139	89	229	
2028	261	1,448	890	558	$1,177,676	13,181	$1,876,771	142	89	232	
2029	267	1,467	908	558	$1,190,319	13,323	$1,936,153	145	89	235	
2030	273	1,487	929	558	$1,205,724	13,495	$2,005,956	149	89	238	
PV					10,762,699	120,462	12,817,875				196

Tables 4.1 and Table 4.2 show how the marginal cost of pumping water increases over time, as the pump depth increases. In addition, the data in these two tables highlight how the different demand projections require different pumping depths and lead to different marginal costs by 2030 (i.e. $202 /ML using a constant projection and $238 /ML using the end use model projection).

The assumptions behind Table 4.1 are detailed below. For the PW projection:

- Depth in 2006 is 159 m which is the weighted average depth (PW, 2005) and increases at 2 m per year (pers comm. Don Pidsley).
- Energy intensity of pumping is assumed to be 1,100 kWh/ML in 2006 (PW, 2005) and increases relative to the increase in energy intensity from pumping water to the surface.
- The energy intensity of pumping water to the surface increases as the bore depth increases. It is calculated by the lift height (m)*9.81 divided by 3.6; at an assumed pump efficiency of 80%. In 2006 this equals 542 kWh/ML.
- The energy intensity of pumping to town is assumed to be constant and is the difference between the total energy intensity and the energy intensity of pumping to the surface in 2006. This equals 558 kWh/ML.
- The cost of pumping to town is calculated by the energy intensity of pumping to town*water demand*$0.16 (the cost of electricity/kWh, pers comm. Don Pidsley).
- The cost of pumping to the surface is calculated by the energy intensity of pumping to the surface*water demand*$0.16 (the cost of electricity/kWh, pers comm. Pidsley)
- The unit cost of pumping to the surface is calculated by the cost of pumping to the surface divided by the volume of water pumped.
- The unit cost of pumping to town is calculated by the cost of pumping to town divided by the volume of water pumped.
- The addition of the two unit costs of pumping is equal to the total unit costs of water pumping which is equal to the marginal operating cost.

For the revised projection Table 4.2, calculations and assumptions are the same with the following exception:

- Depth in 2006 is 159 m, which is the weighted average depth (PW, 2005) and increases relative to the annual change in water demand. It is calculated by dividing the PW projection of water demand by the depth, multiplied by the revised projection of water demand.

4.3.2 Marginal Capacity Cost

The marginal capacity cost is predominately a function of the water related expenditure on new bores and bore augmentation. This expenditure cannot be precisely determined due to operational considerations, however, it is estimated by PW using a borefield model. PW have estimated an expenditure schedule based on a reference case demand of approximately 10,000 ML/a to 2020. This is estimated using a borefield model, which as discussed in Section 2.3.3, has not been updated since 1999. PW intend to update the borefield model, however, in the interim period, modify the borefield outputs for the capital cost projections schedule to 2020 for their Asset Management Plans (PW, 2005).

In the absence of any more up-to-date information, the WES Study Team have based the capital cost schedule on PW derived figures. For the projected capital expenditure from 2021 to 2030, which is required to complete the analysis period being considered, the WES Study Team have extrapolated PW past expenditure estimates to 2030.

The marginal cost calculations are shown using the PW water demand projection. The marginal capacity cost is calculated by dividing the PV water demand by the PV capital cost. Table 4.3 illustrates the marginal capacity cost and expenditure through time. The marginal capacity cost is estimated to be relatively low at $53 /ML

Table 4-3 Marginal Capacity Cost for Potable Water

Year	Capital cost ($'000)	PW Water demand ('000ML)	MC ($/ML)
2006	772	10,252	
2007	-	10,252	
2008	500	10,252	
2009	741	10,252	
2010	600	10,252	
2011	750	10,252	
2012	1,050	10,252	
2013	300	10,252	
2014	-	10,252	
2015	1,350	10,252	
2016	-	10,252	
2017	1,500	10,252	
2018	-	10,252	
2019	-	10,252	
2020	-	10,252	
2021	772	10,252	
2022	-	10,252	
2023	500	10,252	
2024	741	10,252	
2025	600	10,252	
2026	750	10,252	
2027	1,050	10,252	
2028	300	10,252	
2029	-	10,252	
2030	1,350	10,252	
PV	5,793	109,764	52.8

4.3.3 Carbon shadow price

GHG emissions are a cost on society, which currently occur outside the market. They can be valued by using equivalent estimates from similar markets (a surrogate market approach) to generate a shadow price. By converting the energy intensity of operations into CO2-e emissions, we can use carbon values from the EU Emissions Trading System (ETS) to identify a cost to society from GHG produced by provision of water services.

PWC water provision has an energy intensity of 1,100 kWh/ML (PW, 2005, p25), and GHG intensity of energy production at the Ron Goodin plant of 713 kg Co2/MWh (PW, Annual Report, 2004). Accordingly, based on EU ETS current prices (approximately $36/t CO2-e[23]) as the most accurate surrogate market, a carbon costs of approximately $28 /ML can be added to the marginal cost of water supply.

4.3.4 Sewage costs

Approximately 30% of water demand requires sewage treatment and pumping. These costs are related to the volume of water demanded. The sewage costs are calculated at $0.16/kWh*215 to 218 kWh/ML (PW 2005) and therefore equal approximately $35 /ML.

[23] Calculated on EU allowance price of €22.48 (Point Carbon http://www.pointcarbon.com 19/11/05) and exchange rate of $A-Euro 0.6241 (AFR 19/11/05)

4.3.5 Marginal cost

Adding together the components of marginal cost identified, the system has an approximate marginal cost of water of $288/ ML or $0.29/kL, as shown in Table 4.4.

Table 4-4 Marginal Cost of Water

Cost	Estimated value (PV $/ML)	Notes
Marginal operating cost	196	Levelised unit cost using WES Stage III projection
Marginal capacity cost	53	
Carbon shadow price	28	
Sewage costs	10.5	Assumes approximately one third of total unit cost of sewage for each ML of water used.
Total MC	**287.5**	

4.4 Reference case expenditure

The reference case expenditure through time to 2030 can be calculated from the projections identified in Tables 4.1 and 4.2. The NPV of annual capital and operating expenditure to 2030 provides the reference case expenditure. Using the PW reference case of approximately 10,000 ML/a, this is $26 M. Using the revised reference case, determined as part of WES Stage III (i.e. reference case demand rises to approximately 13,500 ML/a by 2030) the reference case expenditure will be closer to $29 M.

Recommendation 4.1

To ensure all water service options are considered using a robust economic assessment method, it is recommended that the ASUWMS Reference Group and PW and NRETA ensure that all future cost assessments undertaken are based on the internationally recognised best practice process of Least Cost Planning/Integrated Resource Planning. Options should be assessed using a total resource cost test and where possible societal cost test, rather than a utility perspective only.

During assessment of previous cost estimates undertaken for the ASUWMS Reference Group, the WES Study Team has noted considerable inconsistency in economic assessment methods used, which causes significant difficulty when trying to compare options from different studies. Using an agreed approach will assist in minimising ambiguity in future.

Recommendation 4.2

Data on the current marginal cost of water has been difficult to obtain for WES Stage III. It is recommended that PW investigate the detailed breakdown of the marginal cost of water as a matter of priority including using the WES Stage III projection assumptions. The current marginal cost of water calculated as part of WES Stage III has been used to determine which WEP options should be taken forward for implementation. If, as is suspected, the marginal cost of water is actually higher than currently estimated this might result in WEP options being deleted from the program unnecessarily, which will be to the detriment of the Alice Springs community.

5 OPTION COSTS & BENEFITS

Having determined the reference case demand for potable water, the options to be assessed, the economic assessment method to be used and marginal cost of the current water supply system, assumptions concerning participation rates, costs and savings of the various options have been determined.

This Section summarises the total costs for each of the individual options described in Section 3.0, ranks the options in terms of unit cost, identifies the benefits of each option (i.e. sewage, energy and greenhouse gases) and identifies four Scenarios to be considered which have been compared against the marginal cost of potable water as described in Section 4.0.

A preliminary assessment of 'who pays' is also considered to assist in potential lost revenue calculations for PW and the NT Government.

5.1 Summary of Options

Table 5.1 provides a summary of the options considered in Section 3.0, their total and unit costs, potential savings in 2010, 2020 and 2030 (the time period considered) together with assumed participation rates. Full assumptions are contained within the EUM/OM. It should be noted that the unit cost (PV$/PVkL) are the total costs for each option independent of 'who pays' and include all costs required for each option such as advertising, marketing, project management, plumbers, training, fixtures and fittings etc. and where applicable ongoing costs to maintain savings.

Figure 5.1 shows the savings that can be achieved for a total PV cost of $12.9 M (approximately 3,000 ML/a by 2030). It should be noted that savings can be increased by increasing the participation rates of a number of the options considered and costs reduced by removing the higher unit cost options. With the current mix of options and participation rates assumed, average potable demand could be maintained at the current level of 10,000 ML/a until approximately 2024.

Figure 5-1 Potential Savings

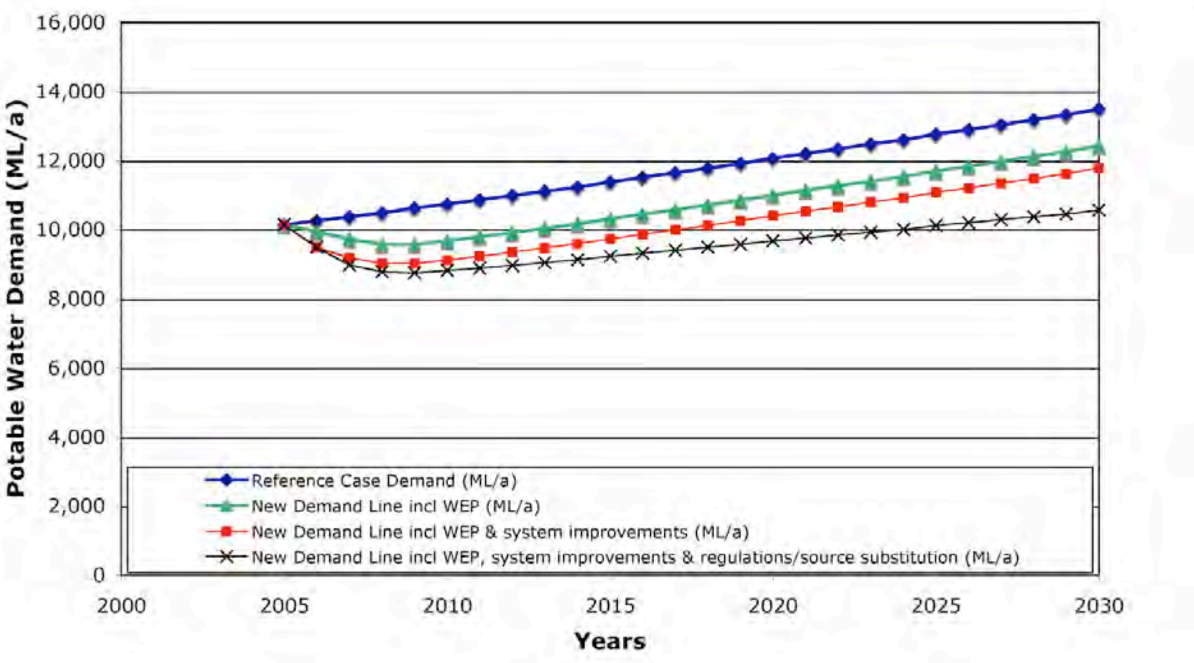


Table 5-1 Summary of Options

Options	No. of Participants	Total PV Cost of Options (PV$)	Unit Cost (PV$/ PVkL)	Yield 2010 (ML/a)	Yield 2020 (ML/a)	Yield 2030 (ML/a)
Customer Water Efficiency Options						
Indoor (SR) retrofit program	1,851	278,684	0.59	53	53	53
Indoor (MR) retrofit program	713	134,789	1.27	12	12	12
Indoor (SR) toilet retrofit program	370	102,790	1.08	11	11	11
Indoor (MR) toilet retrofit program	143	40,510	1.83	2	2	2
Washing machine rebate program	768	142,033	1.12	16	16	16
Public housing indoor retrofit program	833	133,108	0.78	18	18	18
Public housing toilet retrofit program	167	47,241	1.34	4	4	4
Outdoor garden (SR general) program*	1,296	501,050	0.51	121	121	121
Garden outdoor (high user targeted) program*	185	129,980	0.21	65	65	65
Pool cover rebate program	334	227,497	1.04	27	27	27
Cooling Alice residential program	3,111	489,408	1.78	34	34	34
Cooling Alice public housing program	833	135,558	1.76	9	9	9
Pine Gap (SR) program	230	230,661	0.31	76	76	76
Town Camps Program	9	133,514	0.66	24	24	24
General C/I water efficiency program	222	240,783	0.62	53	53	53
High Users C/I water efficiency program	32	454,326	0.47	113	113	113
Hotel program	14	305,514	0.34	107	107	107
Institutional retrofit program	97	522,105	0.46	140	140	140
Hospital program	1	141,472	0.11	130	130	130
Schools program	9	230,696	0.50	50	50	50
Sub Total $		**4,621,720**				
Sub Total Savings (ML/a)				**1,066**	**1,066**	**1,066**
System Options						
Leakage reduction program	1	779,404	0.19	397	439	481
Pressure management program	1	451,489	0.30	163	163	163
Sub Total $		**1,230,893**				
Sub Total Savings (ML/a)				**561**	**602**	**644**
Regulations & Source Substitution Options						
MWEPS	13,827	43,978	0.06	12	147	332
Residential DCP	1,307	161,971	0.30	23	104	195
Non-Residential DCP	162	103,781	0.36	10	58	108
New Smart growth	1,207	1,241,031	1.51	15	171	344
Rainwater tank rebate (existing SR) program	601	2,512,430	21.54	14	14	14
Greywater rebate (existing SR) program	601	2,308,231	7.91	36	36	36
Town Basin (existing)	33	124,238	0.54	26	26	26
Town Basin (extend)	5	461,691	0.93	56	56	56
Reuse	4	88,060	0.09	114	114	114
Sub Total $		**7,045,411**				
Sub Total Savings (ML/a)				**305**	**727**	**1,225**
Totals		**12,898,023**		**1,931**	**2,394**	**2,935**

Note - *The outdoor garden (SR general) program and garden outdoor (high user targeted) program are linked (i.e. The targeted program assumes that the general program would be run in parallel because some of the training and advertising etc. costs that would be needed by the targeted program are included in the general program). All other options are mutually exclusive.

5.2 Ranking of Options

The options have been ranked by unit cost as shown in Figure 5.2 which illustrates the potential savings that could be achieved by the options considered by the year 2010 (approximately 1,900 ML/a). The unit costs of the rainwater tank and greywater rebates are high compared to the other options which are all below $2.00 /kL. Hence to illustrate the unit costs and savings of the other options considered (in 2010, 2020 and 2030) in more detail, Figures 5.3, 5.4 and 5.5 show the unit costs below $2.00 /kL.

Figure 5-2 - Options ranked by unit cost for the year 2010

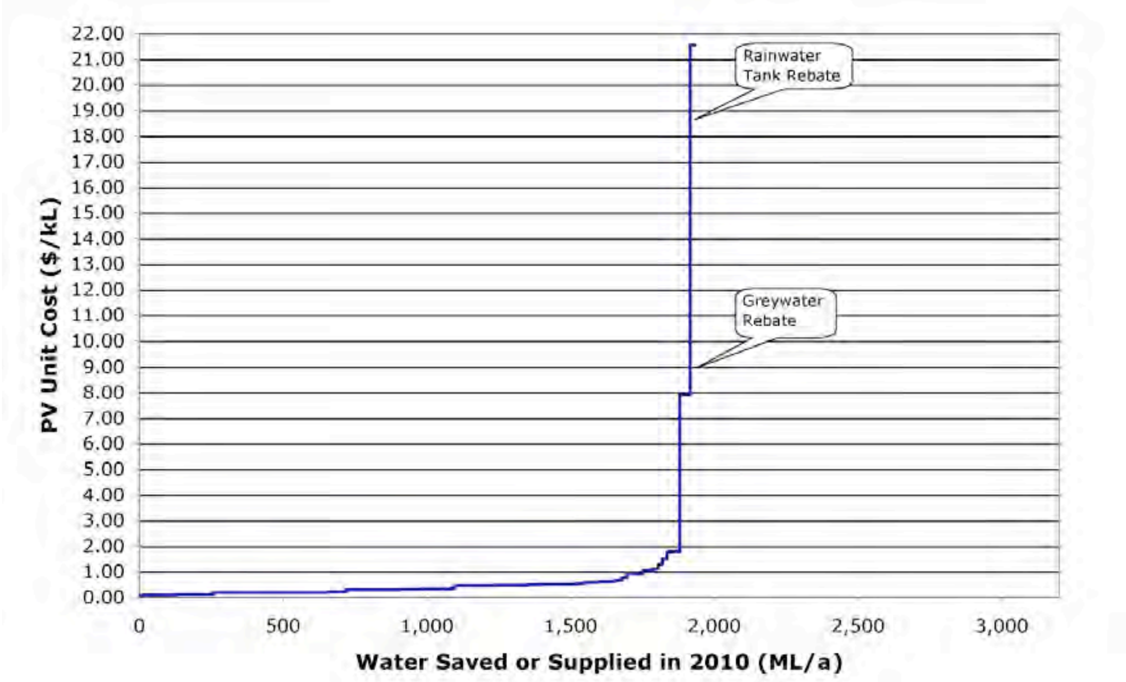


Figure 5-3 Unit Costs and Water Saved or Supplied in 2010

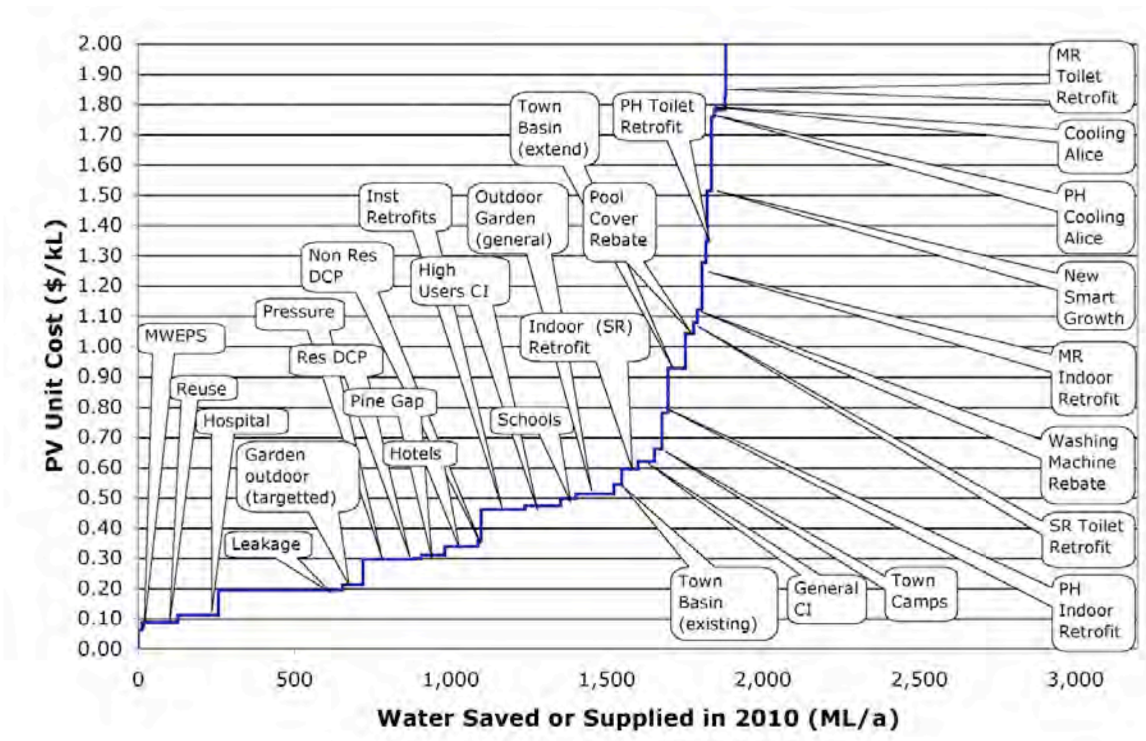


Figure 5-4 Unit Costs and Water Saved or Supplied in 2020

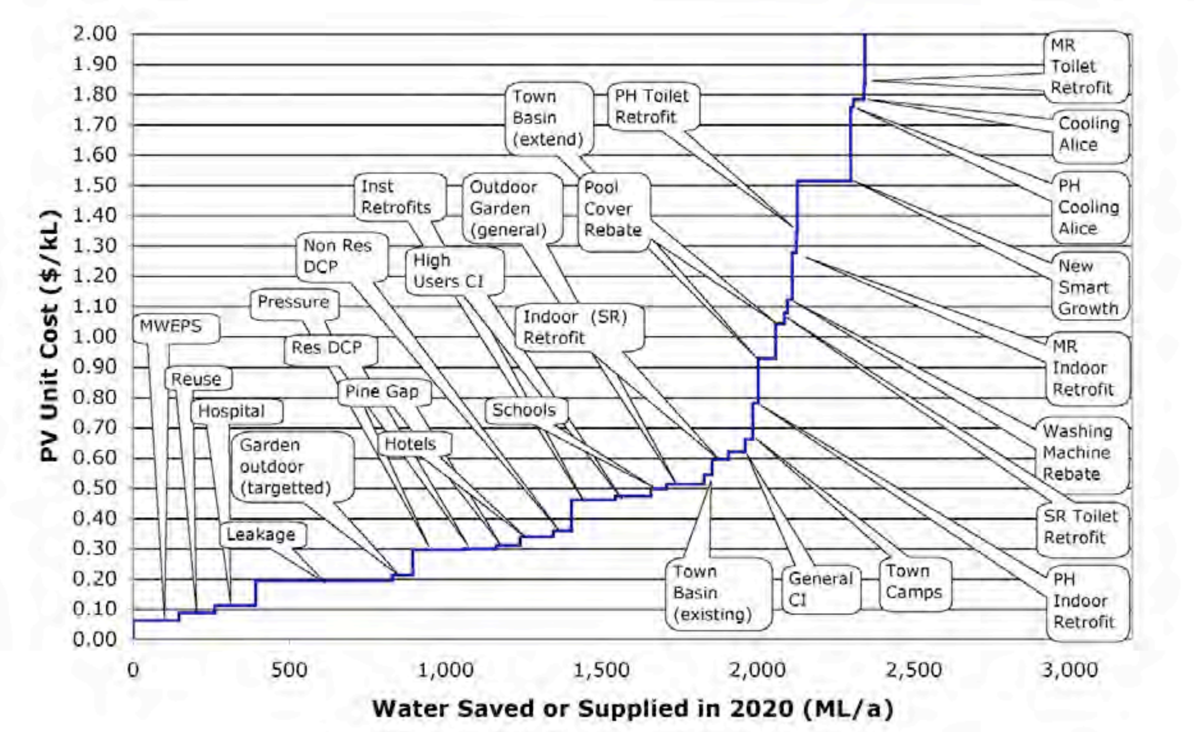
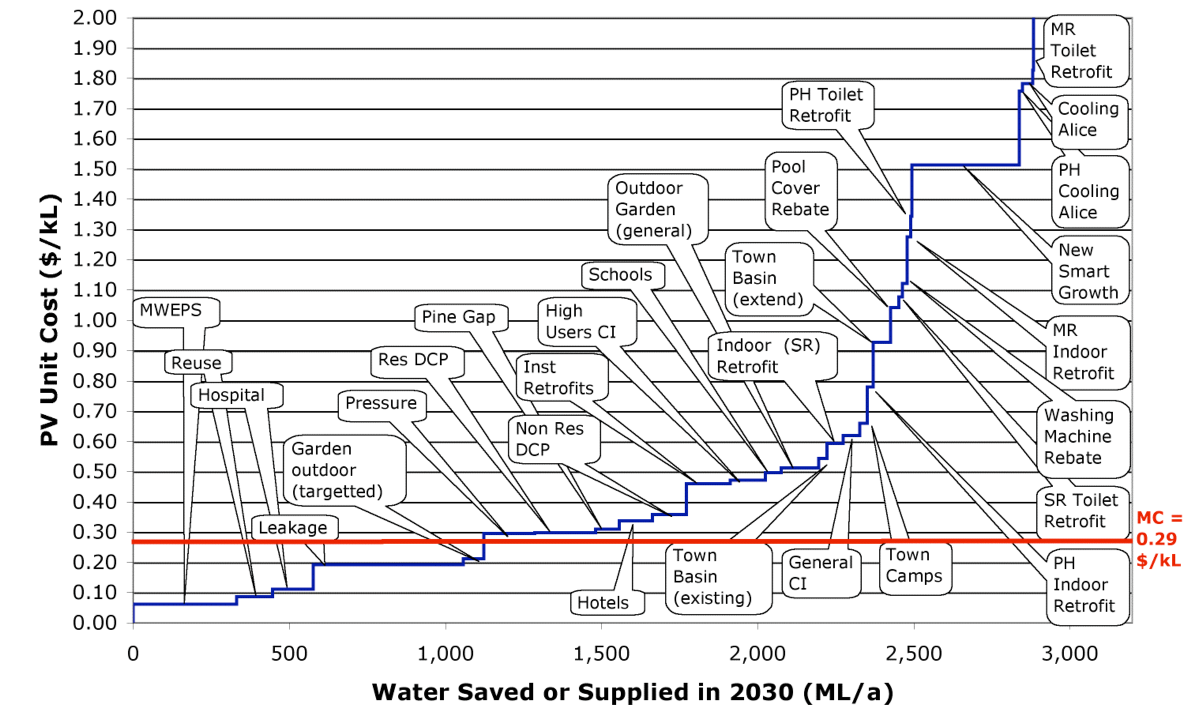


Figure 5-5 Unit Costs and Water Saved or Supplied in 2030



The sequence of Figures 5.3 to 5.5 show how the savings of particular options grow over time (i.e. MWEPS, Residential Development Control Plans and Smart Growth). Figure 5.5 also shows a comparison of the unit cost of the options against the marginal cost of water ($0.29 /kL) identified in Section 4.0. A number of options have relatively low unit costs, less than the unit cost of water, such as the MWEPS, reuse, hospital, leakage and garden outdoor (targeted) programs. These five options alone could potentially provide a saving of over 1,100 ML/a by 2030. It should be noted that a number of the options are dependent on each other. For example, the garden outdoor (targeted) option, with a unit cost of $0.21 /kL, relies on the outdoor garden (general) option with a unit cost of $0.51 /kL. Those options that rely on each other have been considered in the selection of Scenarios discussed in Section 5.4.

5.3 Benefits

In order to assist in determining the Scenarios to be taken forward for consideration the benefits of each option have been assessed where possible. Table 5.2 shows the PV$ total cost of each option, the associated PV unit cost (PV$/PVkL) and the ranking of each option in terms of unit cost. The table also shows five sets of benefits that have been quantified in terms of PV$. On the utility side the PV$ value of reducing: water operating and capital costs, sewage operating costs, and the associated GHGs based on a current market value of $36 per tonne[24], have been quantified. On the customer side the benefits of reducing energy usage associated with hot water have been identified using an energy tariff of $0.14 /kWh (even though the commercial rate is slightly higher at $0.163 /kWh[25]) together with the associated GHG value taking into consideration a large proportion of properties in Alice Springs have solar hot water systems, which reduces the energy intensity of producing hot water.

An additional column (column F) shows the PV$ value of reduced potable water bills to customers based on the current price of water (677 $/ML). This is not included in the analysis on costs and benefits as it is merely a transfer payment between the utility and customers. This transfer payment is assessed later as part of the revenue implications to the utility in the narrower financial analysis considered.

[24] Calculated on EU allowance price of €22.48 (Point Carbon http://www.pointcarbon.com 19/11/05) and exchange rate of $A-Euro 0.6241 (AFR 19/11/05).

[25] http://www.powerwater.com.au/powerwater/customers/tariff_home_power.html accesses 20/12/05

Table 5-2 Summary of benefits for each option

Options	Option Total Cost PV$	Unit Cost PV$/ PVkL	Yield 2010 (ML)	Yield 2020 (ML)	Yield 2030 (ML)	Rank No.	(A) Water Saving Benefits (Utility) PV$	(B) Sewage Saving Benefits (Utility) PV$	(C) GHG Saving Benefits (Utility) PV$	(D) GHG Saving Benefits (Customer) PV$	(E) Energy Saving Benefits (Customer) PV$	(F) Water Saving Benefits in Reduced Bills (Customer) PV$	In Scenario
MWEPS	43,978	0.06	12.18	147.05	331.86	1	189,575	24,888	24,029	73,009	398,209	481,406	2,3,4
Reuse	88,060	0.09	114.21	114.21	114.21	2	253,673	-	28,716	-	-	688,548	2,3,4
Hospital Program	141,472	0.11	130.48	130.48	130.48	3	317,212	29,156	40,815	85,530	466,503	867,644	2,3,4
Leakage program	779,404	0.19	397.29	438.52	480.86	4	1,008,726	-	114,585	-	-	-	1,2,3,4
Garden outdoor (high user targetted) prograr	129,980	0.21	65.46	65.46	65.46	5	152,273	-	17,307	-	-	414,981	1,2,3,4
Pressure Reduction	451,489	0.30	163.37	163.37	163.37	6	380,018	-	43,192	-	-	-	1,2,3,4
Residential DCP	161,971	0.30	22.54	104.37	194.90	7	142,943	3,414	15,890	12,519	68,280	368,012	2,3,4
Pine Gap (SR) program	230,661	0.31	75.93	75.93	75.93	8	184,602	7,831	22,302	28,716	156,625	504,929	2,3,4
Hotel program	305,514	0.34	106.66	106.66	106.66	9	226,526	18,183	28,437	66,673	363,653	612,637	2,3,4
Non-Residential DCP	103,781	0.36	9.51	58.05	107.88	10	76,472	3,041	8,661	4,461	24,330	196,088	2,3,4
Institutional retrofit	522,105	0.46	140.48	140.48	140.48	11	285,367	19,880	35,232	58,319	318,085	769,084	2,3,4
High Users C/I water efficiency program	454,326	0.47	113.43	113.43	113.43	12	240,907	10,105	28,777	14,821	80,840	651,531	2,3,4
Schools Program	230,696	0.50	49.63	49.63	49.63	13	115,440	6,763	14,194	9,919	54,101	314,601	2,3,4
Outdoor Garden (SR general) program	501,050	0.51	121.14	121.14	121.14	14	246,082	-	27,660	-	-	663,208	1,2,3,4
Town Basin (existing)	124,238	0.54	25.65	25.65	25.65	15	56,963	-	6,448	-	-	154,614	3,4
Indoor (SR) retrofit program	278,684	0.59	52.57	52.57	52.57	16	117,044	16,433	15,865	60,256	328,653	317,855	3,4
General C/I water efficiency program	240,783	0.62	53.17	53.17	53.17	17	98,409	4,083	11,626	5,988	32,660	263,225	3,4
Town Camps Program	133,514	0.66	23.83	23.83	23.83	18	50,618	3,539	6,271	5,190	28,309	136,895	3,4
Public housing indoor retrofit	133,108	0.78	18.23	18.23	18.23	19	42,413	5,976	5,769	21,912	119,512	115,585	3,4
Town Basin (extend)	461,691	0.93	56.00	56.00	56.00	20	124,382	-	14,080	-	-	337,612	4
Pool cover rebate	227,497	1.04	27.01	27.01	27.01	21	54,864	-	6,167	-	-	147,864	4
Indoor (SR) toilet retrofit program	102,790	1.08	10.70	10.70	10.70	22	23,819	3,344	3,229	-	-	64,684	4
Washing Machine Rebate	142,033	1.12	15.67	15.67	15.67	23	31,839	4,436	4,283	13,013	70,979	85,808	4
Indoor (MR) retrofit program	134,789	1.27	11.84	11.84	11.84	24	26,357	3,700	3,573	13,569	74,008	71,576	4
Public housing toilet retrofit	47,241	1.34	3.76	3.76	3.76	25	8,742	1,232	1,189	-	-	23,825	4
New Smart growth	1,241,031	1.51	14.60	171.05	344.12	26	218,085	7,179	24,304	26,323	143,572	555,419	4
Cooling Alice Public Housing program	135,558	1.76	9.09	9.09	9.09	27	19,311	-	2,178	-	-	52,228	4
Cooling Alice residential program	489,408	1.78	33.96	33.96	33.96	28	68,993	-	7,755	-	-	185,940	4
Indoor (MR) toilet retrofit program	40,510	1.83	2.48	2.48	2.48	29	5,529	776	750	-	-	15,016	4
Greywater rebate (existing SR)	2,308,231	7.91	36.07	36.07	36.07	30	73,264	13,781	10,423	-	-	197,453	
Rainwater tank rebate (existing SR)	2,512,430	21.54	14.43	14.43	14.43	31	29,306	-	3,294	-	-	78,981	
Totals	**12,898,023**						**4,869,754**	**187,739**	**577,002**	**500,218**	**2,728,319**	**9,337,247**	

Table 5.3 shows the progressive inclusion of the five sets of benefits identified in Table 5.2 in three groupings (A+B, C+D and E) and how these affect the option benefits, net option cost/benefits and cumulative net option cost/benefits of the ranked options in terms of PV$.

In Table 5.3:

- The columns coloured orange (columns 8 to 10) include the PV$ avoided costs of reducing water and sewage supply (columns A & B in Table 5.2).
- The columns coloured green (columns 11 to 13) include the above plus the estimated value of GHG reduction associated with reducing water and sewage supply energy usage and customer hot water energy usage (columns C & D in Table 5.2). These GHG benefits could be claimed by the utility in future if an accreditation scheme similar to the NSW Greenhouse Abatement Certificates NGACs[26] was set up in the NT).
- The columns coloured grey (columns 14 to 16) include the above plus customer energy bill savings associated with reducing their hot water usage (column E in Table 5.2).

To provide an example, the reuse option, which is ranked no. 2 in terms of unit cost, has a program cost of $88,060 (column (4)). In the orange columns, column (8) shows an option benefit of $253,673 gained through the avoided costs of reducing water and sewage, column (9) shows the net cost/benefit of the option ($253,673 - $88,060 = $165,613) and column (10) shows the cumulative net cost/benefit including the above options ($170,485 for MWEPS + $165,613 for reuse = $336,098). This analysis continues down the orange columns until the 31 ranked options are included.

This analysis is continued across into the green columns (columns 11 to 13) and grey columns (columns 14 to 16) where the other benefits are gradually added to the analysis.

By looking at column 10, we can see there is a point at which the cumulative net cost/benefit of the ranked options become negative. This is the point at which the cumulative total costs of the options outweigh the cumulative benefits. Hence for column 10, which considers the avoided costs of reduced water and sewage supplies, this means that options up to and including the schools program (unit cost $0.50 /kL) should be included in a WEP.

Similarly, for column 13, which considers the above plus the GHG benefits, options up to and including public housing indoor retrofits (unit cost $0.78 /kL) should be included in a WEP.

Finally, for column 16, which includes the above plus the customer energy bill savings associated with hot water, options up to and including indoor (MR) toilet retrofits (unit cost of $1.83 /kL) should be included in a WEP.

By taking into consideration the broader spectrum of benefits it becomes evident that more options should be included in the WEP as they provide overall benefits to the community. This analysis has been used to assist in determining the WEP Scenarios to be considered as detailed in Section 5.4.

By assessing the broader benefits to the community we are moving away from a total resource cost test (direct costs) to a broader societal cost test, which will enable the NT Government to determine the most beneficial suite of options to society as a whole.

[26] http://www.greenhousegas.nsw.gov.au/benchmark/future_demand.asp [accessed 21/12/05]

Table 5-3 Summary of Cumulative Benefits

Options (1)	Yield in 2030 (ML) (2)	Cumulative Yield by Ranked Option in 2030 (ML) (3)	Option Total Cost PV$ (4)	Unit Cost PV$/ PVkL (5)	Rank No. (6)	Cumulative Option Total Cost PV$ (7)	Option Benefits (utility) PV$ (8)	Net Option Cost/ Benefit (utility) PV$ (9)	Cumulative Net Option Cost/Benefit (utility) PV$ (10)	Option Benefits (utility + all GHG) PV$ (11)	Net Option Cost/ Benefit (utility + all GHG) PV$ (12)	Cumulative Net Option Cost/Benefit (utility + all GHG) PV$ (13)	Option Benefits (utility + all GHG + customer energy) PV$ (14)	Net Option Cost/ Benefit (utility + all GHG + customer energy) PV$ (15)	Cumulative Option Cost/Benefit (utility + all GHG + customer energy) PV$ (16)
MWEPS	332	332	43,978	0.06	1	(43,978)	214,463	170,485	170,485	311,501	267,523	267,523	709,709	665,732	665,732
Reuse	114	446	88,060	0.09	2	(132,038)	253,673	165,613	336,098	282,390	194,329	461,852	282,390	194,329	860,061
Hospital	130	577	141,472	0.11	3	(273,510)	346,368	204,896	540,994	472,713	331,241	793,093	939,216	797,744	1,657,805
Leakage	481	1057	779,404	0.19	4	(1,052,914)	1,008,726	229,322	770,316	1,123,310	343,907	1,137,000	1,123,310	343,907	2,001,712
Garden outdoor (targeted)	65	1123	129,980	0.21	5	(1,182,894)	152,273	22,293	792,609	169,580	39,600	1,176,600	169,580	39,600	2,041,312
Pressure	163	1286	451,489	0.30	7	(1,634,383)	380,018	(71,471)	721,138	423,210	(28,279)	1,148,321	423,210	(28,279)	2,013,033
Residential DCP	195	1481	161,971	0.30	6	(1,796,354)	146,357	(15,614)	705,524	174,766	12,795	1,161,116	243,046	81,075	2,094,108
Pine Gap (SR)	76	1557	230,661	0.31	8	(2,027,015)	192,434	(38,228)	667,297	243,451	12,790	1,173,906	400,076	169,415	2,263,523
Hotel Program	107	1664	305,514	0.34	9	(2,332,529)	244,709	(60,806)	606,491	339,819	34,305	1,208,211	703,473	397,959	2,661,481
Non-Residential DCP	108	1772	103,781	0.36	10	(2,436,311)	79,513	(24,268)	582,223	92,635	(11,146)	1,197,065	116,965	13,183	2,674,665
Institutional retrofit	140	1912	522,105	0.46	11	(2,958,416)	305,247	(216,858)	365,365	398,797	(123,308)	1,073,757	716,883	194,777	2,869,442
High Users C/I	113	2026	454,326	0.47	12	(3,412,742)	251,012	(203,314)	162,050	294,610	(159,716)	914,041	375,450	(78,876)	2,790,566
Schools Program	50	2075	230,696	0.50	13	(3,643,438)	122,202	(108,493)	53,557	146,316	(84,380)	829,661	200,417	(30,279)	2,760,287
Outdoor Garden (SR general)	121	2196	501,050	0.51	14	(4,144,488)	246,082	(254,968)	(201,411)	273,741	(227,309)	602,353	273,741	(227,309)	2,532,978
Town Basin (existing)	26	2222	124,238	0.54	15	(4,268,726)	56,963	(67,275)	(268,687)	63,411	(60,827)	541,526	63,411	(60,827)	2,472,151
Indoor (SR) retrofit	53	2274	278,684	0.59	16	(4,547,410)	133,477	(145,207)	(413,894)	209,599	(69,085)	472,440	538,252	259,568	2,731,720
General C/I	53	2328	240,783	0.62	17	(4,788,193)	102,492	(138,292)	(552,185)	120,106	(120,677)	351,763	152,766	(88,017)	2,643,703
Town Camps	24	2352	133,514	0.66	18	(4,921,707)	54,156	(79,357)	(631,543)	65,618	(67,896)	283,867	93,927	(39,587)	2,604,116
Public housing indoor retrofit	18	2370	133,108	0.78	19	(5,054,815)	48,388	(84,720)	(716,262)	76,069	(57,039)	226,828	195,581	62,473	2,666,589

Options (1)	Yield in 2030 (ML) (2)	Cumulative Yield by Ranked Option in 2030 (ML) (3)	Option Total Cost PV$ (4)	Unit Cost PV$/ PVkL (5)	Rank No. (6)	Cumulative Option Total Cost PV$ (7)	Option Benefits (utility) PV$ (8)	Net Option Cost/ Benefit (utility) PV$ (9)	Cumulative Net Option Cost/Benefit (utility) PV$ (10)	Option Benefits (utility + all GHG) PV$ (11)	Net Option Cost/ Benefit (utility + all GHG) PV$ (12)	Cumulative Net Option Cost/Benefit (utility + all GHG) PV$ (13)	Option Benefits (utility + all GHG + customer energy) PV$ (14)	Net Option Cost/ Benefit (utility + all GHG + customer energy) PV$ (15)	Cumulative Option Cost/Benefit (utility + all GHG + customer energy) PV$ (16)
Town Basin (extend)	56	2426	461,691	0.93	20	(5,516,505)	124,382	(337,308)	(1,053,570)	138,463	(323,228)	(96,400)	138,463	(323,228)	2,343,361
Pool cover rebate	27	2453	227,497	1.04	21	(5,744,003)	54,864	(172,633)	(1,226,203)	61,031	(166,466)	(262,866)	61,031	(166,466)	2,176,895
Indoor (SR) toilet retrofit	11	2463	102,790	1.08	22	(5,846,793)	27,163	(75,627)	(1,301,831)	30,391	(72,399)	(335,264)	30,391	(72,399)	2,104,496
Washing Machine Rebate	16	2479	142,033	1.12	23	(5,988,825)	36,275	(105,758)	(1,407,589)	53,571	(88,461)	(423,726)	124,550	(17,483)	2,087,013
Indoor (MR) retrofit	12	2491	134,789	1.27	24	(6,123,615)	30,057	(104,732)	(1,512,321)	47,199	(87,591)	(511,317)	121,207	(13,583)	2,073,430
PH toilet retrofit	4	2495	47,241	1.34	25	(6,170,856)	9,974	(37,267)	(1,549,588)	11,163	(36,078)	(547,394)	11,163	(36,078)	2,037,352
Smart growth	344	2839	1,241,031	1.51	26	(7,411,887)	225,264	(1,015,767)	(2,565,355)	275,891	(965,140)	(1,512,535)	419,463	(821,568)	1,215,784
Cooling Alice (PH)	9	2848	135,558	1.76	27	(7,547,445)	19,311	(116,246)	(2,681,601)	21,490	(114,068)	(1,626,603)	21,490	(114,068)	1,101,716
Cooling Alice residential	34	2882	489,408	1.78	28	(8,036,852)	68,993	(420,415)	(3,102,016)	76,747	(412,660)	(2,039,263)	76,747	(412,660)	689,056
Indoor (MR) toilet retrofit	2	2884	40,510	1.83	29	(8,077,362)	6,306	(34,204)	(3,136,220)	7,055	(33,455)	(2,072,717)	7,055	(33,455)	655,602
Greywater rebate (existing SR)	36	2920	2,308,231	7.91	30	(10,385,593)	87,045	(2,221,186)	(5,357,406)	97,468	(2,210,763)	(4,283,481)	97,468	(2,210,763)	(1,555,162)
Rainwater tank rebate (existing SR)	14	2935	2,512,430	21.54	31	(12,898,023)	29,306	(2,483,124)	(7,840,530)	32,600	(2,479,830)	(6,763,311)	32,600	(2,479,830)	(4,034,992)

5.4 Scenarios

This leads to questions around which suite of options should be taken forward for implementation, who pays and how the costs and benefits can be attributed across society. A number of Scenarios have been considered to assist in determining a way forward for budgeting and implementation of a WEP for Alice Springs as well as determining potential lost revenue for PW (refer to Section 6.0).

Four Scenarios have been considered for assessment:

- **Scenario 1 -** A program that includes leakage reduction, pressure management and an outdoor garden program both general and targeted. The outdoor garden options have been included at the request of PW/NRETA as part of the Scope of Works for this Study. The Study Team have also included the leakage reduction and pressure management options as these will not have an impact on PW revenue and have relatively low unit costs.

  This Scenario would have a total cost of $1.86 M, average unit cost of $0.26 /kL and save approximately 831 ML/a by 2030. Total benefits include $1.79 M for avoided costs of reduced water and sewage supply and $0.20 M for reduction in GHG.

- **Scenario 2** – A program that includes the above options and all those options up to and including those that have a unit cost of $0.50 /kL, as indicated in column 8 of Table 5.3. This selection has been chosen to include avoided costs of reduced water and sewage supply. The Outdoor Garden (general) program ($0.51 /kL) has been added to this suite of options as it is required for the Garden outdoor (targeted) option.

  This Scenario would have a total cost of $4.14 M, average unit cost of $0.27 /kL and save approximately 2,196 ML/a by 2030. Total benefits include $3.94 M for avoided costs of reduced water and sewage supply, $0.80 M for reduction in GHG and $1.93 M for reduction in customer energy bills.

- **Scenario 3 –** A program that includes all options up to and including those that have a unit cost of $0.78 /kL, as indicated in column 11 of Table 5.3. This selection has been chosen to include avoided costs (as in Scenario 2) plus the GHG benefits. This Scenario includes a number of options that are important to consider from an equity point of view (i.e. General C/I, Town Camps and Public Housing indoor).

  This Scenario would have a total cost of $5.05 M, an average unit cost of $0.30 /kL and save approximately 2,370 ML/a by 2030. Total benefits include $4.34 M for avoided costs of reduced water and sewage supply, $0.94 M for reduction in GHG and $2.44 M for reduction in customer energy bills.

- **Scenario 4** – A final Scenario has been considered that includes all the options up to and including those that have a unit cost of $1.83 /kL, as indicated in column 13 of Table 5.3. This selection has been chosen to include avoided costs and GHG benefits (as in Scenario 3) plus customer energy bill savings associated with reduction in hot water usage. The higher unit costs greywater and rainwater tank rebates options have also been added to this Scenario) to test (in terms of lost revenue to the utility) the implications of adding higher unit cost options.

  This Scenario would have a total cost of $12.90 M, an average unit cost of $0.67 /kL and save approximately 2,935 ML/a by 2030. Total benefits include $5.06 M for avoided costs of reduced water and sewage supply, $1.08 M for reduction in GHG and $2.73 M for reduction in customer energy bills.

All the Scenarios, except for Scenario 4, are cost effective when considering the total costs and benefits to the community.

5.5 Preliminary Assessment of 'Who Pays'

To assist in determining potential lost revenue implications to PW and to consider in more detail how the WEP might be implemented, a preliminary assessment of 'who pays' has been undertaken. Four key stakeholder groups have been identified: NRETA, PW, other and customers.

The assumptions for 'who pays' are as follows:

- It is assumed that NRETA will take the role of project manager/co-ordinator for the WEP (i.e. Government funds will be managed by a Government Department). The team required is discussed further in Section 7.0, however, it is assumed that a mix of skills will be required from both NRETA, PW and other individuals. Hence it is assumed that although NRETA have been identified as managing the project, PW staff will need to be seconded into the WEP Team for the duration of the program.
- NRETA will also generally manage costs associated with advertising, marketing, training, brochure design and printing together with managing costs associated with program post implementation evaluation.
- In the residential sector PW are assumed to contribute costs such as a proportion of the fixtures and fittings provided in the retrofit program together with the cost of the plumber/specialist visitor. It is assumed the customer will pay a proportion of the costs of an audit and retrofit (often approximately 25%) as is typical of retrofit programs such as the SWC Every Drop Counts Residential Retrofit Program.
- In the commercial sector, as for the residential sector, PW is assumed to pay for the major part of the audit and fixtures and fittings costs and the customer is assumed to pay approximately 25% of this.
- 'Other' are generally other Government funded (often institutional organisations) such as public housing, Town Camps, general institutional customers, the hospital, schools and Pine Gap. As these customers are generally funded by Government to maintain their properties they are assumed to contribute the cost of plumbers that are likely to already be part of their maintenance team and fixtures and fittings such as showerheads and toilets. It is assumed PW contribute the cost of an audit specialist liaison officer to assist in these programs.
- For the system options the majority of the expenses are attributed to PW except for overarching project management costs and evaluation, which are assumed to be undertaken by NRETA.
- In the regulatory options it is assumed that NRETA will cover the costs to set the regulations in place and management of the regulations thereafter. Site visits of properties for accreditation/certification are assumed to be paid for by individual customers.
- For source substitution options such as greywater systems and rainwater tanks, PW are assumed to contribute a small portion of the rebate but the majority of the costs are assumed to be borne by the customers.
- In the Town Basin options it is assumed PW will pay the full cost of connecting customers to the system to gain maximum up take and contribute the cost of a liaison officer/field technician as part of the management team. This approach is also suggested for the reuse option.

Tables 5.4 to 5.7 provide the anticipated breakdown of program costs for each of the stakeholder groups for each of the four Scenarios considered[27].

[27] Note – due to the elapsed time between the draft and final versions of this report expenditure needs to be shifted by one year commencing in 2007.

Table 5-4 Scenario 1 Program Cost Breakdown - Total PV cost $1.86 M, average PV unit cost $0.26 /kL, 831 ML/a by 2030

Who Pays	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
NRETA ($M)	0.02	0.06	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PW ($M)	0.34	0.28	0.17	0.19	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15
Other ($M)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Customer ($M)	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total ($M)	**0.36**	**0.35**	**0.22**	**0.22**	**0.13**	**0.13**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.14**	**0.15**

Table 5-5 Scenario 2 Program Cost Breakdown - Total PV cost $4.14 M, average PV unit cost $0.27 /kL, 2,196 ML/a by 2030

Who Pays	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
NRETA ($M)	0.10	0.23	0.19	0.16	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PW ($M)	0.36	0.70	0.50	0.20	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15
Other ($M)	0.44	0.29	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Customer ($M)	0.00	0.09	0.10	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total ($M)	**0.89**	**1.31**	**0.98**	**0.56**	**0.20**	**0.15**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**

Table 5-6 Scenario 3 Program Cost Breakdown - Total PV cost $5.05 M, average PV unit cost $0.30 /kL, 2,370 ML/a by 2030

Who Pays	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
NRETA ($M)	0.15	0.31	0.27	0.18	0.07	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PW ($M)	0.42	0.90	0.63	0.27	0.21	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15
Other ($M)	0.50	0.42	0.25	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Customer ($M)	0.02	0.11	0.13	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total ($M)	**1.08**	**1.73**	**1.29**	**0.68**	**0.31**	**0.15**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**	**0.16**

Table 5-7 Scenario 4 Program Cost Breakdown - Total PV cost $12.90 M, average PV unit cost $0.67 /kL, 2,935 ML/a by 2030

Who Pays	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
NRETA ($M)	0.18	0.49	0.42	0.26	0.13	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PW ($M)	0.48	1.95	1.15	0.73	0.27	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Other ($M)	0.52	0.51	0.32	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Customer ($M)	0.04	1.68	1.73	1.65	0.21	0.19	0.20	0.20	0.21	0.22	0.22	0.22	0.23	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.27	0.27	0.28	0.28	0.29
Total ($M)	**1.23**	**4.63**	**3.63**	**2.83**	**0.61**	**0.41**	**0.41**	**0.42**	**0.43**	**0.44**	**0.44**	**0.45**	**0.46**	**0.46**	**0.47**	**0.47**	**0.47**	**0.48**	**0.49**	**0.49**	**0.50**	**0.51**	**0.51**	**0.52**	**0.53**

The apportioning of costs (and the associated benefits) between the various stakeholders needs to be considered by NRETA, PW and other ASUWMS Reference Group representatives. In addition the actual timing of when each of the individual programs is implemented and the duration of programs, which will affect cash flow for each of the stakeholders, should also be considered in more detail. The figures presented are preliminary estimates determined by the WES Team from experience of working with other utilities around Australia.

The apportioning of costs and cash flows have been used to assist in determining the potential lost revenue to PW and potential need for a price pass through detailed in Section 6.0.

Further details of how the individual stakeholders need to participate in the program and details of an ‘Implementation Work Plan’ are provided in Section 7.0.

Recommendation 5.1

It is recommended that a suite of options similar to Scenario 3 (total PV cost of $5.05 M, average unit cost of $0.30 /kL and potential savings of 2,370 ML/a by 2030) is taken forward for further consideration and implementation considering the relatively low cost and significant benefits that can be attained by society as a whole.

6 PROGRAM COSTS & REVENUE NEUTRALITY

The economic assessment of the scenarios is based on the costs and benefits from the combined perspective of the utility, government and customers. It asks the question "is this a cost effective investment for the community?" compared to not investing in the WEP and merely providing additional water. As indicated in Section 5.0, several scenarios offer cost effective WEPs in Alice Springs depending on the category of benefits included in the analysis.

This Section is concerned with the financial assessment, or the financial impacts on the different stakeholders, and in particular, the projected cash flow implications for PW. As described in Section 4.0, foregone revenue will impact on the water utility unless a price pass through or CSO is granted to the utility to compensate for this. This does not imply that the WEP is not cost-effective but that the level of foregone revenue is dependent on the water price, which is matched by reduced bills to customers. In other words it represents a transfer payment. Best practice regulation allows efficient costs of investments to be passed through in price changes. In this case, if a WEP that is cost effective from the combined perspective (total resource cost) is implemented, *average* bills will be reduced or at least remain approximately the same, even though the price may rise, because participating customers will be reducing their water use by a greater percentage than the price increase.

In reality, at present the NT Government policy is to have a common water price across the Northern Territory. This means that the costs of the WEP and the foregone revenue, if passed through as a price change, will be spread across all water users in the NT. If it is reflected in a CSO payment, or a reduced dividend then it will be shared across all NT citizens.

The costs of a WEP, if passed through in a price change, can be covered to ensure a short pay back period. This Section illustrates why a WEP in Alice Springs is a sensible investment using the four modelled scenarios. An examination of discounted cash flow including avoided costs and foregone revenue for the utility, illustrates that from a societal perspective a WEP results in a better outcome and from a utility perspective, water savings are achieved while remaining revenue neutral. This Section also highlights the impact on customer bills, and shows how costs can be passed through to customers.

6.1 Program expenditure

Program expenditure of the four Scenarios that have been developed is outlined in Section 5.4 where:

- Scenario 1 has a total cost of $1.86 M, average unit cost of $0.26 /kL and saves approximately 831 ML/a by 2030. Total benefits include $1.79 M for avoided costs of reduced water and sewage supply and $0.20 M for reduction in GHG.
- Scenario 2 has a total cost of $4.14 M, average unit cost of $0.27 /kL and saves approximately 2,196 ML/a by 2030. Total benefits include $3.94 M for avoided costs of reduced water and sewage supply, $0.80 M for reduction in GHG and $1.93 M for reduction in customer energy bills.
- Scenario 3 has a total cost of $5.05 M, an average unit cost of $0.30 /kL and saves approximately 2,370 ML/a by 2030. Total benefits include $4.34 M for avoided costs of reduced water and sewage supply, $0.94 M for reduction in GHG and $2.44 M for reduction in customer energy bills.
- Scenario 4 has a total cost of $12.9 M, an average unit cost of $0.67 /kL and saves approximately 2,935 ML/a by 2030. Total benefits include $5.06 M for avoided costs of reduced water and sewage supply, $1.08 M for reduction in GHG and $2.73 M for reduction in customer energy bills.

The preliminary expenditure profiles for these key stakeholders are detailed in Section 5.5.

6.2 Revenue implications of water efficiency programs

Program expenditure needs to be examined along with avoided costs (capital and operating expenditure savings) and foregone revenue (lost revenue because of selling less water at the same price), to determine the cash flow implications for the utility.

Capital and operating savings arise from the avoided cost of water provision. Water efficiency programs, which create lower water demand, require less water pumping and a slower increase in bore depth, saving on electricity and operating cost. In addition, the need for new bores can be deferred leading to significant savings in capital expenditure.

However, lower demand at the same water price will lead to less revenue and a net transfer of financial benefits to customers in reduced average bills.

6.3 Billing implications for customers

Water efficiency programs also have implications for the variable component of customer bills. Participating customers will have a lower water bill following their reduction in water use. The level of reduction and extent to which this is shared amongst the community will be dependent on the Scenario chosen for implementation.

6.4 Cost pass through and revenue neutrality

The WEPs have an up-front cost to the utility, government and customers. This cost is compensated by longer term avoided costs. Participating customers will receive smaller bills while maintaining the same levels of service, so there is an opportunity for any remaining cost to be passed through to customers via higher prices.

A simplified model of the flow of costs and benefits for customers and a utility is illustrated in Figure 6.1, where on the customer side, customers costs (CC) will be negative while their reduced bills (RB) will be positive. On the utility side the program costs (PC) will be negative, foregone revenue (FR) will also be negative but the avoided costs (AC) will be positive. In the total resource cost test, the customer RB and FR cancel each other out, as they are a transfer payment.

Table 6.1 helps to illustrate the costs and benefits for each stakeholder for a more complex Alice Springs model with three identified stakeholder groups.

Figure 6-1 Simple model of cost/benefit flows

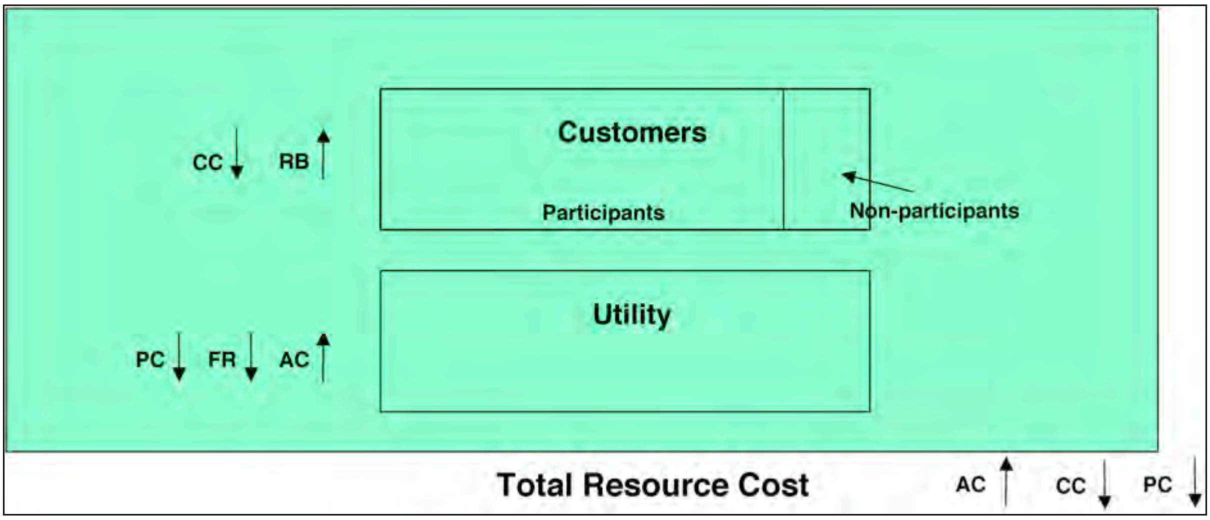


Table 6-1 Total Resource Cost Test

	Government	Customers	Total Resource Cost
PV Costs ($ M)	-1.6 (PC) – 5.0 (FR)	-1.3 (CC)	-7.9
PV Benefits ($ M)	3.4 (AC)	5.0 (RB)	8.4
Totals	**-3.2**	**3.7**	**0.4**

	NRETA	PW	Customers
PV Costs ($ M)	- 0.4 (PC)	- 1.2 (PC) – 5.0 (FR)	- 1.3 (CC)
PV Benefits ($ M)		3.4 (AC)	5.0 (RB)
Total	**- 0.4**	**-2.8**	**3.7**

Note – This Table is provided for indicative purposes only and does not correspond to any of the four scenarios being assessed as part of this Study.

As indicated in Table 6.1, under the total resource cost test the indicative scenario shown makes sense, as there is a net benefit to the community. However, based on the financial analysis, NRETA and PW will pay for the program and although PW will gain significant avoided cost benefits from implementation of the WEP, these avoided costs are outweighed by foregone revenue. This illustrates that the customers receive significant benefits from a WEP, in the form of reduced bills to participating customers and that these benefits need to be reapportioned, for example in the form of a price change, to assist in reducing the impact to PW.

For each of the four Scenarios modelled as part of this Study, Table 6.2 shows the net cash flow, and the price pass through required to ensure revenue neutrality following program implementation[28].

[28] Note – due to the elapsed time between the draft and final versions of this report expenditure needs to be shifted by one year commencing in 2007.

Table 6-2 Net cash flow and price pass through

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
Year	Cash flow for utility ($ M)	Price pass through ($/kL)	Cash Flow for utility ($ M)	Price pass through ($/kL)	Cash Flow for utility ($ M)	Price pass through ($/kL)	Cash Flow for utility ($ M)	Price pass through ($/kL)
2006	-0.25	-0.03	-0.36	-0.04	-0.44	-0.05	-0.50	-0.06
2007	-0.20	-0.02	-0.85	-0.10	-1.08	-0.13	-2.19	-0.26
2008	-0.11	-0.01	-0.73	-0.09	-0.93	-0.11	-1.52	-0.18
2009	-0.14	-0.02	-0.47	-0.05	-0.61	-0.07	-1.16	-0.13
2010	-0.08	-0.01	-0.41	-0.05	-0.56	-0.06	-0.72	-0.08
2011	-0.08	-0.01	-0.42	-0.05	-0.49	-0.05	-0.66	-0.07
2012	-0.08	-0.01	-0.42	-0.05	-0.50	-0.05	-0.67	-0.07
2013	-0.08	-0.01	-0.43	-0.05	-0.50	-0.05	-0.69	-0.08
2014	-0.07	-0.01	-0.44	-0.05	-0.51	-0.05	-0.70	-0.08
2015	-0.07	-0.01	-0.44	-0.05	-0.51	-0.05	-0.71	-0.08
2016	-0.07	-0.01	-0.45	-0.05	-0.52	-0.05	-0.72	-0.08
2017	-0.07	-0.01	-0.45	-0.05	-0.52	-0.05	-0.73	-0.08
2018	-0.06	-0.01	-0.46	-0.05	-0.53	-0.05	-0.75	-0.08
2019	-0.06	-0.01	-0.47	-0.05	-0.54	-0.05	-0.76	-0.08
2020	-0.06	-0.01	-0.47	-0.05	-0.54	-0.05	-0.77	-0.08
2021	-0.06	-0.01	-0.48	-0.05	-0.55	-0.05	-0.78	-0.08
2022	-0.05	-0.01	-0.49	-0.05	-0.55	-0.05	-0.80	-0.08
2023	-0.05	0.00	-0.49	-0.05	-0.56	-0.05	-0.81	-0.08
2024	-0.05	0.00	-0.50	-0.05	-0.56	-0.05	-0.82	-0.08
2025	-0.05	0.00	-0.50	-0.05	-0.57	-0.05	-0.83	-0.08
2026	-0.04	0.00	-0.51	-0.05	-0.57	-0.05	-0.84	-0.08
2027	-0.04	0.00	-0.51	-0.05	-0.58	-0.05	-0.85	-0.08
2028	-0.04	0.00	-0.52	-0.05	-0.58	-0.05	-0.86	-0.08
2029	-0.03	0.00	-0.53	-0.05	-0.59	-0.05	-0.88	-0.08
2030	-0.03	0.00	-0.53	-0.05	-0.60	-0.05	-0.89	-0.08

Table 6.2 shows the annual net cash flow from PW's perspective for each scenario. The price pass through shows the price ($/kL) required above the current price, in order to cover all utility costs, assuming that these costs are recovered from Alice Springs customers only. For example, under Scenario 1, there would be a negative net cash flow in 2006 of $0.25 M and the price would have to be set at $0.70 /kL ($0.03 /kL above the current price of $0.67 /kL) to ensure revenue neutrality. In 2010, there would be a negative net cash flow under Scenario 1 of $0.08 M and the price would have to be set at $0.68/kL ($0.01 above the current price of $0.67) to ensure revenue neutrality.

Lumpy changes in price increase that might be required can be converted into a one-off price increase that will ensure discounted cumulative revenue neutrality. Likewise, the price increase could be staged gradually. These figures assume that this price change is applied in Alice Springs alone. In the absence of regional pricing, and on the basis that a WEP is economically beneficial for the community as a whole, and therefore represents a wise investment, the price change is appropriately shared across all PW customers as is shown in Section 6.5.

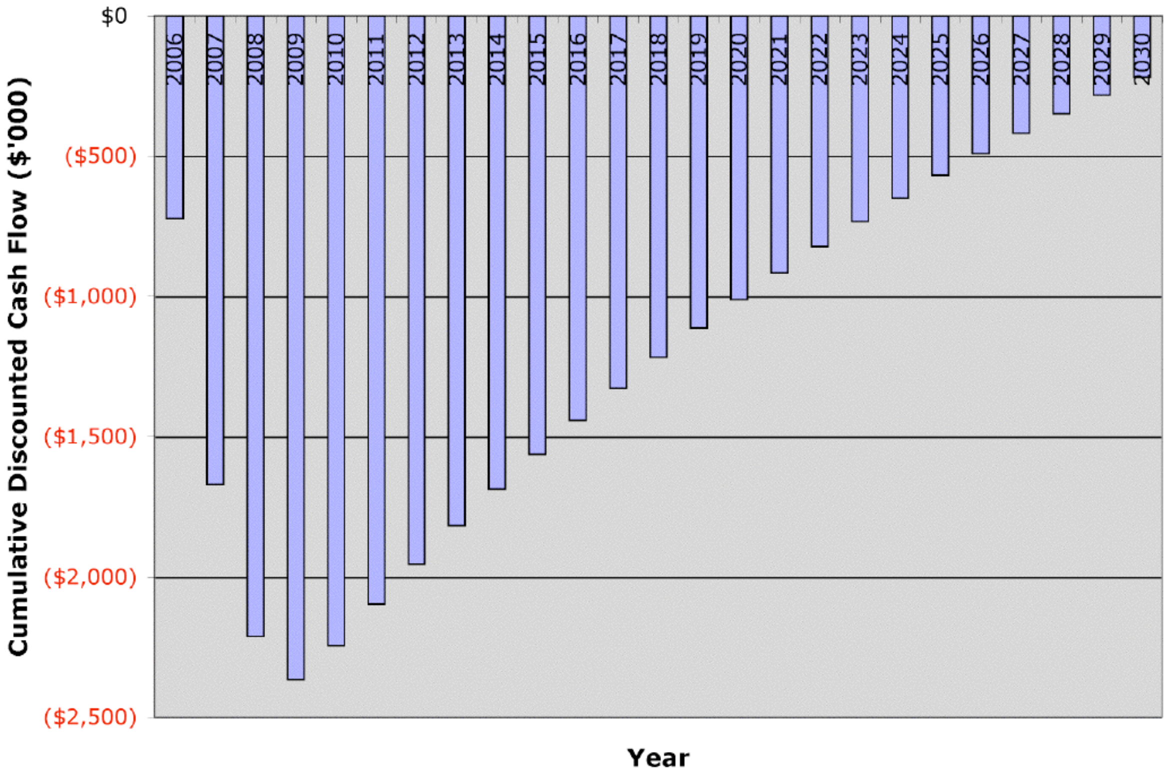
6.5 Cash flow

Cash flow analysis helps to illustrate how the costs for a WEP affect the different stakeholders over time. When considering the total resource cost perspective the WEP may represent a sensible investment. However, when considering the cash flow incurred by the utility in isolation, the cash flow may be negative over the period considered and thus require the utility to be compensated by price changes to ensure revenue neutrality.

6.5.1 Total resource cost

The total resource cost includes all costs including utility costs, customer costs and cost to government and participating agencies such as Pine Gap but excludes foregone revenue. The total resource cost discounted cumulative cash flow shows the cumulative cash flow for the whole community in each year. Figure 6.2 shows the discounted cumulative cash flow for Scenario 2 as an example[29].

Figure 6-2 Total Resource Cost cumulative Discounted Cash Flow



From a total resource cost perspective Figure 6.2 (which includes the avoided costs of reduced water and sewage supply) shows that the net cash flow declines rapidly in the initial period as program costs are high (most of program expenditure is incurred over the first 5 years) but this begins to recover as costs fall and avoided costs associated with water savings rise. The figure shows that from the perspective of the community, Scenario 2 will be a sensible investment regardless of any price change[30].

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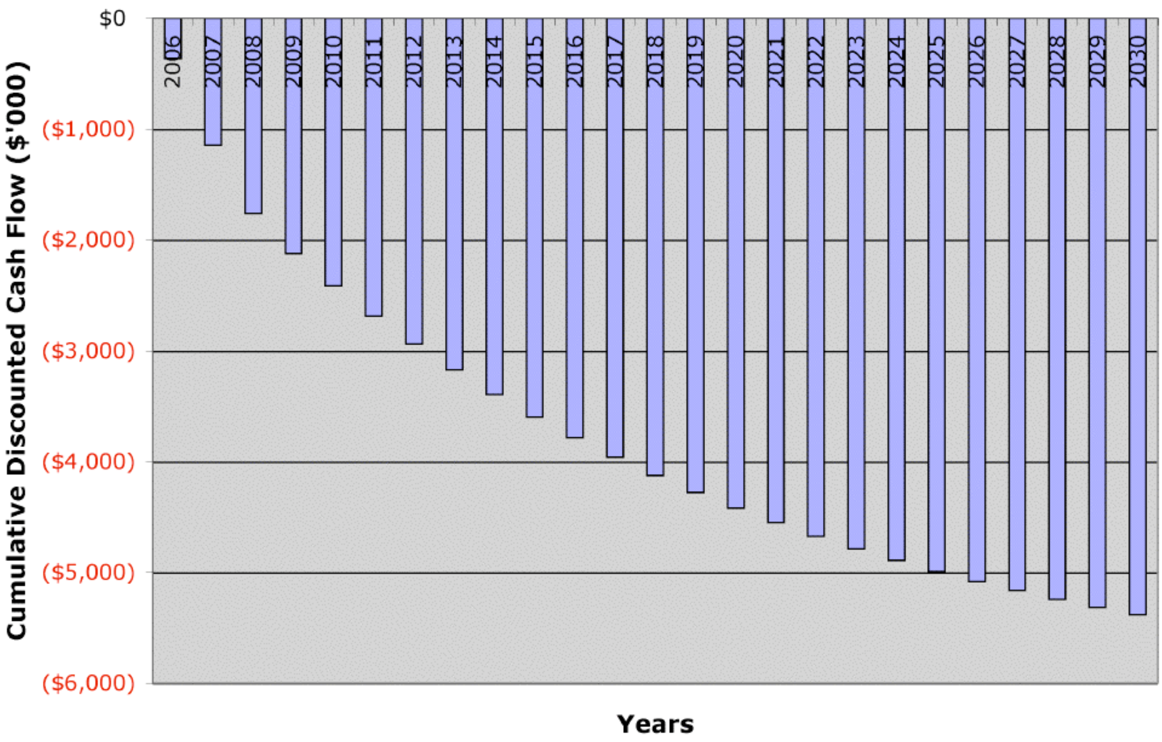
[29] Note – due to the elapsed time between the draft and final versions of this report expenditure needs to be shifted by one year commencing in 2007 for Figures 6.2, 6.3 and 6.4.

[30] The slightly higher unit cost 'Outdoor general' option has been included in this Scenario as discussed in Section 5.4. The slightly higher unit cost means that this option just tips the payback period slightly over the 25 year period considered.

6.5.2 Utility cost

By focussing on the utility only, we can see the implications for utility cash flow. This approach includes foregone revenue and excludes customer cost and the costs incurred by government and other agencies. The costs have been split based on the WES Study Team estimates, as discussed in Section 5.5. Figure 6.3 shows the cumulative discounted cash flow from the perspective of the utility for Scenario 2. The net cash flow starts off negative and declines quickly as most program costs are incurred in the first 5 years. As costs required for the program begin to reduce and discounting takes effect the cumulative discounted cash flow begins to decline more slowly. The discounted cumulative cash flow is negative throughout the timeframe considered.

Figure 6-3 Cumulative Discounted Cash Flow for the Utility



As previously indicated the shortfall can be matched by passing through costs to the customer. From the utility perspective this is an efficient investment decision and the price change is merely correcting for a transfer payment due to reduced average bills. The average discounted price change to ensure revenue neutrality is $0.06/kL. This means that a price rise in the first year would ensure the outcomes presented in Figure 6.4.

Figure 6-4 Cumulative Discounted Cash Flow for Utility with Price Change ($0.06/kL)

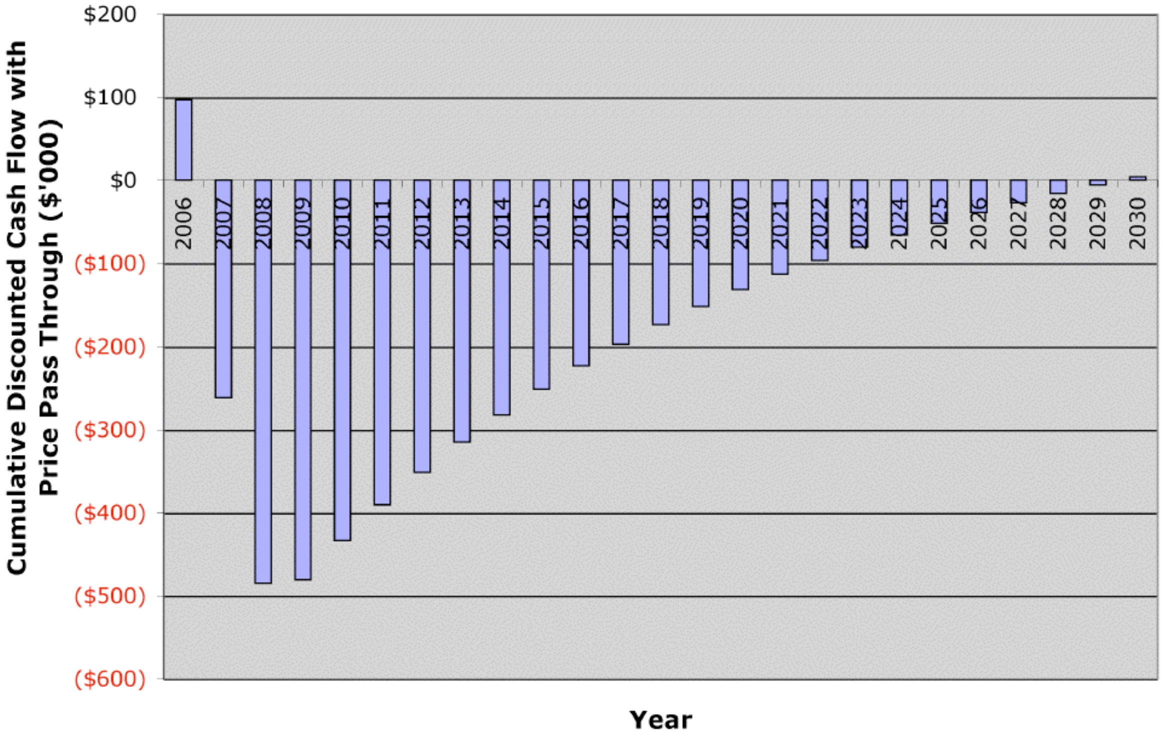


Figure 6.4 illustrates that in 2006 there is a positive net cash flow before a decline from 2007 until break-even point between 2029 and 2030. The discounted net cumulative cash flow returns to the positive in 2030 providing a pay back on the investment. This Scenario uses a $0.06/kL price increase on the current price of $0.67/kL and represents a sensible investment from the perspective of the utility.

Using principles of cost recovery practiced elsewhere in Australia and recommended under the NWI (refer to Section 6.6 for details), the utility can maintain cash flow under Scenario 2 by raising the variable water price by $0.06 /kL. This price rise, at the projected level of water demand identified for Scenario 2, will cover the remaining program cost, leaving the utility revenue neutral.

6.5.3 Pricing options

Each scenario has different costs and benefits and thus different implications for price. In addition, prices can be added to customers in Alice Springs (as illustrated with the examples above for Scenario 2) or they can be spread across all PW customers.

Table 6.3 illustrates necessary price changes for each scenario to ensure revenue neutrality for the utility, and includes the price change necessary for Alice Springs customers only, and also if the price change was borne by all PW customers in the NT.

It is important to note that these prices represent a once only price rise. Price rises could be staged over the 30 year time period, and/or prices could include an inclining block tariff to reflect higher prices for higher water users, or alternatively the fixed price could be increased.

Table 6-3 Potential Price Changes

Scenario	Once Only Price Rise Equivalent for Alice Springs Customers c/kL	Once Only Price Rise Equivalent for all NT Customers c/kL
1	1	<1
2	5.5	1.5
3	6.5	2
4	10	3

6.6 Revenue neutrality

The implementation of water efficiency options often leads to discussion about the cost to the utility of foregone revenue from reduced water sales. In White and Howe (1998) it is shown that foregone revenue has no implications on the cost effectiveness of options, but the relative magnitude of avoided costs and the combined program costs (or, in the case of a supply side option such as reuse, the capital and operating costs) are important. Where the present value of the avoided costs is higher than the total combined program costs, the option is cost effective regardless of the magnitude of foregone revenue.

WEPs aim to sell less water. The result for the utility is reduced revenue. However, experience shows revenue neutrality can be achieved by a combination of reduced or delayed capital expenditure and/or increased water prices. For the utility this means providing the same level of service while remaining revenue neutral and for the consumer this means consuming less water and gaining the same level of satisfaction for that service while paying the same in total average bills (despite paying more per unit of water).

6.6.1 Revenue neutrality elsewhere

Regulators and price setters need to be cognisant of the impact of foregone revenue on utilities and allow the cost of WEPs and the foregone revenue to be passed through to consumers when price setting (White and Howe, 1998).

In NSW, IPART phased in a two part tariff including a variable component to signal the cost associated with water consumption and a fixed component to reduce the variability of revenue to the utility (2004). IPART have also explored pricing alternatives to reduce the financial incentive for the utility to increase water sales, while creating revenue certainty and neutrality. The Water Demand Management Forum recommended that cost recovery be addressed through increased water prices, or the use of revenue regulation to decouple profits from sales, or use loans for customers participating in water efficiency programs (IPART, 1996). In each case, the customer and the water service provider should benefit financially while the whole of society is better off following the reduced use of scarce resources.

The water use survey carried out on the Alice Springs community (McGregor Tan, 2005) indicates that a high proportion of the community would support changes in the price of water to achieve better water conservation.

The following case studies presented below assist in illustrating how similar approaches are being used in other locations both nationally and internationally.

Case 1: The Californian Urban Water Conservation Council (CUWCC)

In California, the Pacific Institute (PI, 2003) assessed an indoor and outdoor water efficiency package for residential water efficiency. The approach was conducted from the perspective of the customer and the utility. Water bill savings were not evaluated as a benefit to the customer, however the cost of conserved water based on the investment required by the customer and operating or maintenance costs they would experience, was compared with the cost of the conserved water using short-run and long-run marginal costs.

PI (2003) used this approach because it addresses both costs and benefits to the water supplier – *which are eventually passed onto the customer* – as well as costs and benefits the customer experiences (apart from what they pay for water services). This method highlighted that:

"Assessing costs and benefits for customers other than changes in their water bill shows that the cost of water conservation measures is often much lower than it appears to be when evaluated more narrowly." (PI 2003)

Aspects of the costing methodology to note include:

- Costing for the base-case cost estimates were conservative because of some assumptions excluding favourable but uncertain factors such as avoided wastewater treatment costs.
- Only reasonably quantifiable and financially tangible benefits of water efficiency were included, e.g. low-flow showerheads reducing water heating bills, or improved irrigation scheduling reducing fertilizer use.
- Many additional benefits to the environment and community from water efficiency were not included, such as lower detergent costs for clothes and dishwashers. It was noted that in an ideal scenario, other less quantifiable benefits such as environmental externalities of freshwater withdrawals from the water cycle would be included and would make the cost of conserved water even more favourable.
- Water efficiency will reduce wastewater costs and can be passed onto customers.
- The cost of conserved water stays constant for the life of the water efficiency device, whereas for source augmentation there is a reliability cost.

When the cost of the WEP is less than the cost of water supply avoided by conservation, "*the customer and the water utility (collectively) will make money…… collective benefits that cause utility losses can and should be corrected by adjusting the water rates to keep the financially whole (PI, 2003).*" Importantly where benefits are derived for both the utility and the consumer, there is the opportunity for rate changes whilst allowing the customer to save. It is critical to identify the cost of water supply displaced by efficiency and by imposing rate changes, recognise the penalty placed on the utility by reduced revenue due to water efficiency. This problem is quite common because neither the utility nor customers are seeing the whole economic picture (PI, 2003).

Consequently, levelised or unit cost clarifies the cost sharing notions behind water efficiency and water provision. Where a customer investing in water efficiency reduces the need for investment in infrastructure by the water utility, then a rebate to the customer who invests in the efficiency may be the most cost effective way to progress for the whole of society. This is because in the absence of efficiency measures, the water rates would have to rise with consequences for all customers.

Based upon a consideration of the economic welfare of the whole of society, the findings in California regarding water efficiency (PI, 2003) indicated that:

- saving water usually saves money;
- water users can reduce their bills;
- water suppliers can reduce delivery costs and treatment costs;
- wastewater treatment utilities can reduce operation costs;
- water service providers can reduce costs of new supply and equipment; and

- customer savings may differ from avoided costs of the utility with implications for water prices and passing costs onto consumers.

Case 2: IPART, NSW

The Water Demand Management Forum agreed that the appropriate methodology for assessing water efficiency options is one that takes into account costs and benefits of the water agency and the customers, and includes environmental, as well as financial, costs and benefits (IPART 1996). This approach is key to comparing supply and demand options on an equal basis, and highlights the significant opportunities for achieving benefits for customers from water efficiency options, many of which have a unit cost less than supplying water (IPART 1996). IPART implements the principles of revenue neutrality when there is an impact on utility revenue from reduced water demand (IPART 2004). Additional benefits for the environment such as environment flows, which occur external to the market, are delivered.

On 2 September 2005, IPART issued its final determination on Sydney water prices – confirming a new two-tier pricing structure (inclining block tariff) and significant price increases for average residential customers to promote water conservation. Since 1 October, residential customers using the average 250 kL of water per annum will pay $59.10 (or 8.7 % including inflation) more for water and wastewater in 2005/06 than the previous year. There are planned increases of $30.85 (4.2 %) in 2006/07, $23.33 (3 %) in 2007/08 and $26.20 (3.3 %) in 2008/09.

Prices rise more sharply for residential customers using more than 100 kL of water per quarter or 1.096 kL/day. Residential customers using 500 kL of water per annum will pay an extra $116.84 (or 12.6 %) in 2005/06, a further $72.09 (6.9 %) in 2006/07, $51.02 (4.6 %) in 2007/8 and $56.88 (4.9 %) more in 2008/09.

IPART is also proposing extra protection for large families using more than 100 kL of water per quarter. Most large families are eligible for assistance to install new fittings, which help save water. In addition, low-income families who use more than 100 kL a quarter are eligible for a $40 annual rebate on their water bill. Under the new price structure, Sydney householders using up to 100 kL of water per quarter will pay $1.20 /kL from October, rising to $1.31 /kL in 2008/09. Above 100 kL per quarter, residential consumers will pay $1.48 /kL from October, rising to $1.85 /kL in 2008/09.

To partially offset the water usage price increases the fixed water service charge will be cut by 45 % over the four years of the determination.

Case 3: OFWAT UK

In the UK, OFWAT (2001) are quite clear on the issue of cost recovery from water efficiency programs, requiring that where providers choose water efficiency measures as part of their least cost supply/demand balance program, costs should be included in the calculation of long run marginal cost. This means that the cost estimates should take account of the continuing costs of maintaining the effectiveness of measures in constraining demand. Where pricing is calculated at the long run marginal costs, program costs are passed through to customers.

NWI requirements

The revenue neutrality principles discussed in the case studies above are supported by the NWI. The NWI, which aims to achieve "*policy settings which facilitate water use efficiency and innovation in urban and rural settings*[31]" encourages "*full cost recovery for all surface and groundwater based systems*[32]." In addition, "*where full cost recovery is unlikely and a CSO is necessary, the size of the subsidy is to be reported publicly.*"

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[31] NWI paragraph 23

[32] NWI paragraph 66

Specifically, when implementing pricing policy, the NWI requires:

"…pricing policies for water storage and delivery in rural and urban systems that facilitates efficient water use … , including through the use of:

- *consumption based pricing*
- *full cost recovery for water services to ensure business viability and avoid monopoly rents, including recovery of environmental externalities"*

The second dot point aims to ensure the provision of *"water to meet environmental and other public benefit outcomes*[33]*."*

Overall, there is an emphasis on urban water reform that increases water use efficiency in domestic and commercial settings. One specific focus mentioned is to:

- prioritise and implement, where cost effective, management responses to water supply and discharge systems losses including leakage, excess pressure, overflows and other maintenance needs.

Recommendation 6.1

By using the LCP/IRP unit cost analysis for Alice Springs and inclusion of various benefits we are able to show which options and Scenarios are a sensible investment based on the combined perspective of all stakeholders – the 'total resource cost test'. Depending on the marginal cost of water, which in the WES Stage III analysis is considered to be a conservative estimate, a number of the Scenarios are cost effective from the total resource cost perspective and represent sensible investment decisions. If these options are not implemented this will mean PW will actually spend more under the reference case Scenario compared with these Scenarios because the advantage of the avoided costs of reduced water and wastewater supply has not been realised. Over the time period considered (25 years) these Scenarios will pay for themselves.

From the broader perspective of the community (which includes benefits such as customer energy bills and the estimated value of GHG reduction associated with reduced water and wastewater supply energy usage and customer hot water usage), all Scenarios except Scenario 4 (which contains the two highest unit cost options) provide worthwhile investment decisions. Again, if the options are not implemented this will mean that the community as a whole will incur greater costs, direct and indirect, than under the reference case Scenario.

From the viewpoint of the utility, the use of transfer payments (using price changes) will ensure that any of the Scenarios developed can be implemented while leaving the utility revenue neutral. Average customer bills will still be lower than before.

It is recommend that, as undertaken as part of this Study, water efficiency options and supply options should be analysed from the combined perspective of PW, NT Government and the customer and that both this perspective (full economic perspective) for the purpose of ranking and choosing options, as well as the financial (cash flow from perspective of the utility only) are presented for decision making. This transparency of analysis will enable PW to make the case to the NT Government to allow price pass through to customers or for Government to fund the shortfall directly. Considering the significant benefits associated with each of the Scenarios at least Scenario 3 should be recommended to the NT Government for consideration.

[33] NWI paragraph 35

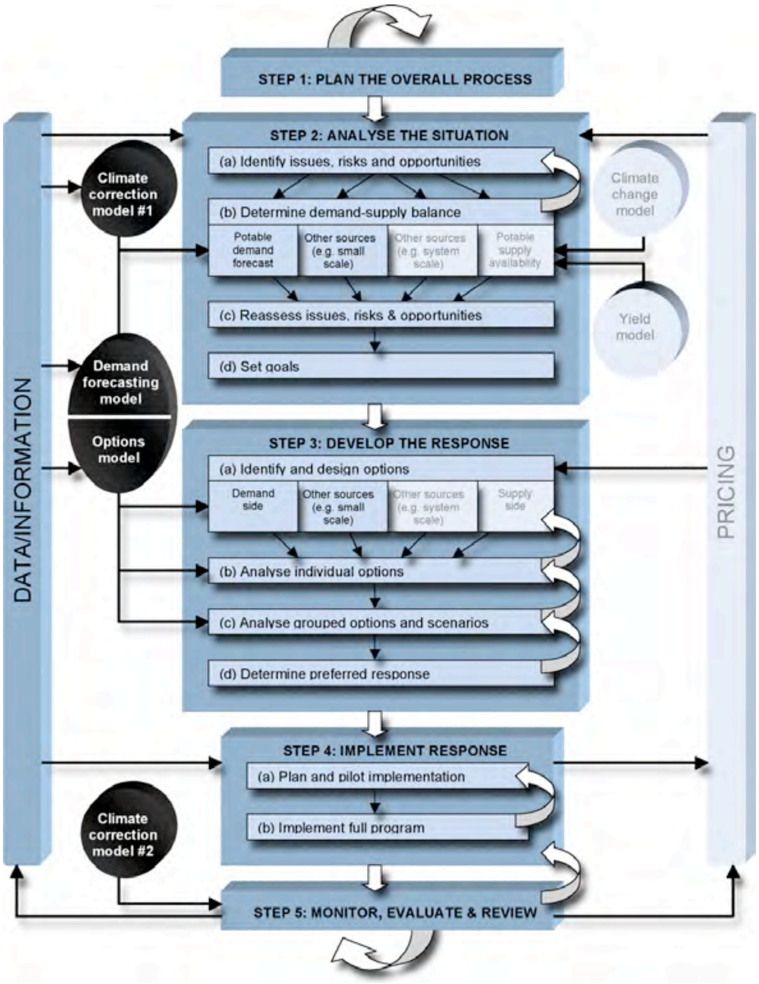
7 IMPLEMENTATION WORK PLAN

7.1 The Process

Having determined that Scenario 3 should be taken forward for implementation, this Section identifies the key work elements that will be required to progress into the 'Implementation' phase of the WEP and beyond.

Before detailing the work elements required it is essential to ensure that the ASUWMS Reference Group and other stakeholders involved are familiar with the robust overall planning and decision making process, which is effectively being used and how the work carried out to date, and that which is planned, fits within that process. The LCP/IRP process being undertaken is now recognised internationally as best practice in the water industry and is gradually being implemented in a number of locations (i.e. UK, California, Sydney, Perth). Figure 7.1 shows an outline of the overall LCP/IRP process[34] being used to assist in the planning and implementation of water services in Alice Springs. The economic principles behind this process are as discussed in Section 4.0.

Figure 7-1 The LCP/IRP Process



[34] It should be noted that the Water Services Association of Australia (WSAA) is currently developing a Manual to assist other utilities, water service providers and resource managers to step through this water services planning process in their region, as is the International Water Association (IWA). ISF is currently in the process of developing both of these Manuals for WSAA and the IWA. The WSAA Manual and associated tools will be available in 2007.

As part of Stages I & II of the WES, Steps 1 to 3 of the process shown in Figure 7.1 were undertaken to a limited extent together with development of a climate correction model, demand forecasting end use model and options model (EUM/OM) and associated data collection. As part of Stages I & II it was recognised that: water efficiency options alone could not achieve the required targets; the identified targets may not be set at a level that is economically cost effective to the community and thus should potentially be revisited; the marginal cost of water supply should be further investigated to assist in determining this; and the analysis of options should be broaden to 'other sources' such as reuse to identify other potential for offsetting potable water. Stage III has enabled the process to be revisited, the EUM/OM to be updated and expanded and Step 3 'Develop the Response' to be broadened to enable additional options to be analysed (i.e. other sources such as rainwater tanks, greywater systems, the Town Basin and reuse) and assessed against the marginal cost of water. By expanding the analysis in this way it appears that a number of additional low cost options have been found for both water efficiency and source substitution that should be taken forward for implementation. Hence Scenario 3 has been identified as the preferred response to be taken forward for Step 4 'Implement the Response'.

This Section therefore provides guidance on Step 4 'Implement the Response' but also provides guidance on the other elements of the LCP/IRP process, which should not be undertaken as a 'one off' but an iterative adaptive management process that is embedded in the management of the resource for a specific region.

7.2 The WEP Elements

To maximise the success of the WEP it will be essential that it is planned, funded, managed, reviewed/evaluated and documented etc. in a similar way to a capital works project as the benefits achieved and money invested will be of an equivalent magnitude. Hence a '**Detailed Implementation Plan**' which will contain planning and/or collation of many of the elements described below will need to be developed prior to commencement of implementation of the WEP.

It is currently assumed that a number of the various individual programs of the WEP will commence in 2007 and be gradually implemented over a core five year period. Hence planning of the implementation needs to commence immediately to assist in this process.

A number of individual elements, as discussed below, need to be considered.

7.2.1 Stakeholder Agreement

A number of stakeholders will need to be involved in the WEP. It is therefore critical that they are involved in the final decision making process to ensure ownership and engagement in the WEP to be implemented. Hence, the ASUWMS Reference Group together with any other individuals/organisations that will be affected by implementation of the preferred WEP (including representatives of the community and local specialists 'trade allies' such as plumbers, garden/irrigation specialists, evaporative a/c specialists) should be brought together for a '**Stakeholder Workshop**' and presented the findings of this Study. An interactive workshop, similar to that undertaken during WES Stage I & II, should be held with the group to enable any concerns and opportunities to be raised and addressed as required. The ASUWMS Reference Group, brought together at this time, should remain the core group to whom the WEP Team report to and gain advice from on a regular basis for at least the duration of the core five year program.

7.2.2 Budget Plans

NRETA have indicated that approximately $0.05 M of Government funds have been identified for a WEP in 2006/07 and $0.1 M thereafter (pers com John Childs, NRETA). As indicated in Section 5.5 a preliminary estimate of 'who pays' has been made for the Stage III analysis (refer to Table 5.6). For Scenario 3 (the preferred response) a total of $1.08 M is required in the first year of the program, of which $0.15 M will be needed for NRETA, $0.42 M is assumed to be contributed by PW, $0.50 M by other government agencies (i.e. the hospital, public housing) and only $0.02 M by customers. In the second year, investment will need to rise to $1.73 M (maximum funding requirement in any one year under Scenario 3) of which only $0.11 M might be expected to be contributed by customers. Hence, even with a slight shift in program timing, 'who pays' and how much is finally budgeted for each individual program it can be seen that NRETA, PW and other NT government bodies need to commence budget negotiations which are substantially more than currently being provided by the NT Government, if any significant water savings are to be achieved from next year.

Hence following finalisation and agreement of this Report, a '**Detailed Budget Plan**' should be developed for the preferred Scenario that identifies the total funds required and the agreed in kind support/commitment required for 2007 under each stakeholder and the longer term funding requirements for the next five years.

7.2.3 Price Modifications

As indicated in Section 6.0 a price modification or price pass through may be required to transfer costs and benefits across the various stakeholders and assist PW in minimising foregone revenue. Alternatively, a CSO or other mechanism can be used. It is worth noting that the difference in revenue that is likely is less than the volatility in revenue arising from a cooler year relative to a hotter dryer year, and so no special considerations may be required. A '**PW Board Paper**' should be prepared based on the findings of this Report summarising the various price modifications and other options (e.g. CSO, direct allocation) required for the agreed Scenario. This information will also need to be taken to the NT Government for discussion/approval along with the Budget Plans as part of a '**Cabinet Submission**'.

7.2.4 Program Team

The WEP will require the set up of a strong '**WEP Team**' including a project manager and trained support staff for a minimum period of five years. Many of the programs will need to be embedded in the current systems by that time, to ensure savings are maintained. The WEP Team will require a wide range of skills. Hence as indicated in Section 5.5, it is preferable that suitably qualified staff from both NRETA and PW are dedicated to the WEP Team together with part time assistance from individuals from other organisations with specific skills. As has been found in several water efficiency teams around Australia, the success of a WEP is highly dependent on the staff implementing the program and the commitment of staff. Team members must be allowed to focus suitable time to the WEP and be provided with start up time to learn the new skills required. This can often be facilitated by close contact with practitioners from other locations or specialists with experience in the field[35]. It is preferable that the WEP Team members provide a long term commitment to the WEP, considering the up-skilling that is required.

Formal arrangements with key WEP Team staff can potentially be utilised, where for example a performance contract is set up to ensure water saving targets are achieved. However, in a location such as Alice Springs, a more collaborative team based approach is considered more appropriate.

Key tasks of the WEP Team will include:

- Management and control of the overall WEP including budget, timing, regular reporting of outcomes etc.
- Co-ordination of the communication strategy, education material, brochures and media releases.
- Negotiation and liaison with stakeholders and trade allies.

[35] WSAA (with assistance from ISF and CSIRO) are in the process developing a demand management network and associated tools to assist WEP teams across the country to share knowledge on water efficiency activities and research.

- Set up of liaison and contracts with suppliers to ensure sufficient appliances are available and can be obtained at a reasonable cost to the WEP.
- Recruitment of specialist staff/advice, release of tenders and setting up contractual arrangements with plumbers and other specialists.
- Organisation of required training courses and trade allies accreditation to ensure contact with the public has a consistent approach and "common voice".
- Control of customer water efficiency action plans (e.g. hotels, institutional properties) associated with specific programs, sign off upon completion and provision of ongoing advice.
- Arrangement of retrofits/audits/rebates with customers and logging and data entry of retrofits, including fixtures and fittings modified.
- Careful implementation of individual programs in line with the original design to ensure 'cream skimming' of savings does not occur such as in the case of showerhead rebate and residential retrofit programs[36]. Cream skimming of savings is a common issue where the option design team are separated from those implementing the WEP.
- Review, monitoring and evaluation of individual programs to assess effectiveness and need for modification to increase savings, participation and/or customer satisfaction including use of the EUM/OM.
- Documentation of all actions undertaken and regular reporting to the NT Government, the ASUWMS Reference Group and the community on the outcomes achieved. SWC produce a similar report each year "Conservation & Recycling Implementation Report"[37] which provides a focal point for identifying the outcomes of the year and future plans.
- Identification and documentation and management of ongoing information/research needs.

7.2.5 Roles and Responsibilities

An assessment of 'who pays' in Section 5.5 assists in briefly identifying some of the key roles and responsibilities that have been assumed to be taken by the key stakeholders in the WEP. As indicated in Section 5.5:

- NRETA is assumed to take the overall project management/co-ordination role of the WEP Team although the skills of individuals in PW and other organisations will need to be seconded into the core WEP Team. The NRETA led WEP Team will effectively be the Government representative managing Government funds and will be responsible for managing advertising, marketing, training, brochure design, printing, co-ordination of the ASUWMS

[36] For example, during implementation the roll out of a showerhead rebate program may take place prior to or in parallel to the residential indoor retrofit program. If this occurs then the savings in the retrofit program for a participant could be significantly reduced because the showerhead conservation potential has already been tapped into due to the participant already taking part in the showerhead rebate program. During design this danger of cream skimming would have been taken into consideration by assuming for example the showerhead rebate program would only be offered to a select group of households (e.g. new MR households likely to have a dual flush toilet and thus likely to reap relatively low benefits as part of a retrofit program). These design considerations may not be apparent to those implementing the program.

[37] http://www.sydneywater.com.au/Publications/_download.cfm?DownloadFile=Reports/WaterConservationAnnualReport2004.pdf [accessed 23/12/05]

Reference Group, data collection and analysis, research direction, post implementation evaluation and liaison with specialists etc. It will be essential for various skilled PW staff to be part of the WEP Team that have experience in contractual arrangements, database analysis and modelling, non residential customer liaison and auditing. By bringing these skilled staff into the NRETA led WEP Team it is envisaged that significant capacity building and a collaborative approach will be achieved rather than compartmentalising skills and knowledge into the different organisations. In many locations around Australia a number of approaches to the set up of a WEP Team have been utilised. From the Study Teams knowledge of these individual locations the proposed NRETA led WEP Team is envisaged to be the most appropriate approach.

- NRETA are also assumed to focus their responsibilities on regulatory modifications required for the individual programs and the associated ongoing management of such regulations including site visits to inspect properties requiring accreditation/certification.

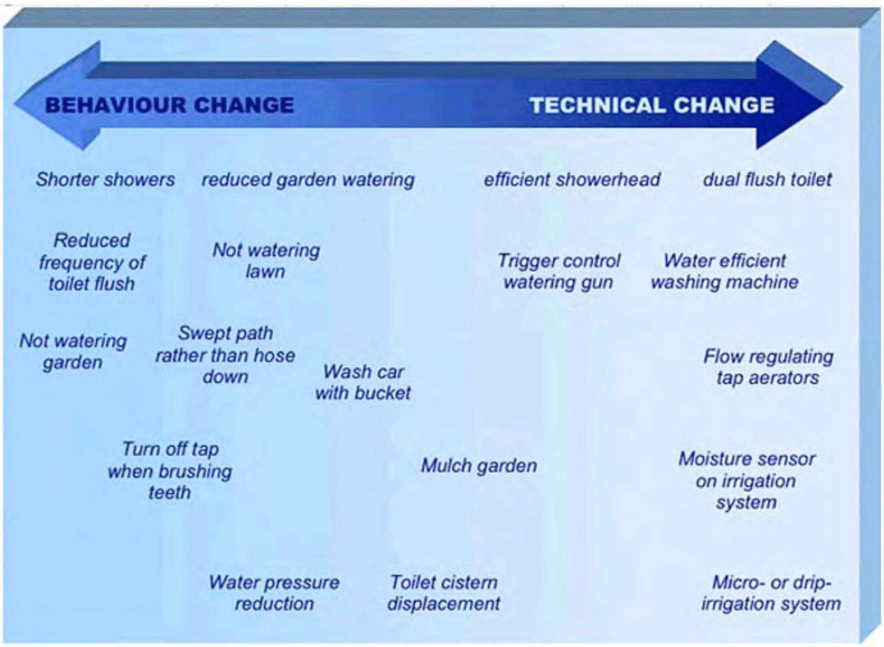
- PW are assumed to focus their responsibilities, through the WEP Team, on the contractual arrangements and negotiations required to increase water usage of the Town Basin and Reuse Schemes and to reduce losses through the leakage and pressure reduction programs.

- The 'Other' stakeholders including institutional bodies such as the hospital, public housing, schools, Town Council etc. and the 'Customers' in the non residential sectors will have the responsibility of achieving savings as agreed as part of the series of audits and management plans developed under individual programs. The WEP Team will be responsible for evaluating the savings achieved and assessing whether the individual stakeholders are adequately achieving agreed goals in order to determine whether stakeholders should receive the funding assistance offered under individual agreements. It should be noted that agreements for water savings, effective evaluation of those savings and funding assistance where demonstrated are essential in the institutional and commercial/industrial sectors if water savings are to be achieved and maintained.

7.2.6 Communication Strategy

In many locations internationally WEPs have focussed solely on a communication strategy to obtain water savings through behaviour change. However, from evaluation of such programs it can be seen that a communication strategy alone provides minimal savings, which often decay once the communication strategy stops. To obtain higher and longer term water savings it is essential to combine both structural/technical and behavioural changes. The options developed for the Alice Springs WEP are designed to focus on both structural and behavioural change. Figure 7.2 illustrates examples of structural/technical and behavioural change.

Figure 7-2 Examples of Structural/Technical and Behavioural Change



Source – White et al, 2003

The communication strategy will need to be carefully designed for the community of Alice Springs and cater for the specific requirements of an arid climate, long term residents, the short term residents that are prevalent in Town, specific cultural differences such as Aboriginal communities and Pine Gap residents, the large number of tourists and the non residential sector.

A number of water efficiency activities, particularly relating to communication and education, have been implemented in Alice Springs since the early 1990s (refer to Turner et al, 2003, App B) with varying degrees of success and longevity in terms of savings (refer to Turner et al, 2003, p48). Hence it will be essential to maintain the momentum of the WEP and it's message for the minimum five year period and ensure both the structural and behavioural changes are embedded in how water is used in Alice Springs. The recent customer survey on attitudes to water use (McGregor Tan, 2005) indicates the communities clear concern about water usage in Alice Springs, their openness to conservation measures and willingness to improve current practices (i.e. structural and behavioural changes), refer to Section 2.3.3 'Customer Survey'. Hence implementation of an effective communication strategy as part of the WEP could provide significant savings at this time due to the receptiveness of the community.

It will be essential that the WEP Team and trade allies have 'one voice', and that the communication and education materials used are well presented, easy to understand, informative, practical and up to date and that the water savings message reaches a diverse cross section of the community. The communication strategy will need to involve elements such as:

- a generic advertising campaign that uses various media such as radio, newspapers and television (when required);
- information booklets/pamphlets/stickers covering air conditioners, pools, garden watering, water efficiency tips around the house and more focussed material for hotels and the non residential sector for use in general and specific options respectively;
- mail out and point-of-sale vouchers and information for general and target groups;
- set up of a general enquiry telephone number for information on promotions available, booking audits and information on how advice can be obtained;

- training materials for trade allies, auditors and specialists; and
- an informative, easy to navigate and up to date website.

A number of these elements already exist such as the NRETA and PW websites and brochures on garden watering in Alice Springs. However, many of these will need to be updated as part of the WEP.

Preliminary costs of training materials, including the courses by which trade allies would gain certification to be involved in the program have been included in individual options where necessary. The WEP Team would need to organise the training of participants for relevant options. The detailed '**communication strategy and training plan**' will need to be designed once the Scenario, individual programs, budgets and timing have been agreed by the individual stakeholders involved.

Due to the relatively small size of the Alice Springs community, significant opportunities are available to focus the communication strategy and set up activities in key locations or at key events where a broad spectrum of residents will be present. For example, using Todd Mall as a focal point for demonstrations of different showerheads, giving out leaflets on water saving tips and tricks around the home, a draw for water saving washing machines, 'gifts' such as shower timers and water saving awareness for tourists etc. could be advantageous. Similarly, the Alice Springs Show can be used, as it has in the past, for such activities. Other locations such as garden centres provide ideal locations to focus the communication strategy on garden watering and school events to reach teachers, parents and children. Focusing the communication strategies for particular work places can also provide significant benefits (i.e. PW and NRETA could develop and monitor the effectiveness of saving water initiatives in their specific offices, which could then be rolled out into other work places).

To increase awareness of water issues among the community it may be advantageous to use more innovative communication strategies such as art work in public or prominent places, periodic competitions for water efficiency ideas, games for families and calendars that provide advice on water scheduling in the garden and reminders on when to check for leaks. These more innovative communication approaches can be explored during the detailed development of the 'communication strategy and training plan'. The identification of a 'brand name' for the WEP, individual programs and approved products/advisers will also need to be considered at this time.

7.2.7 Implementation Issues

As indicated in Figure 7.1 pilots should be considered as part of Step 4 (Implement the Response). Piloting or phasing of individual programs can be very useful in resolving any implementation issues. A number of implementation issues were identified as part of Stages I & II of the project during interviews with specific customer types and specialists such as plumbers and evaporative air conditioning contractors and by consulting with the ASUWMS Reference Group.

On 20 March 2003, a workshop was held in the DIPE/NRETA offices where the Study Team presented Stages I & II of the Study to the ASUWMS Reference Group (including the draft options developed). After the presentation a workshop was convened to discuss the concerns and opportunities of the options developed and to suggest modification where necessary. The details of the workshop discussions are provided in the Stage I & II Report (Turner et al, 2003, Appendix I). During the workshop, it became evident that the ASUWMS Reference Group had the view that implementation issues were extremely important and needed to be investigated thoroughly. Thus indicating that Stage III will need to include investigation of a number of implementation issues to ensure smooth implementation of individual programs.

Some of the key implementation issues identified during the Study and by the ASUWMS Reference Group during the workshop were:

- Concerns associated with hard water deposits affecting water efficient showerheads and other water efficiency devices.

Investigation into the suitability of a number of water efficiency appliances in the Alice Springs environment should be tested before a widespread retrofitting program is implemented. This could be done by setting up a pilot study for a sample of households before a widespread role out (see '**Phase 1 Pilot Study**' below). However, considering a number of households have already installed such devices it would be advantageous to also undertake a small survey to gather information on: how particular appliances have functioned in households that have had them installed for a number of years (e.g. various showerheads, tap regulators, irrigation equipment), any issues identified, methods used to mitigate build up of deposits, particular brands that are susceptible to the build up of deposits or have not shown any issues etc. A first step prior to such an investigation would be to check whether similar investigations and/or surveys have been undertaken in other areas with similar hard water issues. Such survey information and investigations together with an extension of the survey undertaken as part of Stage I & II of plumbers (refer to Turner et al, 2003, Volume II) could be used to develop a discussion paper to assist in the implementation phase of the WEP.

- It will be essential to ensure that trade allies such as garden specialists and plumbers, who will be critical to the successful implementation of a number of programs, trust and support the programs being implemented, the equipment installed and the message being given to the customers.

  Hence, it will be essential to bring representatives of trade allies into discussions on individual programs. For example, a number of plumbers in Alice Springs are sceptical of water efficient appliances and believe that hard water will be an issue with respect to performance. Carrying out the proposed Phase 1 Pilot Study and survey and identifying appliances that work effectively in Alice Springs should allay these concerns.

  Other issues such as the watering requirements for various plants, the best way to present outdoor water efficiency tips and the way to engage with local residents to obtain the maximum uptake of outdoor programs developed will require close liaison with garden specialists and the use of their expertise in developing up to date information packages. These can again be investigated as part of the proposed Phase 1 Pilot Study.

  In addition, novel ideas such as the use of centrally controlled watering systems or pager information systems on when to water (which have been used in the U.S.) could be advantageous and should potentially be trialled in Alice Springs for non residential customers such as schools, the Alice Springs Town Council etc.

- There is a need to link the proposed programs with other initiatives such as the ALEC Myer Foundation funded project on water conservation, Cool Communities, Desert Knowledge and CRC projects to take advantage of synergies that may be available and to ensure that the programs complement other initiatives being implemented and advance knowledge where possible.

  It is proposed that the WEP Team ensure that representatives of such organisations are active members of the ASUWMS Reference Group and thus assist in not only informing the group of what each organisation is currently investigating (on a regular basis) but also assist in determining how synergies and multiple benefits can be obtained as part of a '**joint research plan'** that specifically benefits the WEP and assists in ensuring Alice Springs becomes internationally recognised as a knowledge hub for water efficiency issues in an arid environment.

- A clear and consistent message on water efficiency that will engage the residents and visitors of Alice Springs, is required. Innovative ideas and advertising will be required to change attitudes and behaviour. A brand name for the demand management program may be required and the use of brand distinction may aid in identifying appliances that are water efficient.

As indicated in Section 7.2.6 the detailed communication strategy will need to address these issues.

- Further investigation into the water usage of particular appliances.

  The water usage/wastage of a number of appliances (e.g. non efficient showerheads, evaporative air conditioners, proportion of toilets leaking and associated volumes etc.) needs to be confirmed through further investigation to assist in refining how much water is being used and how much can be saved through the various individual water efficiency programs. Incorporating these investigations into the Phase 1 Pilot Study could significantly reduce costs of obtaining this data.

7.2.8 Proposed Phase 1 Pilot Study & Survey

The original ISF 'Alice Springs Water Efficiency Study – Proposal for Next Steps' September 2003 (that was developed once the Alice Springs WES Stage I & II Report was completed) identified the need for a number of key issues to be addressed before full implementation of the WEP commenced. One such issue was associated with implementation issues and the need to gather further information as indicated in Section 7.2.7. The use of a pilot study and survey to assist in addressing a number of these issues and data gaps was proposed and preliminary task details identified[38].

It is proposed that the pilot study is considered as Phase 1 of the 'Indoor (SR) retrofit program' and 'Outdoor garden (SR general) program'[39]. The pilot study would aim to concentrate on an already constrained area such as Northside and would investigate issues such as: how to maximise participant uptake; real implementation costs; the best communication materials; how specialists can work together; contract arrangements; collection on information on existing appliances, leaks and flow rates in the home etc. This kind of information is invaluable and enables early evaluation of the benefits and concerns of the individual programs and the kinds of difficulties that need to be addressed.

7.2.9 Funding & Regulatory Instrument Mechanisms for the Non Residential Sector

Both the institutional ('other') participants and commercial and industrial ('customer') participants of the individual programs will need some form of financial assistance/incentive and/or regulatory instrument to ensure they take part in the WEP. The costs of the individual programs developed for this Study take into consideration the total costs of each program from all perspectives (i.e. PW, NRETA, other, customer), however, as part of the implementation planning stage the most appropriate mechanisms need to be considered. In many WEPs across Australia and internationally failure to consider these mechanisms, often leads to poor participation in programs and/or a reduction in savings achieved.

In the institutional sector (i.e. hospital, schools, public housing) it is likely the best approach to ensuring participation in individual programs will be for the WEP Team to work with the individual government departments, as soon as possible, to ensure the funds identified as part of this Study (and more detailed budget plans) are made available and agreed in annual budgets over the next five years. Either the funds can be allocated to the individual government departments directly or transferred from the WEP central funds on an annual basis. The funds should only be released to the individual government departments once an action plan has been agreed following WEP Team advice, audits and check off of the action plan upon completion of actions and retrofits etc. Alternatively, a model where action plans that ensure retrofits or targets are embedded in the annual maintenance programs (i.e. the public housing department is required to replace inefficient equipment in a proportion of households

[38] Refer to e-mail 03/09/03 sent from Andrea Turner to Darryl Day, Paul Heaton and John Childs.

[39] A similar approach was used in the ACT in 2004 before roll out of the full program.

each year) could also be used. Post implementation evaluation of actions and retrofits will be essential (refer to Section 7.2.10 below) to ensure savings are being achieved.

In the commercial and industrial sectors, many WEPs provide a free or reduced audit for participants but do not provide funding for retrofits and/or structural changes. In the majority of these situations participants do not undertake the retrofit or structural change as they consider the ‘pay back period’ too onerous or not worth considering. Again, total costs for each individual program have been considered in the analysis undertaken for this Study and thus a financial allowance has been provided for participants. As for the institutional sector, it will be essential to set up an agreed action plan with each participant following an audit. The full allocation of financial assistance, for each participant, should only be provided upon satisfactory sign off of the actions and where possible evaluation of savings.

In some cases participants may need further assistance to participate in the individual programs through the provision of a revolving loan fund, which specifically assists in overcoming the issue of the pay back period. Such funds, provided by the water service provider or government financing the WEP, can effectively provide interest free loans to participants, which in some cases are paid back as part of their water bills.

7.2.10 Monitor, Evaluate and Review

An essential element of the WEP will be to monitor, evaluate and review the individual programs and the overall WEP. WEPs often reap enormous benefits when part of this review process occurs in parallel to the early implementation phase so that the program can be adapted according to the strengths and weaknesses found (i.e. adaptive management). For example, the Phase 1 Pilot Program identified in Section 7.2.8 will enable various aspects of the ‘Indoor (SR) retrofit program’ and ‘Outdoor garden (SR general) program’ to be assessed before roll out of the entire program in subsequent years. This early evaluation will enable for example:

- the costs and savings of the programs (and associated unit costs) to be refined at an early stage and incorporated into the EUM/OM;
- participation rates and the best forms of advertising the program investigated to gain maximum uptake;
- ensure customer satisfaction is being obtained and if not how this can be addressed for the broader community (i.e. higher quality or different coloured appliances);
- any issues with communication or quality control with contractors can be addressed (i.e. ensure proportion of contractor visits are audited for quality control similar to SWC audits);
- assessment of how data from individual households should be collected to assist in accurate data collection for data gaps and ongoing evaluation (i.e. Yarra Valley Water with assistance from ISF have developed a computer based data collection software package for pilot studies that reduces the time needed at each household and for analysis and increases accuracy of data collection);
- how the specialists view the program and how the program could be improved with their assistance; and
- early evaluation of actual water savings achieved through assessment of water meter readings of participants versus controls over set time periods.

Issues such as a common leakage problem associated with outdoor taps might be found during a number of garden specialist visits to SR households. If a review of the program is undertaken at the end of say the first 100 properties visited this common problem could be identified and future visits could be modified to include the costs of additional materials and time to fix such leaks as well as carrying out the garden advice service. Similarly if in the indoor program toilets are found to have significant leaks the program can be modified to ensure plumbers have the required materials to fix all leaks during the visit rather than having to make a repeat visit with further expense.

Ongoing evaluation of savings will also be essential. An allowance for evaluation of savings has been provided in the cost estimate of each individual program at the end of the first year. It is advised that an approach similar to that used for the SWC Every Drop Counts Residential Retrofit Program (Turner et al, 2005) is used for the residential programs, which determines the relative savings of matched pairs of participants and controls over a set timeframe. ISF is currently actively involved in determining best practice methodologies for evaluating various residential, non residential and pressure and leakage programs. It is anticipated these methodologies could be made available to the WEP Team.

Overall evaluation of savings and costs of the individual programs and overall WEP will be essential and hence an '**Evaluation and Monitoring Plan**' should be set up at the commencement of the WEP. As indicated in Section 7.2.4 regular reporting to the NT Government, the ASUWMS Reference Group and the community on the outcomes achieved will be required similar to the SWC report "Conservation & Recycling Implementation Report"[40] which provides a focal point for identifying the outcomes of the year and future plans.

7.3 Work Plan Summary & Timing

Figure 7.3 shows the proposed timing of the Scenario 3 WEP including the start and duration of the individual programs over the 25 year period considered. As can be seen it is assumed that a number of the programs commence in 2007 and that the majority of programs are completed within a core 5 year period. The programs highlighted in dark purple are those included in Scenario 3. Those highlighted in grey have not been included due to their unit cost being above $0.87 /kL as discussed in Section 5.4. The System programs will require ongoing investment to maintain savings as indicated in light purple.

A number of activities will also need to be undertaken or at least commenced over the short term (i.e. 2007) as indicated below:

- Detailed Implementation Plan (refer to Section 7.2)
- Stakeholder Workshop (refer to Section 7.2.1)
- Detailed Budget Plan (refer to Section 7.2.2)
- PW Board Paper (refer to Section 7.2.3)
- Cabinet Submission (refer to Section 7.2.3)
- Set up and recruitment of WEP Team (refer to Section 7.2.4)
- Communication Strategy & Training Plan (refer to Section 7.2.6)
- Joint Research Plan (refer to Section 7.2.7)
- Phase 1 Pilot Study and Survey (refer to Section 7.2.8)
- Evaluation and Monitoring Plan (refer to Section 7.2.9)

As indicated in Section 7.2 a number of the documents required will form part of the Detailed Implementation Plan.

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40 http://www.sydneywater.com.au/Publications/_download.cfm?DownloadFile=Reports/WaterConservationAnnualReport2004.pdf [accessed 23/12/05]

Recommendation 7.1

Considering the significant community benefits and support for water efficiency initiatives as demonstrated by the WES Stage III analysis and recent customer survey (McGregor Tan, 2004) it is recommended that a WEP similar to Scenario 3 is taken forward for implementation in 2007 for a core period of 5 years.

Recommendation 7.2

It is also recommended that a number of short term actions are taken forward in the short-term, including set up and or development of: a Detailed Implementation Plan, Stakeholder Workshop, Detailed Budget Plan, PW Board Paper, Cabinet Submission, Communication Strategy & Training Plan, Joint Research Plan, Phase 1 Pilot Study and Survey, Evaluation and Monitoring Plan and set up and recruitment of WEP Team.

Figure 7-3 WEP Timeline

Timeline				Year																									
Options	Unit cost PV $/kL	Option IN=1 OUT=0		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Options		1	0.5																										
Water Efficiency																													
Indoor (SR) retrofit program	0.59	1	N/A																										
Indoor (MR) retrofit program	1.27	1	N/A																										
Indoor (SR) toilet retrofit program	1.08	1	N/A																										
Indoor (MR) toilet retrofit program	1.83	1	N/A																										
Washing Machine Rebate	1.12	1	N/A																										
Public housing indoor retrofit	0.78	1	N/A																										
Public housing toilet retrofit	1.34	1	N/A																										
Outdoor Garden (SR general) program	0.51	1	N/A																										
Garden outdoor (high user targetted) program	0.21	1	use																										
Pool cover rebate	1.04	1	N/A																										
Cooling Alice residential program	1.78	1	N/A																										
Cooling Alice Public Housing program	1.76	1	N/A																										
Pine Gap (SR) program	0.31	1	use																										
Town Camps Program	0.66	1	N/A																										
General C/I water efficiency program	0.62	1	N/A																										
High Users C/I water efficiency program	0.47	1	use																										
Hotel program	0.34	1	use																										
Institutional retrofit	0.46	1	use																										
Hospital Program	0.11	1	use																										
Schools Program	0.50	1	use																										
The System																													
Leakage program	0.19	1	use																										
Pressure Reduction	0.30	1	use																										
Regulations & Source Substitution																													
MWEPS	0.06	1	use																										
Residential DCP	0.30	1	use																										
Non-Residential DCP	0.36	1	use																										
New Smart growth	1.51	1	N/A																										
Rainwater tank rebate (existing SR)	21.54	1	N/A																										
Greywater rebate (existing SR)	7.91	1	N/A																										
Town Basin (existing)	0.54	1	N/A																										
Town Basin (extend)	0.93	1	N/A																										
Reuse	0.09	1	use																										

8 CONCLUSIONS & RECOMMENDATIONS

8.1 Conclusions

The WES Stage III analysis demonstrates that a comprehensive cost effective Water Efficiency Program (WEP) can and should be implemented in Alice Springs. When broader societal benefits are also considered the analysis shows that nearly all the 31 options developed could be implemented providing the community of Alice Springs with significant net benefits including extending the life of the current water resources and deferring the need to develop a new source. With the current strong community support for a WEP, implementation should commence soon to build on this enthusiasm.

A number of stakeholders will need to take part in the implementation of the WEP. Hence, an implementation work plan that uses experience from other areas around Australia has been developed to assist in identifying some of the key tasks that will be needed, including those required in the short term (i.e. before next summer).

To maximise uptake of these program elements a large proportion of the costs required will be borne by the NT Government and PW. This will require some form of direct investment, a CSO payment or a pass though in the water price. The current analysis, is based on a conservatively low estimate of the marginal cost. On this basis, to ensure PW remains revenue neutral a small price pass through will be necessary which can either be shared amongst all PW NT customers (less than 3¢ /kL for a single price change even with the highest cost scenario) or if pricing policy in the NT is modified, isolated to Alice Springs customers (less than 10¢ /kL).

8.2 Recommendations

A series of recommendations have been made throughout this report. These relate to each specific Section and are summarised below. These recommendations assist in setting the direction of actions required to implement a water efficiency program for Alice Springs.

Recommendation 2.1

Although the EUM/OM has been advanced for the purposes of the Stage III analysis it is recommended that the Alice Springs EUM/OM be transferred into the Water Services Association of Australia (WSAA) software package, the Integrated Supply Demand Planning (ISDP) Model, which ISF together with CSIRO have assisted in developing. By transferring the end use and options data into the WSAA ISDP software package in the future, this will enable the NT Government representatives to obtain further model functionality and be able to obtain WSAA modelling advancements being made across Australia on an ongoing basis. In addition, this will enable easier linkage with other models being used or developed by the NT Government representatives such as the PW borefield model and the NRETA groundwater resource model.

Recommendation 2.2

To assist in ensuring assumptions used in the EUM/OM reflect the situation in Alice Springs, it is recommended that a survey is designed and conducted to gain a statistically valid sample on the issues that need further assessment. Information such as the flow rate of non-efficient and AAA-rated showerheads and water usage of evaporative air conditioners needs to be collated. It is also recommended that this survey be combined with a pilot program (e.g. residential indoor retrofit), in (say) an infrastructure constrained area, to reduce the costs of the survey and maximise potential water saving outcomes.

Recommendation 2.3

PW is currently using a reference case for assessing bulk water abstraction (and thus borefield augmentation) based on a borefield model that has not been updated since 1999. It is recommended that the detailed demand forecast developed as part of Stage III and the associated EUM is linked to the borefield model to ensure that bulk production forecasts and scheduling of the need for new bores uses the most up to date information available. This will assist in more accurate scheduling of costs for the provision of water services in Alice Springs.

Recommendation 2.4

Further to Recommendation 2.3, PW and NRETA should take advantage of the WES Stage III analysis in finalising the Alice Springs Water Resource Strategy, by using the Stage III detailed reference case demand in calculation of the current resource capacity. In addition the scenarios developed as part of Stage III could also be used to determine the benefits of introducing a WEP (i.e. extending the life of the current resource). The NRETA investigations of the resource capacity, PW calculations of bore replacement scheduling and ISF analysis into reference case demand and WEP Scenarios need to feed into each other (including linking of models) to ensure consistent assumptions are used and the best outcomes identified.

Recommendation 2.5

A number of investigations into water efficiency, source substitution and reuse are currently being undertaken in Alice Springs. Many of these investigations are being funded by a variety of sources. Due to this fragmentation in funding and implementation there also appears to be fragmentation in the co-ordination of the design of the independent studies and collation of findings, which is causing barriers in identification of a clear strategy and way forward. It is recommended that the ASUWMS Reference Group, including members of NRETA and PW, take the opportunity to use the outcomes of WES Stage III to re-evaluate the overall direction of investigation and actions required for Alice Springs. The Stage III Study is using a Least Cost Planning (LCP)/Integrated Resource Planning (IRP) approach, which is considered best practice internationally. This approach will assist in clarifying total costs of options, environmental and social benefits and who might be required to pay. By using an IRP approach, assumptions are clearly stated and an adaptive management plan presented. The use of this IRP approach will assist the ASUWMS Reference Group (primarily NRTEA and PW) to approach the NT Government to assist in providing adequate funding for a WEP and associated studies/investigations.

Recommendation 3.1

Although options relating to leakage detection and pressure reduction have been developed as part of Stage III of this Study, there is little data on the potential costs and savings of such programs in Alice Springs and therefore data from other Australian cities has been used to provide preliminary costs and savings. Considering the potential of these options, it is recommended that PW undertake an investigation of the leakage detection and pressure reduction costs and savings specifically for Alice Springs, as a matter of priority.

Recommendation 3.2

As required under the brief for WES Stage III, a number of source substitution options have been analysed using available data/information to determine their potential costs and savings. Much of this data is limited, and therefore these represent preliminary estimates only. Considering a number of these options have the potential to provide significant water savings, it is recommended that further investigation is undertaken to refine potential costs and savings prior to implementation as follows:

- Smart Growth – Further investigate the potential costs and savings of Smart Growth by working with developers of the current and planned land release areas to pilot ESD concepts and use other literature available on costs and savings as it becomes available.

- Town Basin Supply – Investigate the demand of the residential and non residential properties adjacent to the existing Town Basin reticulation system and associated extension, and increase the accuracy by interrogating the PW customer water meter database.

Effluent Reuse – Similarly, investigate the demand of the large non residential properties adjacent to the new effluent reuse pipeline more accurately by interrogating the PW customer water meter database. Although not part of the scope of work for Stage III, this has been done to a limited extent by the Study Team with the available customer meter readings. Further interrogation of the database would assist in refining estimated costs and savings.

Recommendation 4.1

To ensure all water service options are considered using a robust economic assessment method, it is recommended that the ASUWMS Reference Group and PW and NRETA ensure that all future cost assessments undertaken are based on the internationally recognised best practice process of Least Cost Planning/Integrated Resource Planning. Options should be assessed using a total resource cost test and where possible societal cost test, rather than a utility perspective only.

During assessment of previous cost estimates undertaken for the ASUWMS Reference Group, the WES Study Team has noted considerable inconsistency in economic assessment methods used, which causes significant difficulty when trying to compare options from different studies. Using an agreed approach will assist in minimising ambiguity in future.

Recommendation 4.2

Data on the current marginal cost of water has been difficult to obtain for WES Stage III. It is recommended that PW investigate the detailed breakdown of the marginal cost of water as a matter of priority including using the WES Stage III projection assumptions. The current marginal cost of water calculated as part of WES Stage III has been used to determine which WEP options should be taken forward for implementation. If, as is suspected, the marginal cost of water is actually higher than currently estimated this might result in WEP options being deleted from the program unnecessarily, which will be to the detriment of the Alice Springs community.

Recommendation 5.1

It is recommended that a suite of options similar to Scenario 3 (total PV cost of $5.05 M, average unit cost of $0.30 /kL and potential savings of 2,370 ML/a by 2030) is taken forward for further consideration and implementation considering the relatively low cost and significant benefits that can be attained by society as a whole.

Recommendation 6.1

By using the LCP/IRP unit cost analysis for Alice Springs and inclusion of various benefits we are able to show which options and Scenarios are a sensible investment based on the combined perspective of all stakeholders – the 'total resource cost test'. Depending on the marginal cost of water, which in the WES Stage III analysis is considered to be a conservative estimate, a number of the Scenarios are cost effective from the total resource cost perspective and represent sensible investment decisions. If these options are not implemented this will mean PW will actually spend more under the reference case Scenario compared with these Scenarios because the advantage of the avoided costs of reduced water and wastewater supply has not been realised. Over the time period considered (25 years) these Scenarios will pay for themselves.

From the broader perspective of the community (which includes benefits such as customer energy bills and the estimated value of GHG reduction associated with reduced water and wastewater supply energy usage and customer hot water usage), all Scenarios except Scenario 4 (which contains the two highest unit cost options) provide worthwhile investment decisions. Again, if the options are not implemented this will mean that the community as a whole will incur greater costs, direct and indirect, than under the reference case Scenario.

From the viewpoint of the utility, the use of transfer payments (using price changes) will ensure that any of the Scenarios developed can be implemented while leaving the utility revenue neutral. Average customer bills will still be lower than before.

It is recommend that, as undertaken as part of this Study, water efficiency options and supply options should be analysed from the combined perspective of PW, NT Government and the customer and that both this perspective (full economic perspective) for the purpose of ranking and choosing options, as well as the financial (cash flow from perspective of the utility only) are presented for decision making. This transparency of analysis will enable PW to make the case to the NT Government to allow price pass through to customers or for Government to fund the shortfall directly. Considering the significant benefits associated with each of the Scenarios at least Scenario 3 should be recommended to the NT Government for consideration.

Recommendation 7.1

Considering the significant community benefits and support for water efficiency initiatives as demonstrated by the WES Stage III analysis and recent customer survey (McGregor Tan, 2004) it is recommended that a WEP similar to Scenario 3 is taken forward for implementation in 2007 for a core period of 5 years.

Recommendation 7.2

It is also recommended that a number of short term actions are taken forward in the short-term, including set up and or development of: a Detailed Implementation Plan, Stakeholder Workshop, Detailed Budget Plan, PW Board Paper, Cabinet Submission, Communication Strategy & Training Plan, Joint Research Plan, Phase 1 Pilot Study and Survey, Evaluation and Monitoring Plan and set up and recruitment of WEP Team.

9 REFERENCES

ABS (2002) Environmental Issues: Peoples views and practices, Catalogue #4602.0

ABS (2004) Environmental Issues: Peoples views and practices, Catalogue #4602.0

AWA (2002) Performance Monitoring Report: Australian Non Major Urban Water Utilities 2000/2001

Department of Public Works and Services (1998) Water Auditing Report – Alice Springs, Department of Public Works and Services, NSW

Fane, S., Turner, A. and Mitchell, C. 2004 'The Secret Life of Water Systems: Least Cost Planning Beyond Demand Management' *2nd IWA Leading Edge Conference on Sustainability in Water Limited Environments*, Sydney 8-10 November 2004.

Independent Pricing and Regulatory Tribunal of NSW (1996) ‘Water Demand Management: a Framework for Option Assessment’ *Report of the Water Demand Management Forum*, White S. (ed), March.

Independent Pricing and Regulatory Tribunal of NSW (2004) *Investigation into Price Structures to Reduce Demand for Water in the Sydney Basin, Final Report.*

Institute for Sustainable Futures (2003) Alice Springs Water Efficiency Study: Proposal for Next Steps, prepared by ISF for PW & DIPE

McGregor Tan Research (2005), Northern Territory Department of Infrastructure and Planning – Water Use in Alice Springs (Draft), report prepared by McGregor Tan Research for the NT NRETA

Miller, Merton H & Upton, Charles W, 1985. "A Test of the Hotelling Valuation Principle," Journal of Political Economy, University of Chicago Press, vol. 93(1), pages 1-25.

NT Government, ESD Paper

Office of Water Services in England and Wales (2001) *Role of long run marginal cost in the provision and regulation of water services*.

P Jolly (2005)

Pacific institute [8/2001] "Economic Evaluation of Cadiz Groundwater Storage and Dry Year Supply Project," Dr. Gary Wolff [Research Paper]

Pacific Institute (2003) *Waste not, want not: the potential for urban water conservation in California*, Gleick, P.H. Haasz, D. Henges-Jeck, C. Srinivasan, V. Wolff, G. Kao Cushing, K. & Mann, A., November.

PW (2001) Alice Springs Water Services System Asset Management Plan 2001

PW annual report 2004

PW (2005) Alice Springs Sewerage Services System Asset Management Plan 2005

PW (2005) Alice Springs Water Services System Asset Management Plan 2005

Roberts P (2004) Appliance Stock and Usage Patterns Survey, Yarra Valley Water

SKM (2001)

Smith 1981

SWC (2003) “Water Conservation & Recycling Implementation Report 2002 – 2003”, Sydney Water Corporation.

Turner, A., Campbell, S., White, S., Milne, G., (2003), Alice Springs Water Efficiency Study – Stages I & II – Final Report – Volumes I&II, prepared by the Institute for Sustainable Futures and Kellogg Brown & Root for PW/DIPE.

Turner, A. & White, S. (2003) *ACT Water Strategy: Preliminary demand management and least cost planning assessment, - Final Report*, prepared for the ACTEW Corporation

Turner, A., White, S., Beatty, K. & Gregory, A. (2005) 'Results of the Largest Residential Demand Management Program in Australia', *International Conference on the Efficient Use and Management of Urban Water*, Santiago, Chile, 15-17 March 2005.

Turner, A., White, S., Westcott, W., Edgerton, N., (2005) A Review of Water Efficiency Programs in Western Australia: Towards a Strategy for Best Practice – Final Report, report prepared by the Institute for Sustainable Futures for Water Corporation, WA.

WBW (2005) “Water Loss Evaluation and Development of a Leakage Control, District Metering and Pressure Management Strategy”, report prepared with and for Gold Coast Water, Version 1.

White, S. & Howe, C. 1998, ‘Water efficiency and reuse: a least cost planning approach’, Proceedings of the 6th NSW Recycled Water Seminar, November.

White, S., Robinson, J., Cordell, D., Jha, M., Milne, G., (2003) ‘ Urban Water Demand Forecasting and Demand Management – Research Needs Review and Recommendations – Occasional Paper No. 9’, report prepared by the Institute for Sustainable Futures for the Water Services Association of Australia

APPENDICES

APPENDIX A – WES STAGE I & II EXECUTIVE SUMMARY

Potable water demand in Alice Springs, in a business as usual scenario, is expected to rise from the current 10,000 ML/a to approximately 12,500 ML/a by 2021 due to the projected rise in population. This Study has developed two demand management program scenarios, which could reduce water demand by at least 1,050 ML/a and 3,400 ML/a by 2021 at an estimated cost of $3.8M and $10.2M respectively. The costs of implementing either of these program scenarios would be recouped by the energy savings obtained from reduced water pumping requirements alone. In addition to reducing the demand for potable water both programs would: reduce wastewater production with subsequent environmental and social benefits in relation to Ilparpa swamp overflows; reduce and/or defer capital investment required to augment the potable water and wastewater systems; reduce greenhouse gas emissions; and provide significant additional social and environmental benefits.

Background

The Northern Territory Government, Power and Water Corporation (PW) and the Department of Infrastructure Planning and Environment (DIPE), have recognised the need to use a coordinated approach to managing water resources in Alice Springs. Hence they have set up the Alice Springs Urban Water Management Strategy (ASUWMS), which aims to use a combination of approaches including demand management, alternative sources and effluent reuse to reduce potable water demand and wastewater production in Alice Springs.

The Alice Springs Water Efficiency Study (the Study), which is the subject of this report, looks specifically at demand management opportunities and thus forms a part of the ASUWMS. The aim of the Study is to identify options for reducing both water demand and the production of wastewater effluent in Alice Springs principally in order to:

- reduce the need for augmentation of the Roe Creek Borefield;
- reduce the need for augmentation of the reticulation system because of future population growth; and
- reduce the volume of effluent overflow from the wastewater treatment plant (WWTP) passing to Ilparpa swamp and subsequently reduce mosquito breeding and other issues.

This report provides details on the work undertaken for Stages I and II of the Study:

- production of models that reflect historical patterns and project future water demand and wastewater production; and
- development of demand management options that aim to reach specific targets to reduce potable water demand, peak demand and wastewater production.

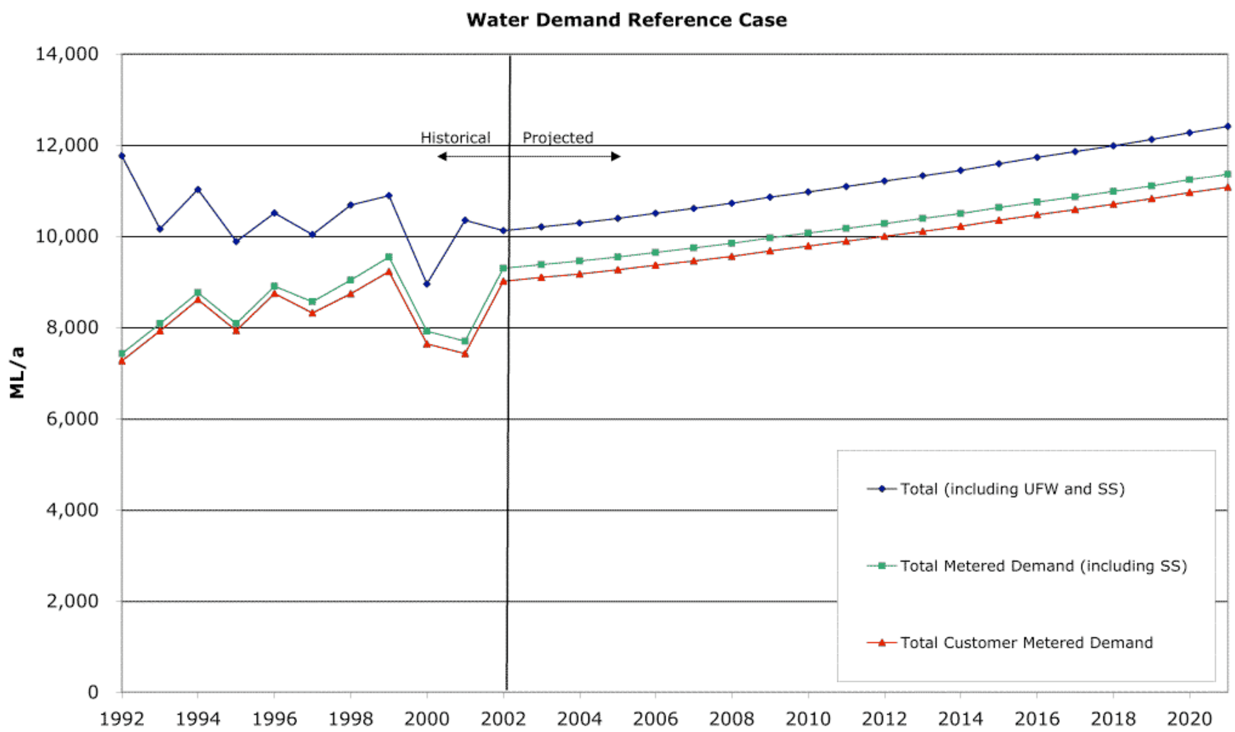
The report also sets out a number of recommendations that should be considered by PW/DIPE and justification for moving to Stage III of the Study, the implementation plan for the proposed demand management program.

The Demand for Water

The population of Alice Springs is expected to grow by more than 5,500 people in the next 20 years from 27,000 (2001) to 32,500 (2021) which represents an increase of 20%. Without investment in demand management, source substitution or reuse alternatives, per capita demand for potable water is likely to remain at or near current levels. Hence the demand for potable water in Alice Springs is likely to increase in the future, from the historical average over the last 10 years of approximately 10,000 ML/a to around 12,500 ML/a by 2021.

Figure 1 shows the historical and projected customer metered demand, metered demand including source substitution (non potable supply from the Town Basin) and the total water supplied by PW including unaccounted for water (UFW), metered potable water and metered source substitution. This water demand projection represents the reference case or business as usual case and has been used to assess the effectiveness of demand management options in achieving identified demand reduction targets. The reference case incorporates anticipated improvements in water use efficiency, which will occur without PW intervention (e.g. stock turnover of 12 L single flush toilets with water efficient 6/3 L dual flush toilets).

Figure 1 Water Demand Reference Case (ML/a)



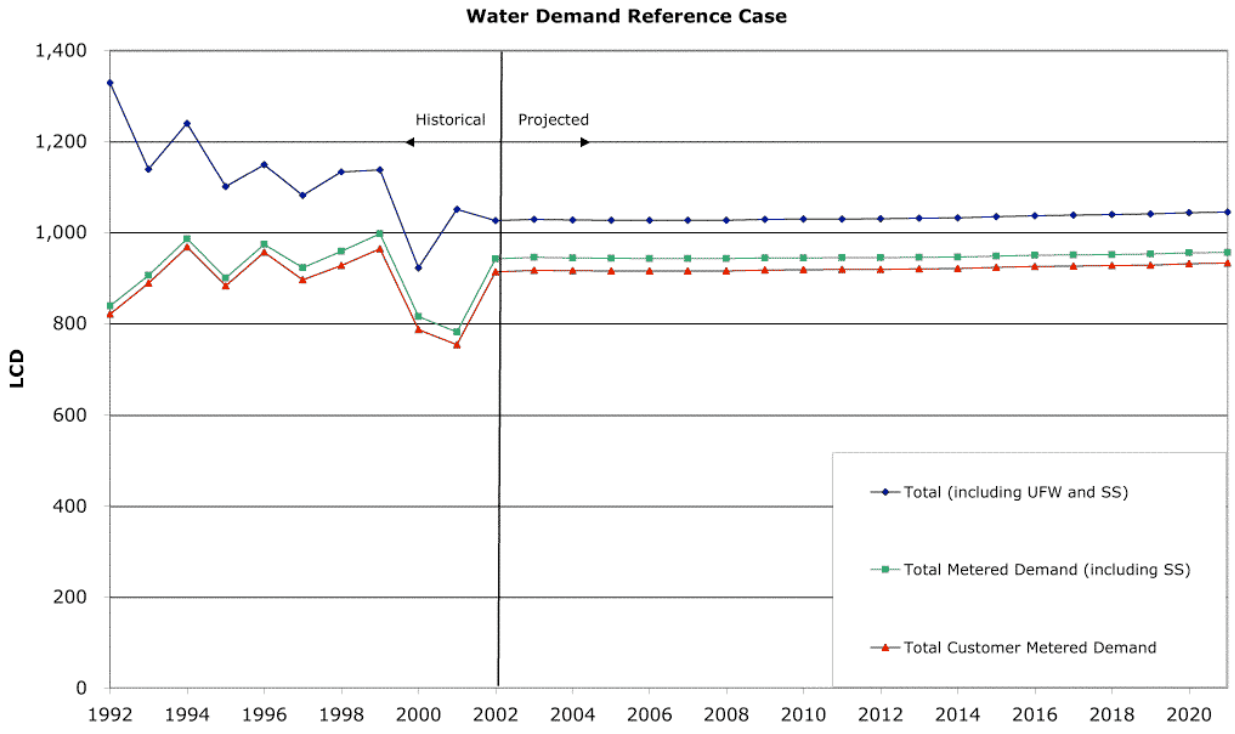
Note – SS represents Town Basin source substitution and UFW represents unaccounted for water.

Figure 1 indicates that there has been a downward trend in total water supplied over the last ten years. However, upon closer inspection of the data the recent reduction in demand can mainly be attributed to two main factors:

- a gradual reduction in system losses or UFW from 21% to 12%, except for 2001 when a major leak contributed to UFW increasing to 27%; and
- a reduction in customer metered demand in 2000 and 2001 due to above average rainfall, which significantly reduced demand in both the residential and non residential sectors.

Hence although water demand has reduced over the last ten years, per capita metered demand has remained fairly constant and is expected to remain so unless a demand management program is implemented. The historical and projected per capita demand is illustrated in litres per capita per day (LCD) in Figure 2.

Figure 2 Water Demand Reference Case (LCD)



Hence overall water demand is expected to increase, as the population grows, as shown in the projection in Figure 1.

Water Supply Constraints

The implications of this increase in water demand are that aquifer levels will continue to fall, as the current annual extraction already exceeds the recharge rate of the primary potable water supply aquifer. The water level of this aquifer is currently at more than 145 m below ground level and is falling at a rate of between 1 to 2 m per year with the current level of water demand. This means that additional capital expenditure will be required to drill new bores or rehabilitate existing bores just to reach the lowering aquifer levels to meet current demand. With greater demand from the additional population the aquifer level will drop more quickly resulting in additional capital costs being required for new bores and to deepen existing bores and earlier in terms of capital expenditure planning. In addition as the aquifer levels fall energy costs associated with pumping will increase as water is extracted from greater depths. Even with no increase in annual demand, extraction depths will increase from the current 145 m to around 190 m by 2021. If demand increases to around 12,500 ML/a, as projected by this Study (the reference case), the extraction depths of the bores could potentially increase to 240 m by 2021. It should be noted that these are estimates.

The energy usage and costs associated with extracting/pumping water in Alice Springs, currently approximately 1,100 kWh/ML and $150/ML respectively, are amongst the highest in the Australian water industry. These will increase as the aquifer level falls further. Hence, if water demand is reduced, significant benefits can be obtained such as avoided or deferred capital and operating costs for water supply and wastewater treatment and disposal, reduced capital and operating costs for the electricity supply system and reduced greenhouse gas (GHG) emissions.

The results of this Study show that a demand management program of the type developed under this Study, could reduce water supply operating costs sufficiently, so that this cost reduction alone would pay for the cost of the demand management program. This does not include the additional benefits of deferred capital expenditure associated with the water supply system and other environmental benefits such as reduction in effluent discharge volumes and reduction in energy usage and GHG emissions.

These factors are discussed in more detail in the following sections together with the associated costs of the demand management program scenarios.

Sewage Overflows

The average annual volume of wastewater passing to the WWTP is currently estimated to be between 2,500 and 3,000 ML/a. This is expected to rise as the population grows. The existing WWTP is nearing both hydraulic and treatment capacity and wastewater effluent overflows from the WWTP (estimated to be approximately 600 ML/a) currently discharge to Ilparpa swamp causing ecological and mosquito breeding issues. These overflows are generally at their peak during winter months when evaporation rates are at their lowest and visitor numbers are at their highest. It is expected that these issues will continue as the population grows unless significant intervention is adopted (e.g. demand management or effluent reuse).

An investment of up to $10M for storage and effluent reuse is planned by PW over the next five years to reduce overflows by establishing an effluent transmission system to supply a horticultural district near the Arid Zone Research Centre. A demand management program that targets indoor water demand and the tourist sector will provide not only water demand reduction but also a reduction in terms of wastewater production, thus reducing the flows passing to the WWTP and overflows to Ilparpa swamp. Hence a demand management program could assist in reducing the capital expenditure required for the planned reuse scheme, reduce or defer the capital costs associated with the future planned WWTP hydraulic and treatment upgrade and general operational costs associated with the wastewater system.

The Study Approach

The main aim of this study has been to develop a suite of options (the demand management program), which together reduce annual and peak potable water demand as well as wastewater production. The demand management options have been developed using the principles of least cost planning (LCP) where LCP involves the development and analysis of a range of options to determine the least cost means ($/ML supplied or saved) of providing customers with the water related services they require rather than the water itself. This process recognises that customers do not necessarily want more water, rather they want the services that water provides (e.g. aesthetically pleasing landscapes, sanitation and clean clothes) and that every litre of water saved is the equivalent of a litre supplied. The demand management options developed target a broad range of customers in all sectors (e.g. residential, commercial/industrial and institutional) and individual end uses such as indoor (e.g. toilets, taps, showers) and outdoor (e.g. pools, air conditioners, gardens). They also use a wide range of approaches to increase indoor and outdoor water efficiency including the use of a measure (e.g. increased water efficiency through the fitting of a AAA-rated showerhead) and an instrument (e.g. economic incentive where PW pays for the showerhead and labour and communicative where PW provides a brochure on water efficient tips around the home).

The Options

The options developed, which are described in detail in Section 8.0 of the report, have been grouped as follows:

- residential indoor;
- residential outdoor;
- other residential;
- commercial/industrial;
- institutional;

- new developments; and
- other options.

The options include a combination of measures and instruments such as: retrofitting appliances and fittings (e.g. toilets, showerheads and taps); specialist visits to targeted properties to investigate outdoor water use; provision of give-aways such as tap timers; rebates for the purchase of AAAA-rated washing machines; audits and associated retrofitting and management advice for hotels; and development controls for new residential and commercial buildings. Targeting of new developments has been included to ensure that water efficiency is locked in to new residential and non residential developments as far as possible. This is in order to reduce future investment in demand management measures and to take advantage of the fact that generally the inclusion of water and energy efficiency in new buildings has only a marginal effect on the overall cost of the building. In addition such buildings can relatively easily incorporate options such as demand management, source substitution and reuse.

Savings in terms of total water, peak day water, sewage effluent, energy and GHG have been modelled together with total implementation costs for each option based on assumptions around take-up rates and savings levels.

These options have been developed into three water saving scenarios (1 – low, 2 – medium and 3 – high) to determine the level of investment required to achieve the Alice Springs Urban Water Management Strategy Reference Group (ASUWMSRG) preliminary goals of:

- a 25% reduction in total annual water demand over the first three years, with a further 10% reduction in the following two years;
- a 10% reduction in peak day demand over the first three years, with a further 5% reduction in the following two years; and
- a reduction in inflows to the WWTP from 8 ML/d to 7 ML/d.

Each of the scenarios uses the options developed with varying levels of implementation. Scenario 1, with the lowest costs, shows the baseline savings achievable and represents a standard efficiency options program. In this scenario the participants in a retrofit program might be assumed to be 50% of all available households. Scenario 2, the mid-range scenario, has involved consideration of which of the model's assumptions may reasonably be increased (for example take-up rates) and at what cost. In this scenario the participants in a retrofit program might be assumed to be considerably more at 75% of all available households, which could potentially require additional incentives and thus cost more to attract the level of participants needed. By changing the take-up rate of those options with the lowest cost first ($/kL), it has been possible to develop Scenario 2 at the lowest cost. The high scenario (Scenario 3) has not been fully developed, as it is considered that Scenario 2 pushes the demand management options considered to the limit of their application (in terms of their uptake) and that a more holistic approach combining demand management, leakage control, source substitution and reuse would provide the overall savings required at a lower average unit cost.

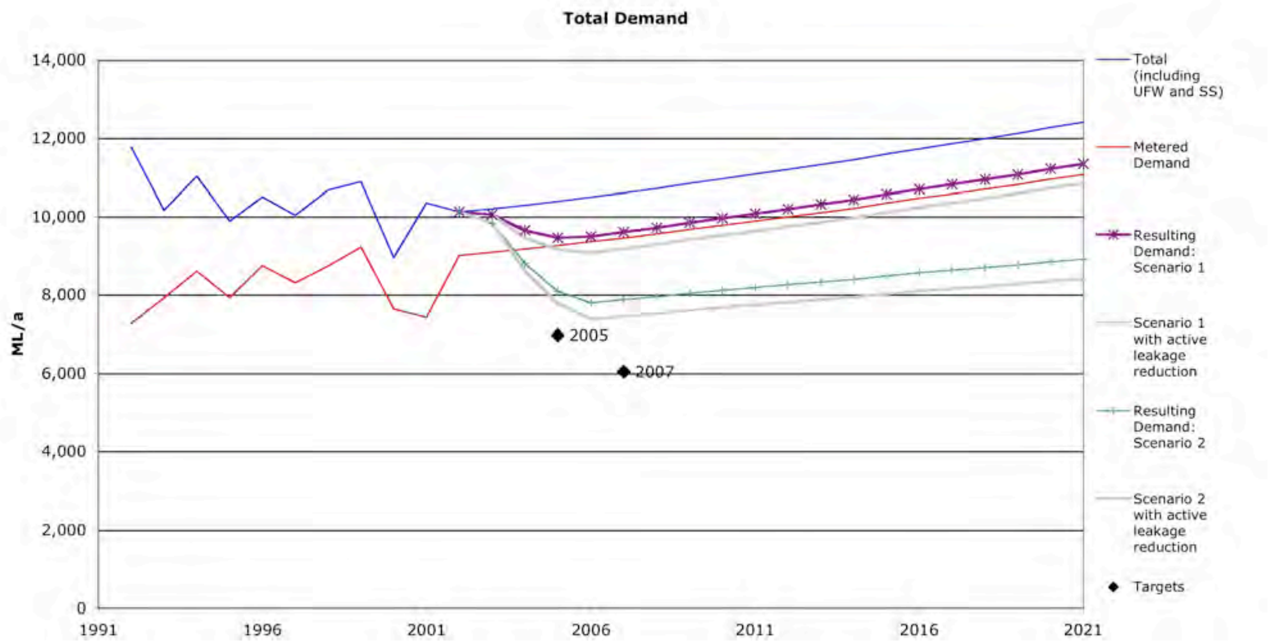
Table 1 shows the results of this process and the scenarios compared with the reference case. These are also illustrated in Figure 3.

Table 1 Demand Management Program Scenarios

Scenario	Resulting Demand (ML/a in 2008)	Demand Reduction Achieved (ML/a in 2008)	Resulting Demand (ML/a in 2021)	Demand Reduction Achieved (ML/a in 2021)	Present Value of Total Cost ($M)
Reference Case	10,715	N/A	12,405	N/A	N/A
1	9,714	1,001	11,339	1,066	3.8
2	8,020	2,695	8,979	3,426	10.2
3*	N/A	N/A	N/A	N/A	N/A

* - Scenario 3 not developed

Figure 3 Demand Management Program (Scenarios 1 and 2)



The demand management programs developed as Scenarios 1 and 2 are estimated to cost approximately $3.8M and $10.2M respectively in present value terms (using a discount rate of 7%). Whilst neither of these scenarios actually meet the preliminary ASUWMSRG targets, it is important to recognise that neither of the scenarios incorporate the full range of opportunities available for inclusion of options relating to leakage control, source substitution or reuse. In Scenario 1, options related to new developments have assumed the use of source substitution/reuse to a limited extent. In Scenario 2, such options have assumed a higher level of source substitution/reuse and in the case of targeted options, such as Pine Gap, some level of source substitution/reuse has be assumed to attain low potable water demand per household.

Although not part of the brief for this Study, Figure 3 provides an indication of how leakage reduction in the PW maintained system could assist in reducing overall demand. The leakage reduction identified is an estimate and indicates the savings available if PW leakage was brought in line with other Australian water service providers at the lower end of current Australian leakage practice. Further leakage reduction could potentially be achieved if PW leakage was brought in line with current international best practice. The estimated savings and costs identified in Table 1 for Scenarios 1 and 2 do not include these potential leakage savings or costs as these will need to be investigated by PW.

As indicated in Table 1, Scenario 3 has not been developed as it is considered that Scenario 2 pushes demand management of the options developed to the limits. Hence, it is recommended that a more holistic strategy is developed in parallel to Stage III of this Study to enable leakage, source substitution and reuse options to be investigated whilst the demand management implementation plan is being developed. It is understood that such options have already been developed to an extent as part of the ASUWMS, however, assessment of all these options together using an LCP approach has not been carried out to date. The evaluation of all options (the reference case, demand management, leakage reduction, source substitution and reuse) should be reviewed using an LCP approach and using the same population and per capita demand assumptions (developed as part of this Study). This will enable PW/DIPE to determine the least cost strategy to take forward for implementation and to ensure that all cross benefits are identified and evaluated. In addition the targets should be reviewed by the ASUWMSRG in the light of the findings of this Study and further assessment of alternative options should be evaluated considering the level of investment required to achieve the preliminary targets.

As a minimum PW should invest in the baseline savings demand management scenario (Scenario 1) at $3.8M. Water efficiency through a demand management program is essential for other options (e.g. supply from additional bores, source substitution and reuse) to provide services effectively and to reduce their unit cost ($/ML) in terms of meeting required demand. For example, if the existing potable water supplied is used more efficiently through demand management then more customers can be supplied with the water saved at no extra cost. In addition, if water required for the watering of ovals from Town Basin supplies is used more efficiently then the water saved can be used for other customers such as hotels for outdoor water use at no extra cost and reduces the demand for potable water demand by these customers. Hence a demand management program is effectively a foundation upon which to build alternative supply options. Without a demand management program investment in alternative options will not be optimised as the water being provided will still be wasted.

Investment in Demand Management

As previously identified Scenarios 1 and 2 are estimated to cost $3.8M and $10.2M respectively. These are the full costs of each program and assume that PW will (in a similar way to investment in borehole augmentation) pay for all required costs, thus, maximising the potential take-up rates by participants of the options and incentives developed.

As mentioned previously this investment will effectively be recouped in the form of deferred or avoided capital and operating costs in the water and wastewater (and potentially energy) infrastructure. Table 2 shows the capital and operating expenditure and savings for potable water for the reference case and Scenarios 1 and 2.

Table 2 Capital & Operating Water Expenditure & Savings

Scenario	Reference Case Borehole Expenditure Present Value $M	Scenario 1 Borehole Expenditure Present Value $M	Scenario 1 Borehole Expenditure Savings Present Value $M	Scenario 2 Borehole Expenditure Present Value $M	Scenario 2 Borehole Expenditure Savings Present Value $M
Water					
- capital	5.1*	4.7	Savings proportion unknown	3.9	Savings proportion unknown
- operating	23.7	20	3.8	14.1	9.7

* It should be noted that the present value capital cost for the reference case in this table extracting 12,500 ML/a is virtually the same as the present value cost ($5M) identified by PW in their Asset Management Plan for the borefield extracting only 10,000 ML/a. This can be attributed to the fact that the reference case in this table uses a linear assumption for capital expenditure over the 20 years considered unlike the reference case calculated by PW which assumes distinct times when bores will be replaced. In addition the reference case in the table uses a 7% discount rate and the reference case identified by PW uses a discount rate of 9%.

The table shows that the present value savings in operating costs for Scenarios 1 and 2 are $3.8M and $9.7M respectively. This indicates that for Scenario 1 the present value savings in operating costs for water alone actually pay for the Scenario 1 demand management program ($3.8M) and are only $0.5M short for Scenario 2 ($10.2M). Hence if the savings attributable to deferred capital expenditure for the water system and deferred capital and operating expenditure for the wastewater and electricity system were also included the demand management costs for both scenarios could easily be paid for.

The cost savings attributable to the water, wastewater and energy infrastructure should be reviewed further by PW as full details were not available for this Study. Detail should be available for Stage III of the Study and the assessment of the other alternative options to assist in understanding the full costs and benefits of all options developed.

Recommendations

During this Study a number of recommendations have become apparent. These are summarised below. Full details of the recommendations are provided in individual sections.

PW/DIPE should commit to Stage III of the Study and the implementation of a Demand Management Program by:

- committing required funds for at least Program Scenario 1 ($3.8M);
- investigating Program Team personnel to be involved in Stage III;
- investigating capital and operating costs of running the water, wastewater and electricity systems to assist in clarifying assumptions and costs/benefits identified;
- committing to pilot studies and surveys to assist in Stage III development; and
- investigating other initiatives/projects related to water and energy issues (e.g. CRC, Desert Knowledge) to liaise and coordinate funding and research gaps/synergies to assist in Stage III and long term research.

In parallel to Stage III PW/DIPE should consider:

- restructuring their current pricing structure on water by moving away from an NT uniform tariff policy to a locally based inclining block tariff and a volume based charging system on sewage related to winter water demand similar to the Trade Waste tariffs;
- updating their borefield augmentation model to ensure assumptions are consistent with this Study and to allow fair reference case comparison with other options;
- investigation of leakage reduction, source substitution and reuse options using an LCP framework to determine which other least cost options should be implemented together with the demand management program to form the ASUWMS;
- review of the current preliminary targets together with the ASUWMSRG;
- the implications of the benefits of the demand management program on the investment requirements for other options; and
- evaluate existing initiatives where possible (e.g. Cut the Lawn, audits) to assist in Stage III design and using the climate correction model to check UFW in 2001/02.

PW/DIPE should also consider/investigate:

- using the climate correction model for future evaluation of demand management and other initiatives;
- draft a system management implementation plan/schedule to reduce UFW and move towards best practice management including accurate UFW calculation, the substantial auditing and upgrading

of the CIS to allow for ongoing evaluation of customers, use of flow meters at the WWTP, use of outdoor meters to identify outdoor demand, use of meters on individual units of occupancy and use of SIC for individual customers;

- use of demand management on other sources such as the Town Basin and reactivation of additional sources such as the hospital borehole and gaol reuse system;
- obtain more accurate data on the indigenous populations and Pine Gap residents to improve the accuracy of the model and when available incorporate the Trade Waste results and WWTP flow records to assist in calibration of the end use models; and
- steps to advocate appliance water efficiency nationally and ensure local building codes incorporate the synergies of water and energy efficiency as far as possible in both new and modified buildings to minimise the need to demand management investment in future development.

APPENDIX B – REVISED END USE ASSUMPTIONS

End Use	Assumption		Value	Units
Indoor				
Showers	Lifetime:		13	years
	Flow rate:	'normal' showerhead	8.43	litres/min
		AAA showerhead	6.2	litres/min
	Average duration of shower:		7	minutes
	Frequency :		1	showers/day
	AAA showerhead ownership:	1994	15%	% of hh
		1998	28%	% of hh
		2001	29%	% of hh
		2002	36%	% of hh
	Number of showers per household:	Houses	1.4	shower/house
		Flats	1	shower/flat
	AAA showerhead sales:	1997	30%	% of sales/yr
Toilets	Lifetime:		25	years
	Average water consumption:	11 litre single flush	9.9	litres/flush
		11/6 litres	6.85	litres/flush
		9/4.5 litres	5.375	litres/flush
		6/3 litres	3.45	litres/flush
		Extra water consumption for 2 toilet households	0%	
	Frequency:	1 toilet household	3.5	flushes per day
		2 toilet household	3.5	flushes per day
	Ownership of dual flush:	1994	42%	
		1998	63%	
		2001	69%	
		2002	80%	
		6/3 2002	38%	
		9/4.5 2002	14%	
		11/6 2002	4%	
	Toilet Ownership:		1.5	toilets per hh
Clothes Washers	Lifetime:		14	years
	Ownership:	Total (1999)	90%	penetration
		Top loaders (2002)	85%	% ownership
		Front loaders (2002)	12%	% ownership
		Manual (2002)	3%	% ownership
	Water consumption:	Top (2003)	140	litres/wash
		Front (2003)	80	litres/wash
		Twin Tub (2003)	50	litres/wash
	Frequency:		260	washes/year
		Front loader factor	1.1	
		Standard deviation	0.25	
Bath	Water consumption		58	litres
	Frequency		2.8	baths/hh/week
Taps	Water consumption - kitchen		12	LCD
	Water consumption - bathroom		5.9	LCD
	Water consumption - laundry		7.2	kl/hh/a
Dishwashers	Ownership		26%	of hh
	Usage		4.40	times/week
	Water Demand		21	L/load
			92.4	L/hh/week
Toilet Leakage	Leakage rate		2	kl/toilet/a
			10.95	kl/toilet leak/a
	Leaking toilets		3%	of toilets
			0.33	kl/toilet/a
Outdoor				
Air Conditioning	AC Ownership & Use	SR HHs with Evaporative AC	90%	
		MR HHs with Evaporative AC	80%	
	Seasonal Use		8	months/year
			242	days/year
	Daily Use		10	hrs/day
	Total Run Time		2420	hrs/year
	AC Water Demand	Bleed Rate	6	L/hr
		Evaporated Rate	20	L/hr
Pools	Pool Ownership & Use	SR HHs owning pools	18%	
	Average pool surface area		40	m2
	Average pool volume		48	m3
			48000	L
	Season of pool use		7	months
	Pool Water Demand	Draining and refilling every	5	years
	Evaporation	Av evap. rate	7.78	mm/d
		Loss per pool per day	311.09	L/day
	Backwash	No. occurances	30	/year
		Water per backwash	300	L
	Splash		50	L/week
	Leaks	Assumption - in 1% of pools	50	L/day
	Pool Cover Usage	HHs owning pool covers	33%	
		Days pool covered	50%	
		Reduction in Evaporation	95%	
		Evaporation Rate if not covered	1.94	mm/d

APPENDIX C - DRAFT PW NT WATER USE EFFICIENCY PLAN

This Plan was provided by Alan Whyte to the Stage III Study Team by e-mail (dated 28/10/05).

DRAFT NT WATER USE EFFICIENCY PLAN

The poor recharge of Darwin River Dam over the 2004/05 Wet Season, and competing pressures for access to future ground and surface water sources, has increased the need to develop through consultation a Water Use Efficiency plan. This plan is intended to be applied across all of the Northern Territory, with particular focus on the major urban centres.

STRATEGY

This document sets out the strategy relating to a Water Use Efficiency Plan for the NT. The strategy proposes a range of measures to be investigated and introduced to encourage water conservation and efficiency, whilst ensuring the delivery of value and benefits for both Power and Water and the customer. These investigations will be carried out in consultation with other Power and Water Business Units and relevant service providers and stakeholders.

The basic factors underpinning the strategy are:

1.1 Understanding Understand and identify the various water conservation components.

1.2 Measurement Collect relevant data and analyse in order to make informed business decisions and develop reportable key performance indicators.

1.3 Communication Communicate to staff, customers and the general public, the plan in relation to water conservation and efficiency.

1.4 Minimisation Identify alternate technologies or practices to minimise water use. Conduct continuous process review.

1.5 Reporting Identify reporting requirements for the business in line with defined key performance indicators and other Business Unit’s requirements.

NT Water Use Efficiency Plan

Goal	Objectives	Strategies	Tasks	Task Owner	Start date	End date	Performance Indicator	Report Interval
1. Maximise the benefits of the Water Conservation and Efficiency Program for customers and Power and Water.	1.1 Understanding	1.1.1 Collect and record details of other similar national programs	Research, compare and document other similar national programs	Alan Whyte		Complete	List with details of various programs Refer Version 1 Plan 31/08/05	None
		1.1.2 Analyse and prioritise identified programs and determine achievable functions for Power and Water	Consult with project group and other related business unit representatives in relation to achievable functions.	Project Group/ Alan Whyte		Complete	List with details of agreed achievable functions requiring further consideration Refer Attachment A	None
	1.2 Measurement	1.2.1 Define methods of measurement and determine impact on revenue.	Identify and collect consumption data. Consult with Economics group in relation to cost benefits of program components Develop reportable KPI's ie.: • Current water use per month in comparison to previous • Any foregone revenue Benchmark against other utilities to measure and report on performance.	Water Services, Retail, Finance Water Services			Consumption data is collected and collated. Cost of each component is known KPI's developed and reported	Monthly Monthly Ongoing
	1.4 Communication	1.4.1 Provision of effective communication.	Develop and communicate to staff and stakeholders the program and strategies in relation to water conservation and efficiency	Corp Comms, Retail and Water Services			Information made available to staff.	Ongoing

Goal	Objectives	Strategies	Tasks	Task Owner	Start date	End date	Performance Indicator	Report Interval
			Develop an appropriate communication strategy for customers detailing the program and strategies in relation to water conservation and efficiency and how it affects them. Conduct an annual briefing for internal stakeholders on the water conservation and efficiency program	Corp Comms, Retail and Water Services Project Group			Customer comms strategy actioned Briefing conducted.	Ongoing Annually
	1.5 Minimisation	1.5.1 Process review	Review customer and operational processes and recommend or introduce alternate technologies or practices to minimise water use	Water Services			Methods defined, reviewed and monitored.	Monthly
	1.6 Reporting	1.6.1 Provide timely advice and reports to management on program accomplishments and major cases.	In consultation with stakeholders, determine reporting requirements and develop reports. Create a reporting mechanism that can track program accomplishments. Conduct an annual evaluation of the effectiveness of the water conservation and efficiency program and make appropriate adjustments or recommendations.	Water Services Water Services Water Services			Reports available and provided in a suitable format and timely manner. Report readily available and provided in a suitable format. Review conducted, reported and adjusted.	Monthly Ongoing Annually

ATTACHMENT A

Task: Consult with project group and other related business unit representatives in relation to achievable functions.

KPI: List with details of agreed functions requiring further consideration

Priority TBC	Proposal	Description	Strategies	Comments relating to the NT	Task Owner	Resource
1	Media Plan	Development of a media plan relating to water efficiency			Corp Comms/ Water Services	
2	Water Restrictions	Development and refinement of water restriction policy		Define general terminology and trigger points	Water Services	
3	Government	Obtain Government support and establish an across Government agencies program	CEO's of government customers have a target reduction written into their annual performance plans. 'Greening of Government' cross agency steering group	A whole of Govt program could be set up by us and driven through Regional and Central Co-ords.	Darryl Day/ Alan Whyte/ John Pudney	
3	Utility employee participation	Develop an employee program for water and energy monitoring and reduction	Program demonstrates our commitment and leadership in water conservation and wastewater management, setting an example to the community. Use benchmarks such as: kl/employee/pa and kl/office area/pa.	Power and Water used to have an energy management program in place known as 'Energy Busters'. It would be relatively simple to put in place both energy and water programs whereby staff participate in trying to achieve stretch targets for reductions. Additional metering would need to be installed, together with appropriate internal marketing material. Employee or business unit awards and recognition could be provided. Some discussion has occurred in Alice Springs in regard to a P&W in house program.		
4	Top 200 customers program	Develop the Top 200 program	'Every Drop Counts Program'. This is a change management program, influencing cultural change. The message is 'Reduce Wastage'. The customer DB was segmented and the key tasks and goals are: • Sustainable water savings • Sector approach	Proposal is to duplicate the SW EDC Program as much as possible. This will involve the Retail Contestable Customer Units cooperation. The proposal is to tailor the service to the specific customer's requirements. There will be a need to obtain the services of a trained auditor (cost to customer or PW to be determined) and	Alan Whyte/ Lynne Watson	

Priority TBC	Proposal	Description	Strategies	Comments relating to the NT	Task Owner	Resource
			• Working cooperatively • Cultural change • Identification and implementation • Promoting good corporate citizenship Audits are co funded with the customer and customer activity is tracked using an Access DB. The main meter is data logged. It is important to sell the cost benefits of the required changes to the customer and the associated costs of using extra water for the process such as the electricity, chemical treatment, trade waste costs and labour. There is a need for the business owner/manager to commit and appoint a water manager for the program and agree to a diagnostic being undertaken.	the intent is to provide a business case for the customer to modify process to make savings. Assistance from Economics Unit or similar will be required. Top 200 report has already been produced by Retail Refer to Strategy Paper		
5	Pressure and leakage management	Look at further ways of reducing losses by effective leakage detection and pressure reduction	Reduce typical pressure in residential areas using automatic PRV's connected to SCADA and provision of a failsafe arrangement in the event of a fire flow requirement.	Potential for further pressure reduction in residential areas?	Water Services Operations	
6	Metering	Continue to monitor & develop the meter replacement program			Water Operations	
7	Reporting and Segmentation		Reporting should include above average customers being classified as a high water user. Annual consumption against number of properties (eg 1M house and 500K flats).	There is a need to define and produce customer segmentation reports with Retail.	John Pudney/ Alan Whyte/ Lynne Watson	
8	Pricing	Look at pricing reform in line with NWI requirements	Use industry based sewage discharge factors rather than pedestal charging. Eg Office use 90% and nursery 10%.		Darryl Day/ Economics	

Priority TBC	Proposal	Description	Strategies	Comments relating to the NT	Task Owner	Resource
			A smart water bill that incorporates comparative use data for sizes and types of homes as well as a 'high water use alert' message.	Would use the same function as our Hi/Lo report but is printed on the bill.		
9	Committees	Continue to be involved with various stakeholder committees		Power and Water is a member of the Urban Water Management Reference Group in Alice Springs. There is potential for a similar group to be established in Darwin that will assist with changing the behavioural component	Darryl Day	
10	Industry Programs and relationships	Development of an industry program with garden nurseries, irrigators and landscapers.	'Wise about Water' program for garden industry staff. This in an accredited course and has links to the Nursery and Garden Industry Association website. 'GreenPlumber' program MOU's with suppliers (no financial arrangements in place). Recognise accredited landscapers, irrigators and plumbers on our website Supplying 'tap tags' to customers to put on outdoor taps. These tags detail to the customer the approximate time duration for watering of gardens dependant upon the soil and plant types as determined by a gardening auditor.	Consult with WAWC regarding adoption of program	Alan Whyte	
11	Awards	Development of an annual customer and/or good citizen award for high water saving achievers	Business Excellence Award program. Hold an annual event that recognises good customers with media recognition, a plaque and certificate who have reduced consumption by 10% or more with their internal processes.	Power and Water used to have a contestable electricity customer excellence award in place with a 'Switched On' newsletter	Deb Wightman/ Annie Darcy	
12	Audits		Conduct WaterWise audits for $65 with a $30 rebate available. Keep a list of trained	Potential for relationship with COOLMob NT who have proposed a business relationship with	Alan Whyte/	

Priority TBC	Proposal	Description	Strategies	Comments relating to the NT	Task Owner	Resource
			auditors and supply this to the customer to choose from.	P&W for energy audits. Preliminary discussions indicate the potential for expansion in the water area.	Jim Bamber	
13	Source Substitution	Look at further uses for non-potable or effluent			Water Services	
14	Prosecutions	Establish the Revenue Protection Unit		There is a need to establish the proposed Revenue Protection Unit that was to look at not only theft, but unaccounted for water.	Retail	
15	Retrofits	Develop relationships with customers in order to encourage retrofits	Conduct a public housing retrofit exercise and also an indoor/outdoor metering trial to gather base line data on use. Obtain Renewable Energy Certificates (REC's) from showerheads (3.1 NGAC's (New South Wales Gas abatement scheme) per head). By reducing the amount of hot water used and produced by a standard gas hot water service, the AGO has agreed to this approach. The amount is about $11-11.50 per NGAC (may be scope to apply this approach to electric as well). The customer saves about $50-$100 pa in energy.	Preliminary discussions with Territory Housing indicate that they already utilise water efficient equipment when possible. They are interested in being able to pull down their overall costs due to the fact that they allow a 500-kl limit prior to passing on excess use to the customer. This may be of interest to our Retail Unit		
16	Surveys	Customer attitude and expectation survey		Similar to current DPI survey in Alice Springs. Results are in and will be forwarded when available to look at application to Darwin situation.	Corp Comms/ Water Services	
17	Mandatory Requirements	Required as part of any building proposal		Under Department of Planning and Infrastructure control. Power and Water Cab Sub will request that DPI pursues this WELS will apply to the NT	Darryl Day	
18	Leakage Detection Vehicle	Assists to promote the message of water conservation.	Change behaviour and promote in the media.	Existing use of the Leakage Detection Van promotes a visual message of water conservation and Power and Water '‘doing the right thing’	Water Operations	

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