8. RESIDENTIAL MEASURES

8.1 Overview

The major proportion of bulk demand within a water supply system can generally be attributed to residential consumption. In the pilot communities that were investigated, it was found that approximately 60 - 80% of the overall system demand was consumed in the residential sector. This sector also has the highest proportion of accounts. The aim of any water efficiency measure is to influence a small percentage of these accounts through active demand management, resulting in a follow through effect on the remainder of the water supply demand in the area.

The project brief requires that a particular group of measures be analysed for cost effectiveness. These are as follows:

- Financial incentives for the purchase and/or installation of water efficient showerheads (incorporating various rebate levels)
- Residential water use efficiency assessment combined with retrofitting water efficient showerheads, tap flow regulators, toilet cistern displacement devices and repair of leaks from toilets and taps (provided at a range of costs to the customer).
- Toilet upgrades through either replacement with a 6/3 L dual flush unit, or installation of a toilet cistern displacement device.
- Providing financial incentives, including customer rebates at point of sale, for water efficient washing machines.
- Residential outdoor assessment combined with supplying tap timer kits (at a range of costs to the customer).
- Use of rainwater tanks to supplement water supply.

A number of measures were formulated and added to the predetermined measures. These measures were analysed in the DSS, and are as follows:

- Public Education
- School WaterWise Programs (Kits or Literature)
- Irrigation Advisory Service
- Washing Machine Labelling

8.2 Analysis Approach

Prior to undertaking the benefit/cost analysis, a long list of measures was developed and screened to provide a list of measures for evaluation. The screening process is outlined in Section 8.3.

The approach taken to the economic analysis of various measures using the Decision Support System (DSS) is outlined in Section 3 of this report. Measures were analysed using the DSS for each community. Limited sensitivity analysis was undertaken to determine the response to variation of the assumptions used for water savings and participation rates.

8.3 Measure Screening

8.3.1 Approach

An assessment was carried out to shortlist measures that had been described in a Discussion Paper (refer to **Appendix E**) sent to each participating authority. It was anticipated that each of the authorities may indicate that additional measures may be applicable to the area. However, no feedback was received, and the assessment proceeded using the measures listed in Section 8.1. The process of screening a long list of measures is particularly effective when a Water Efficiency Plan is to have community involvement. Such an approach is recommended, and may be achieved through the formation of a Water Efficiency Committee. This committee would comprise community based representatives as well as elected councillors and council staff. In this way, the plan is owned by the community, rather than having it imposed upon the community.

Over 150 measures, included in the initial screening process, were assessed for suitability by MW, based on local knowledge and discussions with each group during the data collection process. A number of regulatory measures were included as discussed in Section 6. The list of measures were grouped into those relevant to the following main customer categories:

- Residential
- Commercial Residential
- Commercial
- Industrial
- Public
- Irrigation

Each potential measure was screened based on four non-quantifiable criteria:

- *Technology/Market Maturity*.

  This screening criteria indicates whether the necessary technology is available commercially and supported by the local service industry. For example, a device may be screened out if it is not yet commercially available in the region.

- *Service Area Match.*

  This screening criteria seeks to distinguish the technology that is appropriate to the pilot area's climate, building stock, or lifestyle. For example, low water-

use landscape measures for commercial or Council sites may not be appropriate where demand analysis indicates there is little outdoor irrigation.

- *Customer Acceptance/Equity.*

  Customers must be willing to implement measures or else the participation rates (and thus the water savings) would be too low to be significant. Customer acceptance may be affected by:
  - Convenience
  - Economics
  - Perceived fairness
  - Aesthetics

  Measures should also be equitable in the sense that one category of customers should not benefit while another pays the costs without receiving benefits.

- *Better Measure Available.*

  If a choice must be made between two or more measures of equal effectiveness, where one is obviously more appropriate (due to, say, ease of implementation or unit cost), then the more appropriate measure will pass the screening while the other will not.

The criteria were scored on a scale of 1 to 5, with 5 being the most acceptable. Measures with low scores were eliminated from further consideration, while those with high scores were passed into the next evaluation phase.

8.3.2 Ranking of Measures

Measures were screened using the scoring system described in above. Each of the measures with a high score was passed onto the next phase of the analysis. Listings of each of the pilot area's screened measures are given in **Appendix F**. The ranking and subsequent selection of each measure was followed by design and evaluation within the DSS.

8.4 Description of Measures

8.4.1 Water Efficient Showerheads

The aim of this measure was to replace high water using showerheads with water efficient, AAA-rated showerheads. Current research demonstrates that significant savings on shower water usage may be gained through the adoption of more modern water efficient showerhead designs over older technologies. On average, a "high" water use shower uses between 11 and 15 L/min, but may use more than 20 L/min. The flow rate of a AAA-rated showerhead is on average around 7 L/min although the rating is 9 L/min. This represents an average differential of around 6 L/min between the two types of shower and equates to a 46 percent saving.

The Manual of Assessment Procedure for Water Appliances (SAA MP64-1995) specifies three classifications for the grading of a water-using fixture. The three-tier system is highlighted on products by using the labels illustrated in **Figure 8.1**.

Figure 8.1: Water Conservation Rating labels

For showerheads, the three classifications and associated performance requirements are as follows:

Rating	Water Usage
A	Use more than 12 and not more than 15 litres of water per minute
AA	Use more than 9 and not more than 12 litres of water per minute
AAA	Use up to (and including) 9 litres of water per minute

For the purpose of the analysis, the cost of a AAA rated showerhead is assumed to be $35. Three different levels of rebate were analysed, assuming different levels of customer participation. For a higher rebate to the customer, a higher participation rate is assumed. The three adopted levels of rebate were $10, $20 and $30, with annual participation rates of 2%, 5% and 10% respectively.

Maroochy Shire Council and Toowoomba City Council have both offered $20 rebates to any account that purchased a water efficient showerhead. Toowoomba City Council achieved a small participation rate, with 200 properties receiving the rebate, out of approximately 29,000 properties. This represents an annual participation rate of 0.7% based on an annual average of 0.14% participation over the five years that this was offered. Maroochy Shire Council achieved a higher participation rate of approximately 1% per annum, as previously shown in **Table 4.2**.

The level of participation can be directly attributed to the level of marketing and promotion carried out by the authority. The highest levels of participation analysed in the DSS are for concentrated marketing efforts, such as frequent media advertising or telemarketing. The rates adopted for the study are based on experience in similar programs particularly in the US or there is limited data available for Australian programs.

8.4.2 Residential Water Audits and Retrofits

The purpose of this measure is to assess the current level of water usage in each household account, through an inspection of all internal water using fixtures. Following assessment, selected internal fittings would be replaced or upgraded. Toilet flush volume, internal leakage, shower and tap flow rates, along with other types of water using fixtures, all attribute to high, and in most cases, unnecessary water usage. If these high water using fixtures are targeted, it is possible to obtain a considerable reduction in the internal usage for a residential account.

The water meter would be also checked for accuracy and used to quantify any internal leaks. All water using fixtures are turned off and checked for leaks. The property water meter is observed for any change, which would indicate property leakage.

The assessment or auditing of residential water use may be undertaken by trained students. Licensed plumbers would normally be engaged to undertake the implementation of the retrofit component of this measure. As an alternative, the plumbers can undertake an assessment at the same time as the retrofit. Plumbers would be required to undertake the following work:

- Taps
  - Install flow controller devices on bathroom and kitchen taps
  - Replace washers if required.
- Toilets
  - Inspect for leaks
  - Ensure internal mechanisms of toilet are operating correctly
  - Install flush arrestor device
- Showers
  - Replace main shower
  - Inspect remaining showers and adjust (or replace)

The estimated average cost for the retrofit is assumed to be around $110. This cost is broken down into:

- Cost of the showerhead – assumed to be $35.
- Labour and other time expenses associated with the retrofit – assumed to be $75.

Various levels of funding by the customer were considered in the analysis. Assessment of a free retrofit and $30 or $50 contributions by the customer were undertaken.

8.4.3 Toilet Retrofits

One of the major components of water usage within most households is toilet flushing. Older toilet designs typically have high volume flushes of approximately 11 litres per flush (average). National standards were adopted in 1994 that enforce the manufacture of a 6/3 L dual flush toilets in Australia. According to SAA MP64-1995, these toilets must demonstrate an average flush volume of 4.5 L to satisfy the requirements of the standard.

It is possible with existing toilets to replace the cistern with a 6/3 L unit. However, the existing pan configuration may not allow the cistern to operate correctly, and these units need to be adjusted to 9/4.5 flush to provide better performance, i.e. flush all contents out of the bowl in one attempt. It is preferable to carry out a complete retrofit where both the bowl and cistern are replaced to ensure that the average flush of 4.5 L is achieved.

The cost of a new toilet and installation is assumed to be around $350 (materials and labour included). Other aesthetic repairs, such as plaster or tile work would not be included in this cost, and would be the responsibility of the property owner. Two funding scenarios were assessed for this measure – zero rebate and $100 rebate. Low levels of participation were assumed for this measure as the replacement is usually considered by the customer only in the event of toilet failure, or bathroom / toilet renovation.

8.4.4 Washing Machine Rebates

Washing machines are classified according to ratings contained in SAA MP64-1995. The three classifications for washing machines are:

Ratings	Water Usage
A	Use more than 28 and not more than 34 litres of water (per dry kilogram of clothes per load).
AA	Use more than 22 and not more than 28 litres of water (per dry kilogram of clothes per load).
AAA	Use up to (and including) 22 litres of water (per dry kilogram of clothes per load).

Water efficient washing machines are generally more expensive than standard washing machines (which are usually classified as A-rated). AAA-rated washing machines cost around $900 - $1,200. A lower rating washing machine with comparable capacity, costs around $700 - $1,000.

This measure was designed taking into account the extra cost to the customer to upgrade their choice of washing machine to a more water efficient unit. The upgrade cost to the customer is assumed to be around $200. Three different rebate levels were analysed for this measure - $100, $150 and $200. Despite the seemingly high level of rebate, it must be realised that the customer must bear the remaining cost associated with the purchase of the washing machine. As a result of this, the assumed participation rates are generally low (ranging from 0.8 – 1.6%).

8.4.5 Outdoor Audits and Rebates

An outdoor audit and rebate measure would encourage customers to implement water efficiency in the garden. Rebates could be offered to developers of new properties, or to existing owners, to enhance the water efficiency of the property's landscaping. This measure would be especially beneficial in areas with high external usage, such as Emerald.

The assumed cost for this measure is $50 to the customer for the attendance of a council employee at the property to carry out an audit. Further to this measure, a rebate could be offered as an incentive for the property owner to implement changes that would improve their garden's water efficiency.

8.4.6 Rainwater Tanks

The benefit/cost assessment of rainwater tanks and their associated installation is complicated by a wide range of claims regarding their effectiveness. Water saving benefits vary significantly depending on climate factors such as rainfall, evaporation and temperature, as well as the daily water use habits and end uses of the collected water. These factors, together with roof area, determine the yield (kL/a) that may be gained from a particular sized tank in any area of Queensland.

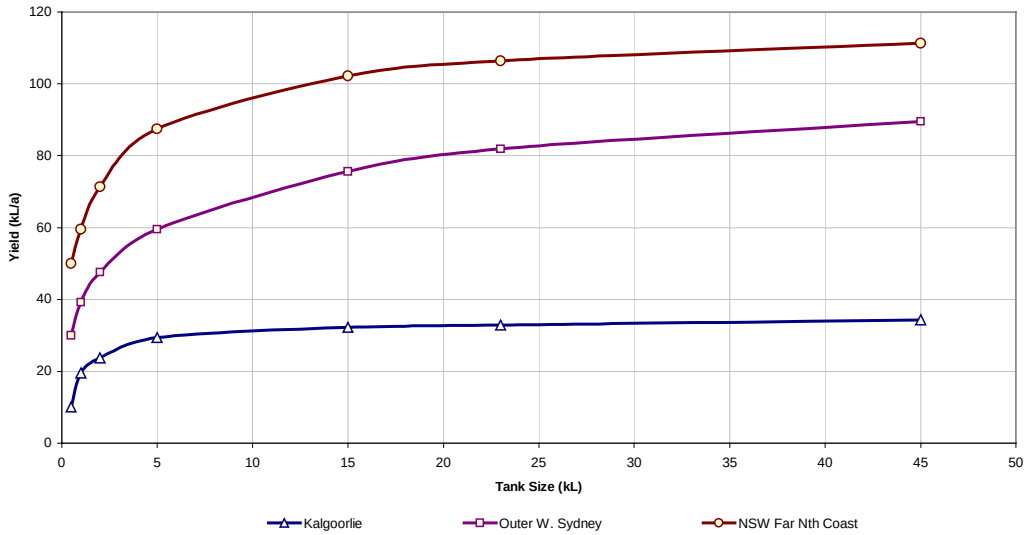
The issue of tank yield is important, as the cost effectiveness of the tank relies on the capability of the tank to supply water to the property during times of low rainfall and high temperature. In areas such as Emerald, a 10kL tank would be drained in less than 14 days if used for external irrigation. The property owner must then supplement their external usage by using the local authority's water supply. In Queensland there are prolonged periods of dry weather and defined, but variable, wet seasons. This climate cycle raises the question of whether sufficient supply will be available when required, and whether the tank needs to be excessively large (>10kL) to be of benefit.

Various published studies on the use of rainwater tanks, including the QDNR *Stormwater Recycling Background Paper* and the WSSA *Wise Water Management Manual*, were researched to formulate a reasonable approach to rainwater tank evaluation, and the determination of benefits.

The results of a water cycle modelling study carried out as a case study for Canberra are discussed in the *Stormwater Recycling Background Paper*. It is stated in this report that "to reasonably supply garden watering and toilet flushing usage, large rainwater tanks were required (of the order of 25-40 kL). For toilet flushing alone, smaller tanks were acceptable (of the order of 2.3-15 kL). In both cases the rainwater tanks were sized on the basis of an annual volumetric reliability of 97%". This study indicates that a large tank, of the order of 20-30 kL would be required to reasonably supply garden watering alone. Extension of these studies to Queensland is difficult, however in many areas the required tank sizes would be expected to increase beyond that determined for Canberra, as external usage is higher and rainfall lower. Tanks that are greater than around 10 kL in size become more expensive, and due to their physical size may require installation in ground. As lot sizes in most Queensland new developments are reducing the opportunity for installation of large rainwater tanks is limited. The amenity of large tanks in urban areas is also a disincentive to installation.

Studies of yield and cost associated with the use of rainwater tanks in three different climatic areas across Australia were reviewed in the WSSA manual. Analysis of tank yield was undertaken using a broad approach for a short period of assessment during the early 1990's for Kalgoorlie, NSW Far North Coast and Outer Western Sydney. Due to the unknown statistical significance of the assessment and doubt over the high yield values assumed, the yield assumed for initial assessment in this report, was reduced by 30% over the published figures. The adopted yields are shown in **Figure 8.2**. The figure indicates that the increases in yield of rainwater tanks reduces as the tank size increases. Therefore increases in yield are negligible when the tank size increases beyond 5 kL for drier areas such as Kalgoorlie and 20 kL for higher rainfall areas.

Figure 8.2: Assumed Rainwater Tank Yield (30% Reduction Included)



Original Source: *Wise Water Management – A Demand Management Manual for Water Utilities* (p.102) (with 30% reduction included)

Based on the assessment of the typical climate in the study communities the rainwater tank yield was assumed to be equivalent to either the Outer West Sydney or NSW Far North Coast areas. The adopted tank yields are given in **Table 8.1**.

Table 8.1: Assumed Rainwater Tank Yield (30% Reduction Included)

Tank Size (kL)	Potential Rainwater Tank Yield (kl/a)	
	Outer West Sydney	NSW Far Nth Coast
0.5	30	50
1.0	39	59
2.0	47	71
5.0	59	87
10.0	68	95

A range of water savings was determined for the use of rainwater tanks in each study community. External activity such as irrigation was assumed to be the only end use to be impacted by the installation of a rainwater tank. It may be possible to utilise rainwater tanks for non-contact internal usage such as toilet flushing, however this was not considered due to the additional installation expense and the possibility of corrosion of copper pipes due to the pH of rainwater. Based on the assumed tank yields, end use savings were calculated for each community and input to the DSS. The assumed savings adopted are listed in **Table 8.2**

Table 8.2: Assumed End Use Savings

Pilot Area	Tank Size (kL)				
	0.5	*1.0*	*2.0*	*5.0*	*10.0*
Emerald	18%	24%	29%	36%	42%
Ingham	37%	43%	52%	64%	79%
Mackay	34%	40%	48%	59%	72%
Maroochy	38%	45%	55%	67%	81%
Toowoomba	22%	28%	35%	43%	52%

The exact yield of rainwater tanks for each of the pilot areas can only be estimated using daily rainfall/water usage models. Specific case studies need to be evaluated to ascertain the effectiveness of rainwater tank performance in various areas of Queensland. Such analysis is outside the scope of this study, however it is suggested that further investigation be undertaken to gain a better understanding of the of rainwater tank yield.

Queensland based suppliers were contacted to provide prices for different sizes of polypropylene rainwater tanks. Five sizes were considered for the analysis ranging from 0.5 to 10.0 kilolitres. Prices supplied included delivery, but did not include associated installation costs. For the installation of a rainwater tank, it is necessary to first construct a base, whether it is an elevated steel stand, or a solid concrete footing. The installation of these units also require a connection to the roof guttering. It was assumed that a pump was not necessary for the end uses affected. Where a pump was required the installation costs would increase by up to $400. **Table 8.3** summarises the assumed costs of the range of rainwater tanks analysed.

Table 8.3: Rainwater Tank Installation and Purchase Cost

Tank Size (kL)	Installation & Purchase Cost
0.5	$1,020
1.0	$1,080
2.0	$1,260
5.0	$1,450
10.0	$2,045

A regime of rebates was adopted for each size of tank. The rebate levels adopted were 10, 15 and 20% of the total cost rounded to the nearest $50 multiple. For example, if a rainwater tank were to cost (in total) $1,020, then the associated rebates would be $100, $150 and $200. However, if the cost were $1,450, then the associated rebates are calculated as $150, $200 and $300.

Maroochy Shire Council implemented a rainwater tank rebate scheme in 1995. A summary of the number of rebates given since the implementation of this scheme is detailed in **Table 4.3**. A detailed analysis of the cost effectiveness of this measure has not been undertaken to date.

8.4.7 Other Measures

Details of the other measures analysed for cost effectiveness are as follows:

- *School WaterWise Programs (Kit and Literature)*

  Two measures were designed around this concept:

  - **Literature**. Provided to students to promote water efficiency in and around the home. Minimal savings were assumed for this measure, as implementation is at the discretion of the student, or their families, to undertake any of the possible efficiency measures or actions.

  - **Kit**. The second measure extends the first measure, providing a *kit* including a flow controller and tap aerator, along with the literature provided in the first measure. This measure is also dependent on action by the account holders, and therefore will not provide a high level of water savings.

  The intention of the program is to educate children in using water effectively, and the real benefits would be realised in the long-term, once students become home owners, directly responsible for water usage.

- *Irrigation Advisory Service*

  This measure is similar to the outdoor audit measure. The intention of this measure is to advise customers on efficient ways to water lawns or gardens. This can be quite a simple measure, with the insertion of leaflets in water bills. The measure may also provide information regarding irrigation requirements based on weather conditions. Such information could be publicised on the Internet, local radio stations or in the local newspaper.

  The costs associated with this measure are assumed to be $5,000 in the first year for the set up of the measure, then $1,000 for each year thereafter. The measure would be targeted at each existing account in the first year, then all new accounts in the following years.

- *Washing Machine Labelling*

  To raise the awareness of the general public, the water authority could consider advertising information regarding washing machine labelling, especially with respect to the Water Conservation Rating scheme (as described in Section 8.4.4), and the savings that may be achieved.

  Leaflets describing the system could be posted with water bills or posters could be displayed at point-of-sale locations, or in places where bills are paid (i.e. post office). This system would illustrate the benefit of purchasing a water efficient machine over a standard washing machine. For instance, comparisons between the two different types of washing machine could illustrate the number of buckets of water saved by utilising a water efficient machine. This measure is designed to heighten customer awareness of the water efficient washing machine technologies available, and hopefully influence their purchase.

The increased awareness gained by providing these pieces of information to the public would prove beneficial to the community, and can be implemented at low cost to the utility.

It is beneficial for such a measure to include education of retailers and assistance through the display of posters in retail outlets.

- *Outdoor Tap Timers*

Outdoor tap timers can assist customers that forget regularly to turn off sprinklers, and waste considerable water in the process. The frequency of such actions is believed to have been reduced as a result of the implementation of user pays pricing, and therefore the water saving potential of tap timers may have been reduced.

Based on previous experience in the United States, it can be demonstrated that outdoor tap timers (and automatic sprinkler systems) may actually encourage higher outdoor usage. If a person were to manually water their garden, it would take between 15 and 30 minutes (depending on the size of garden and personal habit of the property occupier), and occur whenever the garden appeared to need watering. Where an automatic system, and to a lesser extend a clock tap timer is installed, the operator has to use their discretion as to how long the timer should be set for, which is normally up to 2 hours. It is possible that limited savings can however be achieved, particularly in areas of high external usage.

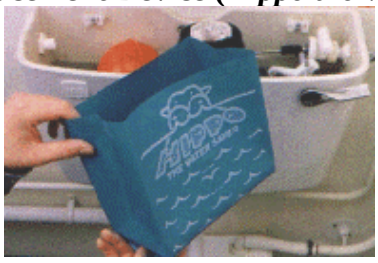
Outdoor tap timers have a limited life span, especially with respect to the less expensive units, whose condition deteriorates when exposed to sunlight for extended periods of time. It is assumed that the life of this measure is three years.

Analysis was carried out for rebates on this measure being offered at $10, $15 and $20. The unit cost of a clock tap timer is assumed to be $20.

- *Toilet Displacement Devices*

There are two possible implementation options for this measure. The first is the installation of a bag or other object that displaces part of the cistern volume. This obviously reduces the total amount of water used in a flush, and is effective when used in older, high-flush design toilets. An example of such a device is shown in **Figure 8.3**.

Figure 8.3: Toilet Displacement Device (*Hippo the Water Saver* (UK) [7])



[7] **Hippo the Water Saver**: http://www.hippo-the-watersaver.co.uk

The second device is the flush arrestor device which requires pressure to be applied by the operator to lengthen the flush time and hence the flush volume. When pressure is removed from the flush button, the flush will cease. An example of this device is illustrated in **Figure 8.4**.

Figure 8.4: Flush Arrester Device (Toilet Watersaver [8])

Toilet displacement devices can save on average up to 3 L in an 11 L flush toilet, and it is claimed that the flush arrestor devices can save up to 70% on flush volumes, when installed in toilet cisterns with an open overflow.

It is understood that such devices may be legally installed in toilets, although not covered by an Australian Standard. SAA MP52 Manual of Authorisation for Plumbing (currently under review by Standards Australia) makes no mention of water conservation devices. SAA 1172.2 – 1999 flush cistern performance criteria also does not make mention of these devices. Plumbing stores actively stock a variety of flush arrestor products, and the toilet dam devices (similar to Hippo the Water Saver) are actively used by water authorities throughout Australia and other parts of the world as a means to conserve water in residential properties.

These devices are relatively inexpensive, and were assumed to be around $5 based on bulk supply. An administration fee is also figured into this measure at a rate of 25% over the total measure cost per account.

- *Public Education*

This measure involves the distribution of information to the community about the merits and potential cost savings that result from being conscious of water consumption. Leaflets and advertisements are potential media devices that can be utilised to distribute the information, but can also be carried out through shopping centre stalls or Internet sites. At this time, the current level of interest for the public to receive this kind of information via the Internet is very low, so more traditional means should be employed to guarantee the measure's overall success.

Efforts to "educate" the public are usually focussed during National Water Week or other locally related events, and are provided to give the community with the necessary information to practice water conservation. Budgets

[8] **Toilet Watersaver** (distributed in Queensland by Mareg – Water Wizz)

relating to this measure can be made up primarily of leaflet production and distribution, up to the employ of a permanent staff member that can field questions from members of the community, and manage a program of water conservation measures and information.

8.5 Evaluation of Selected Measures

In the following sections, the results of the economic analysis of the selected measures are illustrated and discussed.

8.5.1 Showerhead Replacement Measure

To assess this measure, a separate model was developed for residential houses and flats. The assumptions for savings and costs used in the analysis of this measure is:

- $35 cost per shower unit was assumed
- Varying levels of rebate were considered (at $10, $20 and $30)
- Participation rates of 2%, 5% and 10% respectively

The use of rebates to encourage participation in the installation of AAA rated showerheads was analysed using the DSS. The results of the analysis are summarised in **Figure 8.5**.

Figure 8.5: Showerheads Replacement Program (Residential House Accounts)

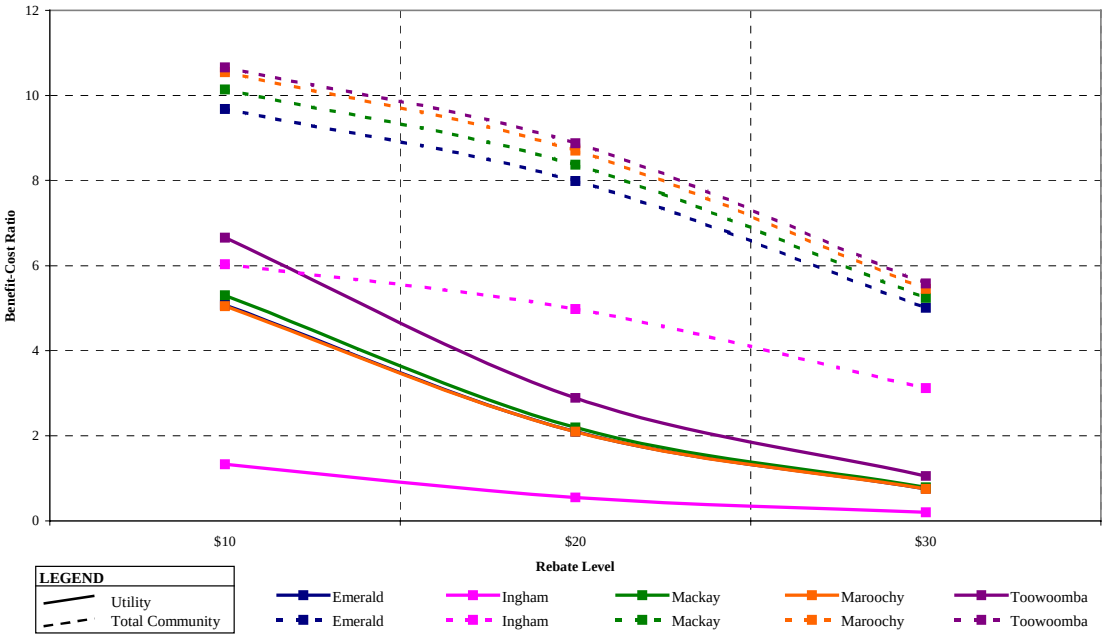


Table 8.4 summarises the results for the $20 rebate level for each of the communities.

Table 8.4: Showerhead Replacement Program Summary of Results for $20 rebate (Residential House Accounts)

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	2.09	7.99	0.10	$76
Ingham	0.55	4.98	0.07	$116
Mackay	2.19	8.37	0.67	$73
Maroochy	2.09	8.70	1.19	$81
Toowoomba	2.89	8.87	0.67	$89

As can be seen from **Figure 8.5**, there is a substantial benefit to most authorities in offering rebates of up to $20 and for the community as a whole at all levels. The high community benefits result from the substantial savings of energy relating to the reduction of hot water usage.

The results of the analysis for flats and units is given in **Figure 8.6,** with a summary of the $20 rebate measure results given in **Table 8.5**.

Figure 8.6: Showerheads Replacement Program (Residential Flat Accounts)

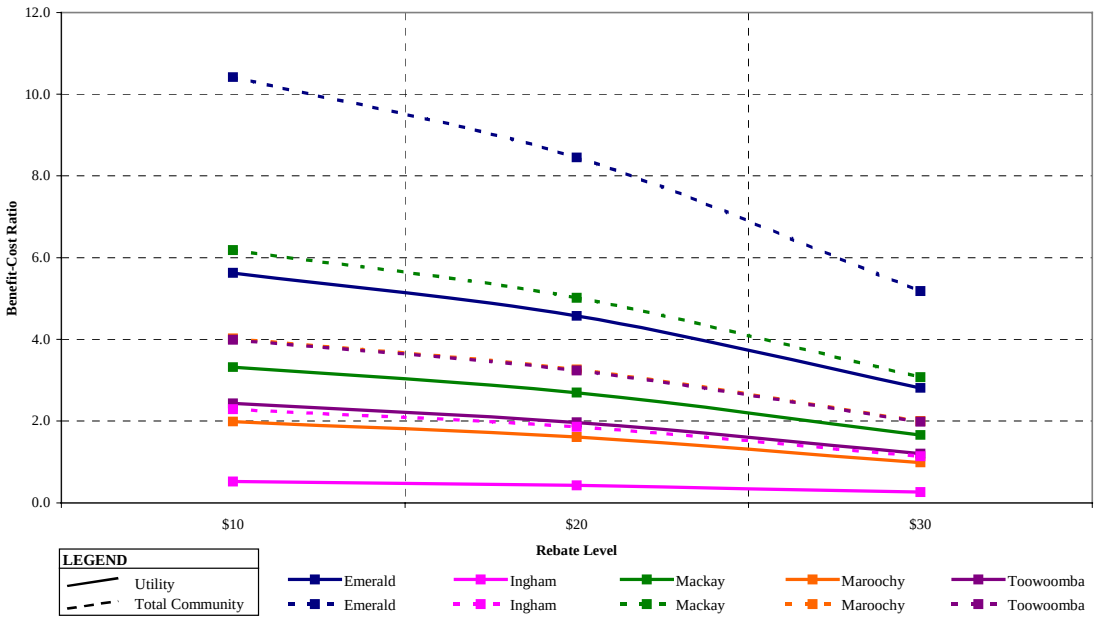


Table 8.5: Showerhead Replacement Program Summary of Results for $20 Rebate (Residential Flat Accounts)

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	4.57	8.45	0.01	$34
Ingham	0.42	1.86	0.00	$149
Mackay	2.70	5.02	0.08	$58
Maroochy	1.61	3.26	0.28	$105
Toowoomba	1.97	3.24	0.05	$116

As expected, high B/C ratios were also achieved for flat accounts for both the utility and community in all centres, except for Ingham. The results indicate that the water savings for this measure are significantly lower than for the Residential House accounts shown in **Figure 8.6**.

A $20 rebate is recommended for each community as the breakeven point (benefit/cost ratio of 1.0) was generally achieved from an authority perspective in each pilot community, (with the exception of Ingham) beyond this level of rebate. In some communities the $10 rebate, while beneficial to both the utility and the community in terms of financial saving, may not have a high level of participation resulting in limited water savings. The $30 rebate scheme would be very attractive to the community, but would be less beneficial to the utility in terms of the expended cost, resulting in a lower benefit/cost ratio (less than 1.0).

If the cost of this measure were to co-sponsored by the electricity companies, the utility B/C would increase significantly. This would ensure that the B/C for Ingham at a rebate level of $20 (assuming 50/50 sponsoring) would be above the breakeven point.

8.5.2 Residential Audits and Retrofits

The assumptions used in the analysis for savings and costs of the residential audit and retrofit measure are listed in **Table 8.6**.

Table 8.6: Measure Assumptions - Residential Audit and Retrofits

End Use Identifier	Type of use (Internal or External)	% of Saving Per Account	Costs/Participation Rates
RH Int. Leakage	Internal	10%	• $110 / Residential House Account • $660 / Residential Flat Account (6 flats per account) • Participation Rate with 10 year Measure Life - 10% p.a. at zero cost - 5% p.a. at $30 cost - 2% p.a. at $50 cost
RH Ext. Leakage	External	5%	
RF Int. Leakage	Internal	10%	
RF Ext. Leakage	External	5%	
RH Toilets	Internal	10%	
RH Showers	Internal	46%	
RF Toilets	Internal	10%	
RF Showers	Internal	46%	
RH Taps/Sinks	Internal	10%	
RF Taps/Sinks	Internal	10%	

The results of the analysis of the internal audit and retrofit program for the residential sector are given in **Figure 8.7** and **Table 8.7**. The measure was evaluated at three levels of cost to the community – nil, $30 and $50. The annual participation rates for each of these cost levels were 10%, 5% and 2% respectively.

As shown in other studies a program funded entirely by the community will have a low participation rate. On the other hand, experience indicates that measures of this type may have only limited success unless there is a high level of participation. If offered on a no charge basis, customers may reject the measure as they may be wary of the measures actual worth. If the community is charged a nominal fee and gain a bonus such as a new showerhead, the participation rates will increase.

Figure 8.7: Residential Audits & Retrofits

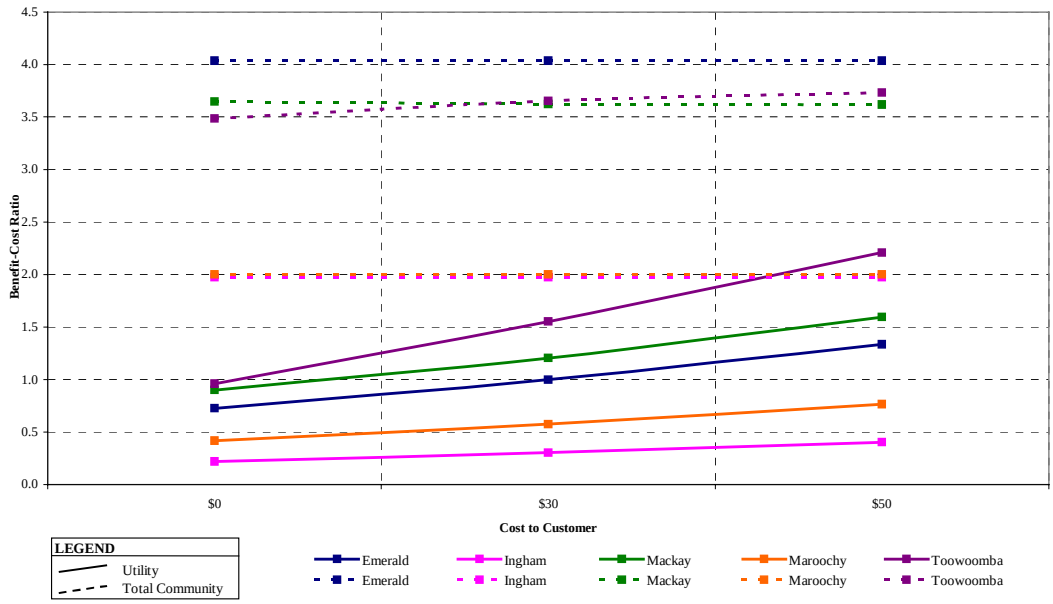


Table 8.7: Residential Audit and Retrofits Summary of Results for $30 Cost

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	1.00	4.04	0.06	$177
Ingham	0.30	1.97	0.06	$227
Mackay	1.21	3.62	0.64	$144
Maroochy	0.57	2.00	1.21	$298
Toowoomba	1.55	3.65	0.60	$191

The results indicate that the measure would be most cost effective and practical with a $30 cost to the customer. Reasonable B/C ratios are achieved by the utility at Mackay, Emerald and Toowoomba. This can be attributed to the higher cost of water production and benefits to be gained in these areas. The proportion of existing residential accounts in these areas is also a major proportion of the demand.

This measure would not be cost effective for the utility in Maroochy, because of the high level of growth in the area. This is due to the fact that the water savings could not produce a significant delay in capital works. This is not to suggest that this measure be disregarded, but that, the measure would have to be implemented with a strong public education program or awareness campaign that produces high participation rates. Alternatively, co-sponsoring by electricity companies for the leakage, taps and controllers and showerheads would be required to increase the B/C to closer to 1.0.

8.5.3 Toilet Retrofits

A toilet retrofit program requires a high level of community participation to be effective. Fitting new toilets often involves substantial cost in repairing carpets, tiles and wall coverings. It is assumed that each participant would be responsible for such work and therefore it is most likely that retrofits would occur during renovation, or following the failure of an existing toilet.

Two measures have been considered for the replacement of high flush toilets – one with and the other without a rebate. A list of the assumptions for savings and costs used in the analysis of this measure are listed in **Table 8.8** and **Table 8.9**. The difference in assumed participation rates between the two measures can be attributed to the fact that a rebate is being offered in the first measure, over a purely voluntary measure, that offers no financial incentive to the community.

Table 8.8: Measure Assumptions - Toilet Replacement Scheme

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Toilets	Internal	59%	• $3,000 in first year (for establishment of measure – purchase of materials, production of literature), $500 per year (distribution of materials, general administration) thereafter • $350 cost to participant to replace existing toilet with 6/3 dual flush unit • 0.5% p.a. participation rate
RF Toilets	Internal	59%	

Table 8.9: Measure Assumptions - Toilet Replacement Rebate Scheme

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Toilets	Internal	59%	• $3,000 in first year (for establishment of measure; purchase of materials and production of literature), $500 per year (distribution of materials, general administration) thereafter *plus $100 rebate per participating account* • $250 cost to participant to replace existing toilet with 6/3 dual flush unit • 5% p.a. participation rate
RF Toilets	Internal	59%	

The results of the toilet replacement analysis is given in **Table 8.10** and **Table 8.11** for the non-rebated and rebated schemes respectively.

Table 8.10: Summary of Results – Toilet Replacement Scheme

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	1.42	0.08	0.01	$141
Ingham	0.36	0.02	0.00	$207
Mackay	9.76	0.07	0.04	$20
Maroochy	42.94	0.08	0.19	$4
Toowoomba	16.16	0.09	0.04	$21

Table 8.11: Summary of Results – Toilet Replacement Rebate Scheme

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	0.31	0.12	0.05	$654
Ingham	0.06	0.02	0.04	$1,214
Mackay	0.25	0.10	0.37	$768
Maroochy	0.28	0.08	1.86	$604
Toowoomba	0.83	0.32	1.08	$327

As can be seen in Figure 8.10 the utility benefit is very high due to the low cost of this measure and the level of water savings. On the other hand the total community benefits are low due to the high capital cost to the community.

The results of the analysis of these measures suggest that the benefit is low for the utility and community, even where a $100 rebate is offered to the community.

8.5.4 Washing Machine Rebates

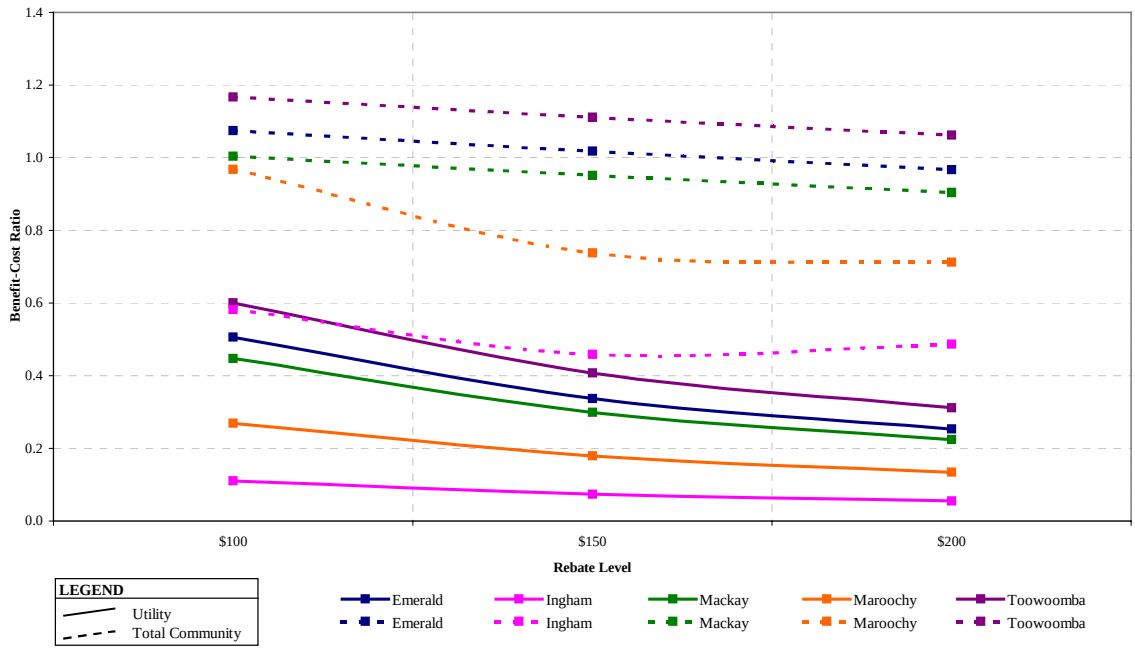
A list of the assumptions for savings and costs used in the analysis of a washing machine rebate measure are listed in **Table 8.12**.

Table 8.12: Measure Assumptions - Washing Machine Rebate Scheme

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Laundry	Internal	30%	• Assume $200 extra cost to participant to upgrade from standard washing machine to water efficient unit • Compensated by $100, $150, $200 rebate to participant • 0.6%, 1.5%, 2.4% p.a participation rates
RF Laundry	Internal	30%	

The results of implementing washing machine rebates of $100, $150 and $200 are summarised in **Figure 8.8**.

Figure 8.8: Residential Houses Washing Machine Rebate Measure



A summary of results for a rebate of $150 is given in **Table 8.13**.

Table 8.13: Washing Machine Rebate Scheme ($150) – Summary of Results

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	0.34	1.02	0.01	$562
Ingham	0.07	0.46	0.01	$929
Mackay	0.30	0.95	0.08	$589
Maroochy	0.18	0.74	0.13	$964
Toowoomba	0.41	1.11	0.09	$748

The analysis of washing machine rebates indicates that:

- The B/C ratios for the authority are below 0.6 for all alternative rebate schemes.
- The majority of communities will benefit from a $150 rebate. Where the rebate is increased to $200 only two communities, Toowoomba and Emerald exhibited B/C ratios greater than 1.0.
- The average water savings are minimal for this measure due to the low participation rates and low level of end use savings.
- If co-sponsoring were to occur where the energy company provided 70% of the $150 rebate, the utility B/C ratio would be increased to breakeven or above for all communities except Ingham. Water savings would remain at a low level.

8.5.5 Outdoor Audits and Tap Timer Information Kit

This measure is intended to assist property owners to understand the amount of water that is used in their garden. The measure is comprised of an audit, carried out by a student or council staff member, at a cost of $30. An information kit including a tap timer is also supplied at the time of the audit to encourage water conservation in the garden, at a cost of $20. The total cost of the measure is $50 per participating account.

A low participation rate would be achieved if this service were offered without any incentive. Based on this assumption, a range of rebates were assessed for this measure at $20, $30 and $50, and participation rates of 0.5%, 1% and 2% of accounts per annum respectively. This measure would impact irrigation by reducing water usage by 25%. These rebates can be targeted at specific areas of the community, and the utility can work towards assessing the landscape of each property over a long period of time. Higher participation rates would realise greater benefit to the community, but would need to be encouraged through the implementation of other measures, such as public education to heighten awareness of the scheme.

The results of the analysis for various levels of rebate are shown in **Figure 8.9.**

Figure 8.9: Outdoor Audits and Tap Timer Information Kit Measure

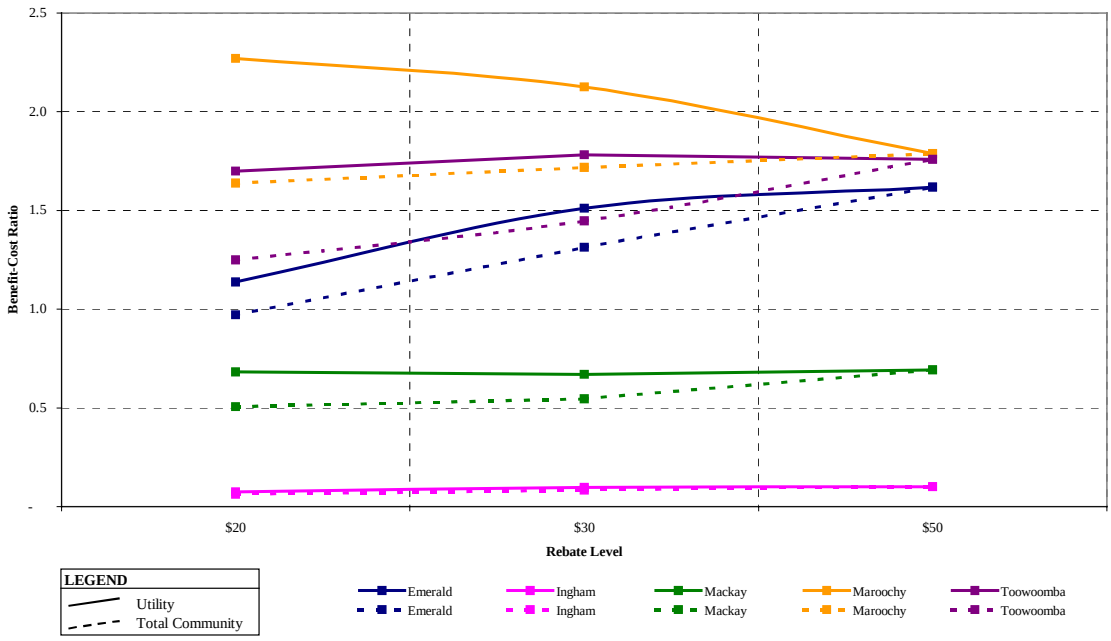


Table 8.14 summarises the results for a rebate of $30 for this measure.

Table 8.14: Outdoor Audit and Tap Timer Information Kit with $30 Rebate – Summary of Results

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	1.51	1.31	0.07	$94
Ingham	0.10	0.08	0.03	$258
Mackay	0.67	0.55	0.22	$128
Maroochy	2.13	1.72	0.46	$118
Toowoomba	1.78	1.45	0.14	$245

The economic analysis of outdoor audits and tap timer/information kits indicates the following:

- The measure is cost effective from both the community and utility perspectives in Toowoomba, Maroochy and Emerald.
- Low B/C ratios are evident for Ingham and Mackay. This is due to the low cost of producing water and the low water savings in these communities.
- Maroochy exhibited a high B/C for this measure as the water savings provide a reasonable delay of future capital works at a low cost of implementation.
- Emerald exhibited a high utility B/C as a result of the high volume of water used for external use.

8.5.6 Rainwater Tanks

The assumptions and adopted costs and tank yields for the assessment of rainwater tanks are given in Section 8.4.6. A summary of the assumptions for savings and costs is given in **Table 8.15**.

Table 8.15: Measure Assumptions - Rainwater Tanks

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Irrigation	External	*Refer to Table 8.2*	• Proposed rebate of 10%, 20%, 30% of total tank cost rounded to nearest $50. • 1%, 1.5%, 2% annual participation rates assumed for increasing levels of rebate. • Cost of tanks are as follows – 5 kL: $1,450 – 10 kL: $2,045 • Quoted cost includes installation without a pump.
RH Wash-Down	External		
RH Car Washing	External		
RH Ext. Leakage	External		

The results of the analysis for various levels of rebate and assuming 70% of the yield documented in the WSAA manual are summarised in **Figure 8.10** and **Figure 8.11** for the 5 and 10 kL tanks respectively. Costs, benefits and the cost of unit water savings are summarised in **Table 8.16** and **Table 8.17**. The participation rates that have been assumed in this analysis are very optimistic. The participation rates achieved in the Maroochy rainwater rebate program (that has been operating since 1995) ranged on average from 0.01% to 0.18% for rebates being offered from $20 to $250.

Figure 8.10: Rainwater Tank Benefit/Cost Ratio Comparison (5 kL Tanks)

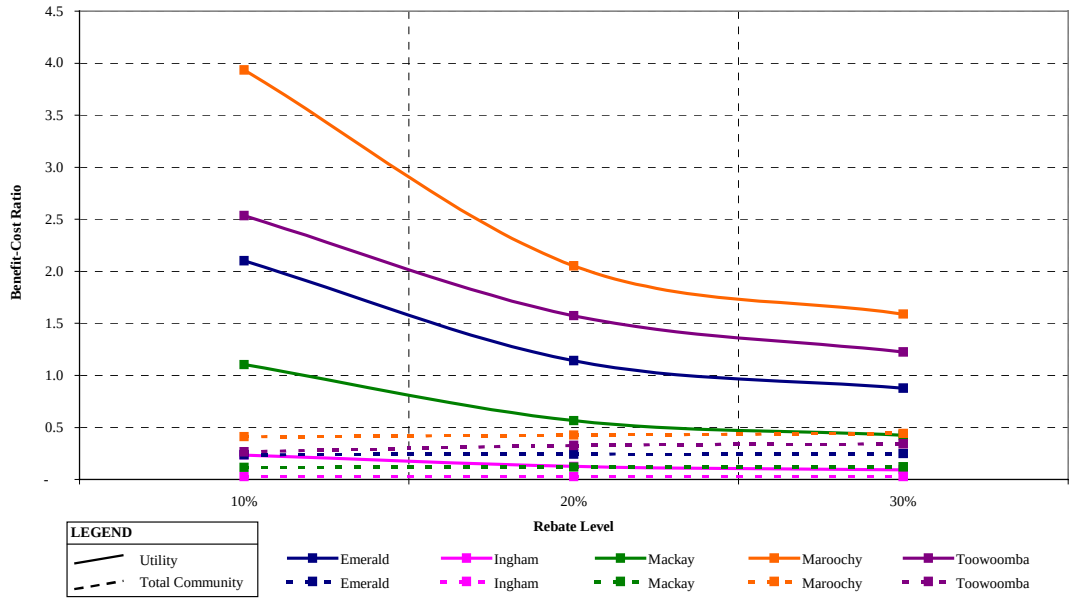


Table 8.16: Summary of Results – 5 kL Rainwater Tanks with 10% rebate

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	2.10	0.24	0.12	$69
Ingham	0.23	0.03	0.08	$107
Mackay	1.10	0.12	0.61	$79
Maroochy	3.94	0.41	1.45	$67
Toowoomba	2.54	0.27	0.28	$210

Figure 8.11: Rainwater Tank Benefit/Cost Ratio Comparison (10 kL Tanks)

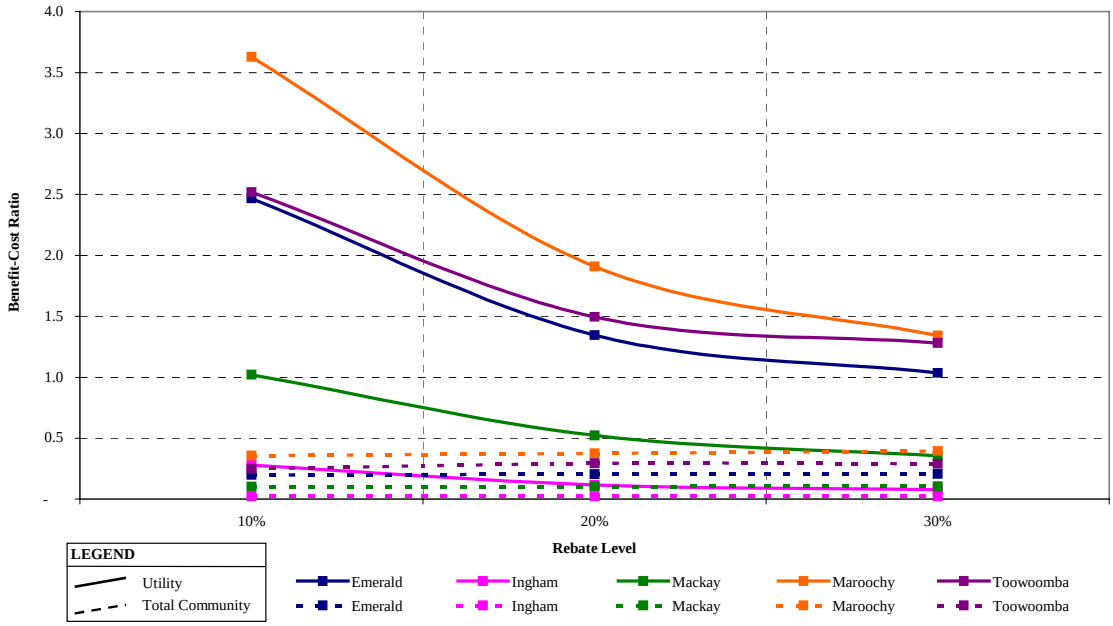


Table 8.17: Summary of Results – 10 kL Rainwater Tanks with 10% Rebate

Pilot Area	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	2.47	0.20	0.13	$59
Ingham	0.28	0.02	0.10	$90
Mackay	1.02	0.10	0.75	$86
Maroochy	3.63	0.36	1.75	$73
Toowoomba	2.52	0.25	0.33	$231

Assuming the same yield as documented in the WSAA manual provides results as shown in **Figure 8.12** and **8.13** for 5 and 10kL tanks respectively.

Figure 8.12: Rainwater Tank Benefit/Cost Ratio Comparison (5 kL Tanks) for Assumed Yield as per WSAA

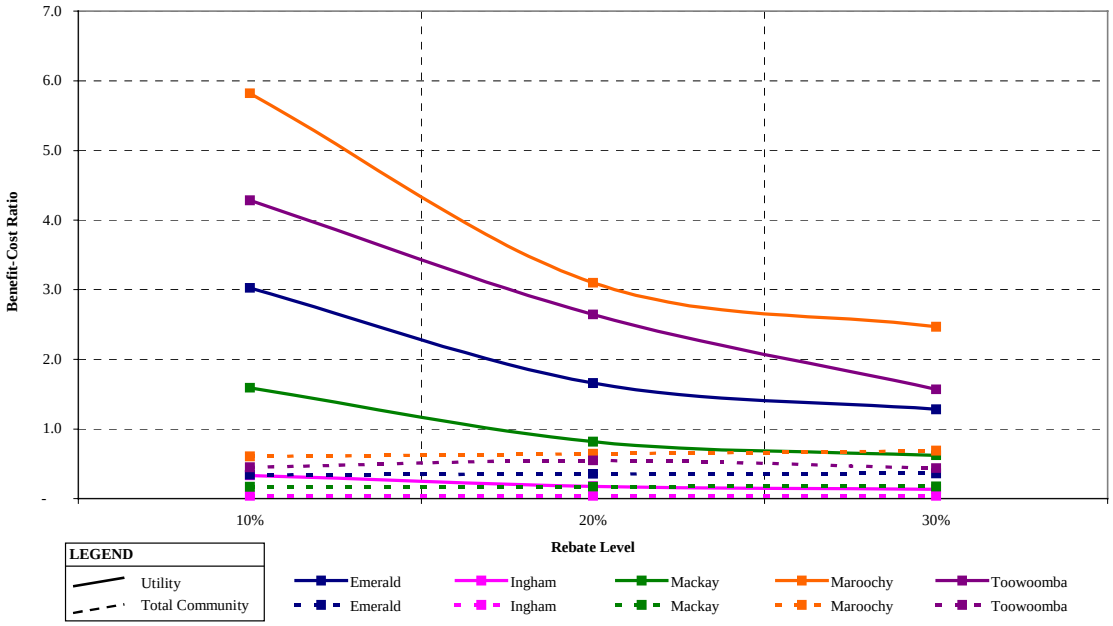
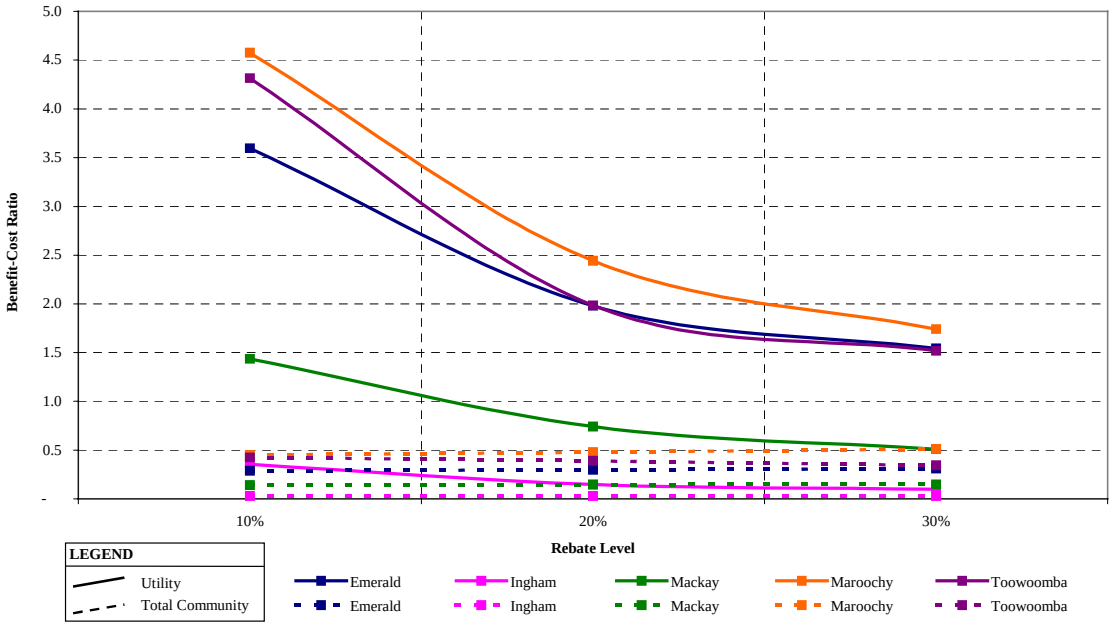


Figure 8.13: Rainwater Tank Benefit/Cost Ratio Comparison (10 kL Tanks) for Assumed Yield as per WSAA



The economic analysis of rainwater tanks as a water conservation measure indicates that:

- The authority B/C ratios for Maroochy are above 1.0 for all rebate cases. This is due the effect of high water savings (up to 4.7 ML/a) producing considerable deferrals of bulk water supply projects required to be constructed in future.

- B/C ratios for the utilities are high for low levels of rebate due to low cost to the authority and the reasonably high water savings. As the rebates increase, costs exceed benefits and the B/C ratios reduce to below 1.0.
- The community B/C ratios are significantly below 1.0 for all cases. This is due to the high cost expended by the community through the purchase of a rainwater tank.
- The cost of unit savings (cost per ML of water saved) was relatively high at between $67 and $210 per ML. This compares with the marginal cost of producing water, which is approximately $80 to $100 per ML (based on treatment and transfer costs of water in the pilot communities). Therefore the savings through capital deferral of projects need to provide considerable benefit to achieve a B/C of 1.0. It should also be noted that, although rainwater tanks may be installed to supply the external needs of a property, the limited reliability of the supply through times of low rainfall would necessitate large volume tanks, or the provision of standby capacity by the authority to supplement tanks as their supply failed. In most urban residential cases standby capacity would probably be provided and therefore benefits from deferrals may be limited.
- The sensitivity analysis showed that a 42% higher yield did not significantly increase the B/C ratios, particularly for the community.
- Analysis was also undertaken for the smaller tank sizes of 0.5, 1.0 and 2.0 kL. The results indicated that the lower B/C ratios were achieved for these tanks as the costs of implementing small tanks are high in comparison with their yield.

The results show that while the use of rainwater tanks may be beneficial from an authority's point of view, the community would be bearing the major proportion of the implementation cost. It is evident that the cost of the measure is difficult to recoup through capital deferrals or reduced operation costs. In addition, due to the requirement for large volume tanks to provide reasonable reliability, the potable water supply would need to augment the rainwater tanks during long dry periods. The downsizing and delay of water supply infrastructure would therefore not be possible, unless it is assumed that restrictions would apply during dry periods. If this were the case then the benefits would be lower than assumed by the analysis and the B/C ratios would be significantly lower.

8.6 Assessment of Further Measures

8.6.1 School WaterWise Programs

Two measures were considered for school education programs. The first measure was the literature based school WaterWise program, where school students were provided with booklets and guides on how to conserve water in and around the house.

The second measure involves the supply of a kit to students. This kit includes literature, as well as some small retrofit devices that can be installed around the home. Assumptions used in the analysis of these measures are listed in **Table 8.18** and

Table 8.19. Specific participation rates are not documented for this type of measure, and therefore estimates based on previous experience were used.

These assumptions are based on the fact that the ratepayers and major water users in a household are required to change habits to achieve water efficiency. Parents generally undertake the water using household tasks and are responsible for the replacement of fittings. The information supplied through the school WaterWise programs is directed at students, and may not reach parents. In addition, students affected by the WaterWise program represent only a minority of households each year. The impact on the community overall is small because water users are not being targeted directly. Public awareness campaigns can remedy this, but the intention of the school based WaterWise program is to instil an awareness of water efficient practices in the students for the future.

Table 8.18: Measure Assumptions - School WaterWise (Literature)

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Toilets	Internal	1%	• $3 per account cost to Utility • 5% p.a. Participation Rate with 5-year Measure Life
RH Int. Leakage	Internal	1%	
RH Showers	Internal	1%	
RH Taps/Sinks	Internal	1%	
RH Wash-Down	Internal	1%	
RH Car Washing	External	1%	
RH Ext. Leakage	Internal	1%	
RH Irrigation	External	1%	
RH Pools/Fountains	External	1%	

Table 8.19: Measure Assumptions - School WaterWise (Kit)

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Toilets	Internal	2%	• $25 per account cost to Utility • 5% p.a. Participation Rate with 5-year Measure Life
RH Int. Leakage	Internal	2%	
RH Showers	Internal	2%	
RH Taps/Sinks	Internal	2%	
RH Wash-Down	Internal	2%	
RH Car Washing	External	2%	
RH Ext. Leakage	Internal	2%	
RH Irrigation	External	2%	
RH Pools/Fountains	External	2%	

The B/C ratios and savings obtained in the pilot areas for these measures are listed in **Table 8.20**.

Table 8.20: School WaterWise Measure Results

Pilot Area	Type of School WaterWise Program	Water Utility B/C	Total Comm B/C	Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	*Kit*	0.51	1.07	0.02	$369
	Literature	2.14	4.46	0.01	$89
Ingham	*Kit*	0.06	0.44	0.01	$839
	Literature	0.27	1.85	0.00	$201
Mackay	*Kit*	0.27	0.85	0.07	$554
	Literature	1.13	3.56	0.04	$133
Maroochy	*Kit*	0.35	0.90	0.14	$586
	Literature	1.44	3.74	0.07	$141
Toowoomba	*Kit*	0.51	1.10	0.06	$843
	Literature	2.16	4.61	0.03	$202

The school WaterWise programs (for both the kit and literature only options) proved to be cost beneficial even with low, water savings. The kit based program is undertaken in most of the pilot communities, as it assists in the generational education process that results in a change of consumer behaviour in later years.

If estimated savings were assumed to be higher, then the B/C ratios would obviously increase. However, as discussed previously in this section, the impact of this measure cannot be overstated as the property owners / major water users within a property are not being specifically targeted. As a result, the end use savings assumed for this measure were not significant, but were considered representative of the impact that this measure could achieve when implemented.

8.6.2 Irrigation Advisory Service

This relatively simple measure can influence the garden watering habits of account holders, and consequently reduce external water consumption. The assumptions adopted for analysis of this measure are given in **Table 8.21**. A high participation rate is assumed for this measure, as all accounts in the community will be offered this "service".

Table 8.21: Measure Assumptions – Irrigation Advisory Service

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Irrigation	External	2%	• $5,000 in first year, $1,000 per year thereafter • 97% participation rate in the first year, then any new households for each year thereafter

Intended as a public awareness measure, whereby leaflets are distributed to properties, this measure proves very cost beneficial (refer to **Table 8.22**), but does not realise the high water savings presented by other higher impact measures. The low cost to the utility to distribute material for this measure, and the zero cost to the community results in a high B/C for this measure.

Table 8.22: Summary of Irrigation Advisory Service Results

Pilot Area	Water Utility B/C	Total Community B/C	Annual Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	4.38	4.38	0.04	$44
Ingham	0.30	0.30	0.02	$101
Mackay	8.03	8.03	0.13	$13
Maroochy	29.34	29.34	0.23	$8
Toowoomba	29.76	29.76	0.09	$20

8.6.3 Washing Machine Labelling

The ultimate aim of this measure is to encourage the purchase of water efficient, preferably AAA-rated washing machines. The focus of such a measure is to encourage businesses to support the AAA washing machine labelling specification (as discussed in Section 6.2.2). The utility would need to create information/promotional material that can be used to inform the community about the benefits of choosing a AAA-rated washing machine over a less water efficient unit. This material would come in the form of:

- Pamphlets for distribution to customers
- Stickers – to show that the business supports, and can advise, on the labelling scheme
- Posters – for in-store information about the labelling scheme

The cost to initially produce the material is reflected in the first year's cost. In the following years, the cost of distributing the material to participating businesses is included. The assumptions for this measure are listed in **Table 8.23**.

Table 8.23: Measure Assumptions - Washing Machine Labelling

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Laundry	Internal	30%	• $10,000 initial measure cost to Utility • $1,000 per year maintenance cost to Utility • $200 cost to participant to upgrade to a AAA washing machine • 0.3% participation rate
RF Laundry	Internal	30%	

Washing machine labelling is a measure that could provide a reasonable benefit to the utility. The measure is relatively inexpensive to implement, and has low recurrent maintenance or administration costs.

The results of the analysis are summarised in **Table 8.24**.

Table 8.24: Washing Machine Labelling Measure Results

Pilot Area	Water Utility B/C	Total Community B/C	Annual Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	0.34	0.55	0.00	$449
Ingham	0.09	0.32	0.00	$634
Mackay	2.40	0.86	0.03	$63
Maroochy	4.59	0.82	0.06	$37
Toowoomba	3.02	0.99	0.03	$65

This measure does not provide high community benefits, but it has the potential to reduce water usage in each participating residential property for most of the pilot areas. Due to the low participation rates the water savings for this measure are not significant.

8.6.4 Outdoor Tap Timers

Assumptions used in the analysis of this measure are listed in **Table 8.25**.

An average water saving of 5% of external irrigation was initially assumed for this measure. The reason for the low level of saving is the assumption that the "forgetful sprinkler" syndrome which the tap timers were designed to overcome, has been impacted through the recent pricing policy changes.

Table 8.25: Measure Assumptions - Outdoor Tap Timers

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
RH Irrigation	External	5%	• Assume $20 for outdoor tap timer • $10, $15, $20 cost to Utility for rebate • $10, $5, $0 cost to participant • 2%, 5% and 10% p.a. participation rate with a 3-year measure life

The results from the analysis of tap timer rebates are summarised in **Figure 8.14** and **Table 8.26**.

Figure 8.14: Outdoor Tap Timer Results

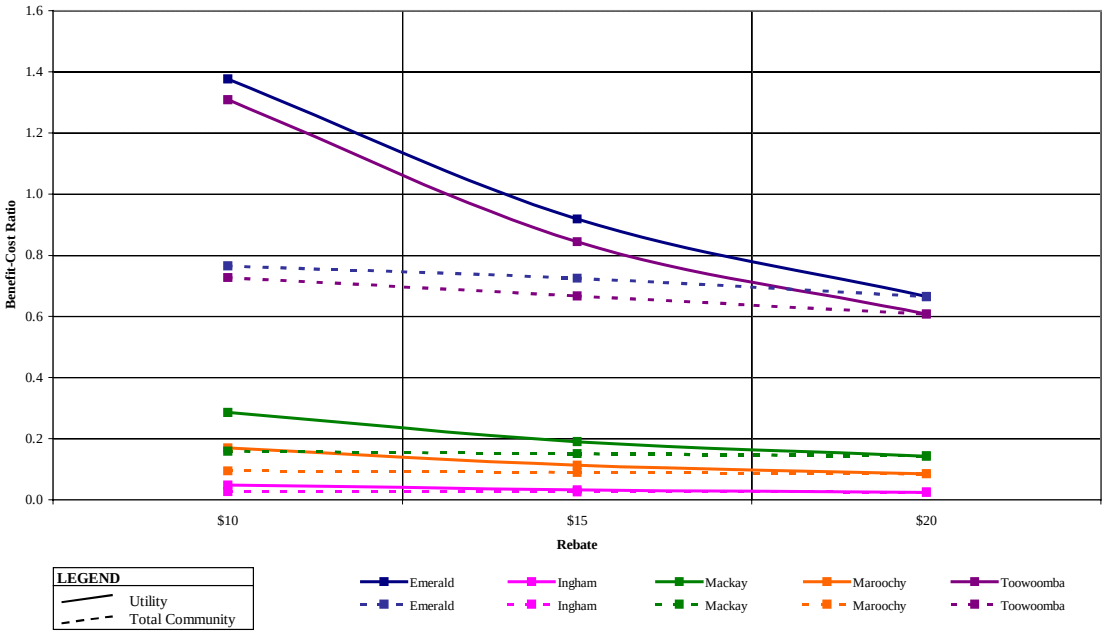


Table 8.26: Outdoor Tap Timer - Summary of Results

Pilot Area	Rebate Level	Water Utility B/C	Total Community B/C	Annual Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	$10	1.38	0.76	0.00	$331
	$15	0.92	0.72	0.00	$496
	$20	0.66	0.66	0.01	$662
Ingham	$10	0.05	0.03	0.00	$953
	$15	0.03	0.03	0.00	$1,429
	$20	0.02	0.02	0.00	$1,906
Mackay	$10	0.29	0.16	0.01	$677
	$15	0.19	0.15	0.01	$1,016
	$20	0.14	0.14	0.03	$1,354
Maroochy	$10	0.17	0.09	0.01	$634
	$15	0.11	0.09	0.02	$951
	$20	0.08	0.08	0.05	$1,268
Toowoomba	$10	1.31	0.73	0.00	$1,349
	$15	0.84	0.67	0.01	$2,023
	$20	0.61	0.61	0.02	$2,698

The results of the economic analysis of outdoor tap timer rebates indicates that:

- The measure would be beneficial at the $10 rebate level for Toowoomba and Emerald.
- Sensitivity analyses were carried out on this measure to ascertain the effects of higher savings. The results obtained indicated that the increase of the end use

savings proportionally increased the benefit/cost ratio obtained. Therefore, if the end use saving was doubled, the benefit/cost was also doubled. However, increasing the *average* end use may over estimate the potential savings that could be obtained by this measure. A conservative estimate of end use savings was employed in the initial analysis to account for potential over use by customers.

8.6.5 Toilet Displacement/Flush Arrestor Devices

Costs and savings assumed for the analysis of this measure are summarised in **Table 8.27**. The measure is offered to the community by the utility free of charge.

Table 8.27: Measure Assumptions - Toilet Displacement/Flush Arrestor Devices

End Use Identifier	Type of Use (Internal or External)	% of Savings Per Account	Costs/Participation Rates
Toilet Displacement Device			• $1,000 in first year plus $5 per participating account, $500 per year thereafter with same per account cost (add 25% for admin) • 5% participation rate
RH Toilets	Internal	27%	
RF Toilets	Internal	27%	
Flush Arrestor			
RH Toilets	Internal	40%	
RF Toilets	Internal	40%	

Toilet devices are relatively inexpensive, and such devices have been employed in Australia, the United States and the United Kingdom with a reasonable level of success.

The results of the analysis are summarised in **Table 8.28** for both the displacement and flush arrestor devices. The results of the analysis show that the use of these devices is cost effective, assuming that installation is undertaken by the customer.

Table 8.28: Toilet Displacement Device / Flush Arrestor Measure Results

Pilot Area	Device	Water Utility Benefit Cost Ratio	Total Community Benefit Cost Ratio	Average Water Savings (ML/d)	Cost of Savings ($/ML)
Emerald	*Toilet Displacement Device*	2.16	2.16	0.02	$93
	Flush Arrestor	3.21	3.21	0.04	$63
Ingham	*Toilet Displacement Device*	0.45	0.45	0.02	$168
	Flush Arrestor	0.66	0.66	0.02	$114
Mackay	*Toilet Displacement Device*	1.81	1.81	0.17	$107
	Flush Arrestor	2.69	2.69	0.25	$72
Maroochy	*Toilet Displacement Device*	0.75	0.75	0.31	$230
	Flush Arrestor	1.10	1.10	0.45	$155
Toowoomba	*Toilet Displacement Device*	2.34	2.34	0.16	$139
	Flush Arrestor	3.39	3.39	0.24	$94

8.7 Summary of Findings and Recommendations

A summary of the findings of the evaluation of stand-alone measures for the pilot communities is as follows:

- Benefit/cost analysis showed that the following measures provided B/C ratios of greater than 1.0 for both the utility and community:
  - Showerhead Replacement Program with rebates of $10 and $20 (except Ingham)
  - Residential Audit & Retrofit Program with a customer contribution of between $30 and $50 (Emerald, Toowoomba and Mackay only). If co-sponsoring occurred Maroochy and Ingham may qualify.
  - School WaterWise Program with literature (except Ingham)
  - Irrigation Advisory Service (except Ingham)
  - Outdoor Audit and Tap Timer Information Kit (Emerald, Maroochy and Toowoomba).
  - Washing Machine Labelling (Toowoomba only)
  - Toilet Displacement/Flush Arrestor Devices (except Ingham)
- Benefit/cost analysis of rainwater tank rebates shows that:
  - the authority B/C ratio for Maroochy was above 1.0 for all levels of rebate (10-30%) for 5 and 10kL tanks.
  - the authority B/C ratio is generally high for low levels of rebate (10% of total cost), as most of the cost is borne by the customer.
  - community B/C ratios are generally lower than 0.5.
- Analysis of rainwater tanks is difficult due to the unknown reliability and expected yield in Queensland. Benefits of rainwater tanks are therefore difficult to estimate.
- The benefit/cost analysis of outdoor tap timers showed that the measure would not be cost effective in most of the pilot areas. Toowoomba and Emerald were the exceptions, with a B/C ratios higher than 1.0 for a rebate of $10. An increase in the savings to 10% or greater of external usage would result in cost effective results in most communities.
- The analysis of toilet displacement/flush arrestor devices indicated that such measures are cost effective assuming that installation is undertaken by the customer.

Based on the results of the analysis it is recommended that:

- In general the following measures are cost effective in Queensland, and should be implemented as base measures where possible:
  - Showerhead replacement (with co-sponsoring)
  - Residential audit and retrofit (with co-sponsoring)
  - School WaterWise
- The implementation of $20 rebates for AAA showerheads should be adopted as a state wide policy to reduce water usage. Such a measure has the potential

for significant water savings and benefits to authorities as well as to the community as a whole. Co-sponsoring by the electricity companies would increase the authority benefits and provide substantial power savings to customers.

- Rainwater tank yield requires research in Queensland to confirm the results of this study.