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TE160

WATER EFFICIENCIES – REPORT ON EXISTING TECHNOLOGY / EXPERTISE IN NEW ZEALAND

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WATER EFFICIENCIES – REPORT ON EXISTING TECHNOLOGY / EXPERTISE IN NEW ZEALAND

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ABSTRACT

This report identifies three key areas and existing technologies which could be targeted for water efficiency. These are: front loading washing machines, water efficient toilets, and reduced garden water consumption. It suggests that, rather than investigate the need for new technologies which may reduce household consumption if used, the consumer needs to be encouraged to make use of existing technologies and information via education and promotion.

REFERENCE

2006. *Water Efficiencies* – Report on Existing Technology / Expertise in New Zealand

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It is possible to reduce domestic household water consumption in a number of ways including use of available technologies and selection of more efficient appliances, in conjunction with behaviour and attitude changes. Major gains are possible with existing technology if it is used. Three key areas identified to recognise water savings are:

- A front loading washing machine can use half the water of an efficient top loading machine, and up to a third of an inefficient one. They are now cost comparative, readily available, equally as energy-efficient, and are deemed to perform better. However currently only a small percentage of New Zealanders use them. One estimate of household water use (Sustainable Households Programme 2004) show that the laundry makes up 13% of household use, so a 50% reduction represents a significant impact.
- Water efficient toilets are also readily available, in all outlets and in a huge range of prices and styles, including those at the cheapest end of the market. An efficient toilet may use up to a third of the water of an old style single flush toilet and as toilet use is estimated (Sustainable Households Programme 2004) to be 20% of the total household water use, again significant savings are easily made. Further savings can be made by the use of less common technologies such as electric toilets which use little or no water and, while less common and more expensive then standard toilets, they are available in New Zealand.
- The garden is another major source of domestic use (Sustainable Households Programme 2004) estimated at an average of 25% of overall use, although this will vary markedly with region and season. While technologies are available to reduce water consumption in the garden, major impacts can be made at little or no cost with behaviour changes, by the simple collection and use of rainwater, or by designing a garden that minimises or negates the need for watering.

The use of cost benefit analysis in the assessment of water saving technology is difficult for two reasons.

- The cost of water and removing waste water is in many areas “free” (or built into rates charges) or a nominal charge. This does not reflect the cost to the community and environment to supply water, and to treat and discharge water, and to continue to do this with increased demand through population increases, and aging infrastructure.
- Many of the technologies are cost neutral, or the cost of any particular item is viewed in conjunction with a number of other features (size, appearance, performance, style, materials etc) that make it impossible to assign a cost to one particular feature. Generally, common household appliances and fittings (toilets, dishwashers, washing machines) that are water-efficient do not appear to be any more expensive then their less efficient counterparts. Many changes that will impact on consumption have little or no cost (collecting rainwater in a barrel for the garden, reducing the water flow from an old style toilet cistern, fitting a low pressure valve, shorter showers to name just a few).

Rather than investigate the need for new technologies which may reduce household consumption if used, the consumer needs to be encouraged to make use of existing technologies and information. If a “water conservation” culture could be promoted to alter the behaviour of a nation that has always treated the provision of unlimited free

drinkable water as a right, then real water savings will easily be made. The issue does not appear to be a lack of information and technology available, but a lack of interest to use them. If the low hanging fruit (which are plentiful) could be gathered, then significant reductions in water use should be realised.

This needs to be achieved through education and promotion, and would be assisted by an information repository which gathered information into a central site, however as the information is easily gathered if searched for, the key to success has to be in education and changing attitudes, both of the public, and of professionals in related industries (plumbers, architects, builders).

1. INTRODUCTION

This report aims to investigate the existing technology, knowledge and expertise available to the New Zealand consumer to reduce consumption through the urban water supply. This is driven more by the cost to the community and country to supply potable water, then necessarily by an actual shortage of water. Associated with this is a reduction in waste water generated that again represents a cost to the community if not always directly to the consumer.

All information presented has been accessed in ways that are available to the general public, through either the internet, stores, product brochures, and telephoning companies. For most products, information searches have been limited to New Zealand and Australia in an attempt to reflect what is realistically useful for the average home owner / occupier in New Zealand. Particularly in relation to bulky purchases such as appliances and water tanks, it is felt that this better reflects the available market.

2. EXISTING WATER USE

Water use in urban areas is driven to a large extent by the domestic consumer. As an example, the graph below shows the breakdown of consumers for Watercare Services Limited (who provide water to the six Local Network Operators who supply the Auckland region), indicating that in 2004/05 62% of the water supplied was for domestic use (Watercare Services Ltd, 2006 / 07).

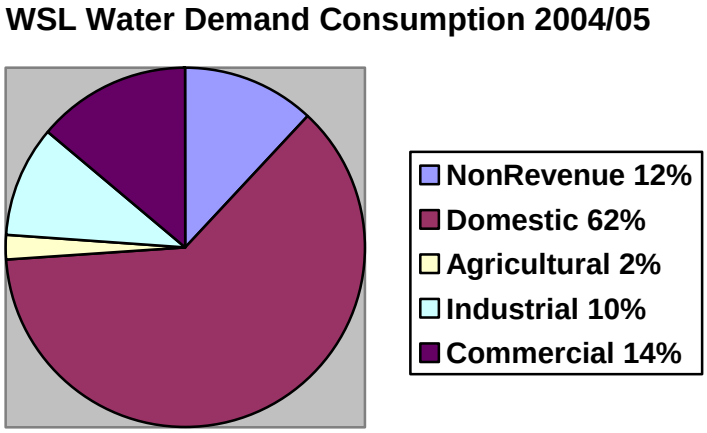

Figure 1: (Sourced from Watercare Services Ltd, Asset Management Plan 2006 / 07)

The domestic user is then an obvious target group for reducing total consumption. An estimated breakdown of domestic use is given by the Sustainable Households Programme.

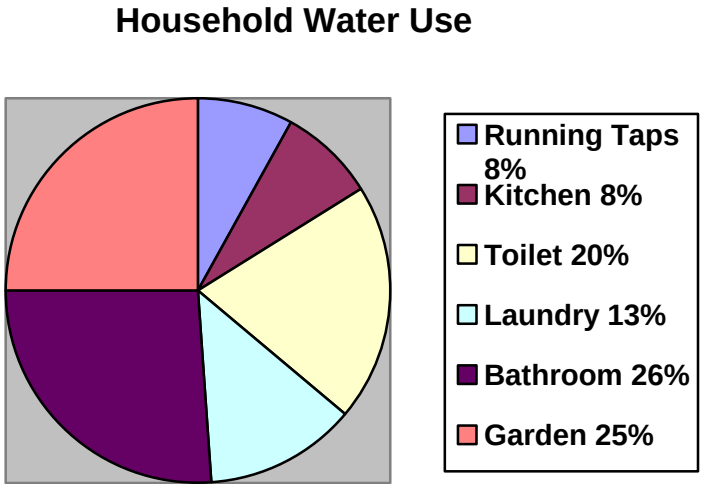

Figure 2: (Sustainable Households Programme 2004)

These figures are a national average, and will vary by region, particularly percentage of water used in the garden which will be a much higher percentage of total use in dry areas, and seasonally.

3. GOVERNMENT PROGRAMMES

There are a number of initiatives currently being pursued by the Government relating to reducing water consumption in New Zealand. The Ministry for the Environment is investigating the potential to introduce Water Efficiency Labelling for various appliances into New Zealand as has been done in Australia. Reasons include marketing / trade relations with Australia as well as a drive to encourage a reduction in water use. A cost benefit study has been completed (Covec Limited June 2004) which can be accessed at www.covec.co.nz and submissions have been sought from industry and the public on the introduction of such a scheme.

The Sustainable Households Programme has been developed by a partnership of local councils across New Zealand, with funding assistance from the Ministry for the Environment Sustainable Management Fund. Their publication "Water Actions – Saving Water at Home" (Sustainable Households Programme 2004) has excellent information on reducing water consumption.

Another source of information is the Ministry for the Environment booklet "Sustainable Wastewater Management: A Handbook for Smaller Communities" (Ministry for the Environment 2003) which has useful data on water savings possible from improved practices and use of more efficient technologies. They suggest that internal domestic water use can be reduced by 50% with the adoption of water saving technologies in the home.

The Ministry for the Environment has also produced a paper "Fresh Water for a Sustainable Future – Issues and Options (Ministry for the Environment 2004)". This discussion document outlines the different ways in which New Zealanders value and use freshwater. It also looks at how New Zealand's water is presently managed and the pressures and challenges facing our water management system. A preferred set of directions for improving our system for managing freshwater is also identified. This includes a suggested action to raise public awareness of freshwater use problems

and pressures and to promote solutions. All of this information can be accessed by the public using internet search engines.

4. LOCAL GOVERNMENT

There is a wealth of practical information on water saving supplied by various local government bodies including city, district and environmental councils. This information is easily sourced through the internet, with water saving tips and advice for reduction in water use and waste water production. The advice varies from council to council, with the Waitakere City Council having very extensive and detailed information ranging from saving water and using grey water to collecting rainwater and improving the drought resistance of a garden (Waitakere City Council 2006). In 2004, only seven Local Network operators were charging for water supply with two also charging for waste water calculated as a percentage of water used. (Covec 2004). The table below shows charges, of which only one rate (waste water charges from Metrowater are now $2.81) has changed since 2004. Other councils have started charging for water (for example Far North District Council $2.31 M3), and a number of councils charge fixed rates to consumers for the supply of water, or will charge for excessive water use. Examples are Rotorua District Council and Christchurch City Council. As there are 75 district and city councils in the country, a wide variety of charges and method of charging are used and these are constantly being reviewed and updated.

Table 1: Water and Wastewater Variable Charges per unit of Water Consumption (Covec 2004)

Local Network operator	Water Supply($/m3) Incl GST	Waste Water ($/m3) Incl GST	Total
Metro Water	1.175	2.11	3.98
Manukau City	1.07	0	1.07
North Shore City	1.27	0	1.29
Waitakere City	1.48	0	1.48
United Water Papakura	1.26	1.94	3.20
Tauranga City	1.20	0	1.20
Tasman District	0.55	0	0.55

Examples of councils which offer free water “audits” to assess how “water efficient” a house is and how this can be improved, are Waitakere City Council and the Tauranga City Council. The Waitakere Council’s subsidiary, Ecowater, runs a “Water Wise Up” programme where houses are visited and checked for leaks, a water saving “gizmo” is installed in the toilet, and residents are advised on ways they can make water savings. The Tauranga City Council has a free mobile advisory service, which will visit homes for advice on water conservation and will even fix leaky washers, all at no charge. Another example of incentives offered by councils is a rebate for installing rainwater tanks in urban areas offered by the Rodney District Council and the Waitakere City Council.

5. SAVINGS THROUGH LIFESTYLE AND EDUCATION

As noted above, there are a number of different sources of information on ways to save water in a domestic situation, and these generally all suggest the same ideas, with greater or lesser detail. A number of these ideas cost nothing to implement but simply involve change to daily practices. Some can be implemented immediately whereas some are longer term solutions or require investment in equipment or technologies. It is simple to source ways to improve water use efficiency when building new homes, in existing homes, when retro fitting homes, when creating or upgrading gardens and when purchasing appliances. If the will to make a difference exists, the information and technology is relatively easy to access.

A survey on environmental concerns and actions of the public conducted by Environment Waikato (Enviro Solutions 2001) found that only 4% of people surveyed took action about their environmental concerns by trying to save water. This may be partially due to the low cost of water to most New Zealanders. However water use is increasingly an area of concern for both local and national government, not only because water can become scarce in areas with population growth, but also because of the high cost of infrastructure required both to supply drinkable water and to remove and treat waste water generated. As a country and particularly in various regions, huge savings can be made if costly upgrades and/or new infrastructure are avoided or delayed by reducing water consumption and waste water generated.

Where restrictions on water use are implemented, public awareness increases and users start to change their habits and infrastructure. The challenge will be whether it is possible to drive these changes by means other then financial incentives and/or through regulation.

6. TECHNOLOGIES

Water saving technologies within the domestic environment tend to be grouped into toilet, shower, washing machine, taps, dishwashers, and flow regulators, however alternative plumbing systems, rainwater gathering systems and garden technology should also be included.

Table 2: Comparison of water use between conventional and water-saving domestic appliances. (Source Ministry for the Environment 2003)

Appliances / fixture per capita daily flow (litres/person/day

	Toilet	Washing Machine	Shower	Washbasins, bathroom, Kitchen, laundry	Total per capita
Standard household fixtures 11 / 5.5 dual flush cistern, top loading washing machine	38	22	90	30	180
Full water reduction fixtures 6 / 3 L dual flush cistern, front loading washing machine, low flow showers, aerator faucets	22	13	45	15	95
% saving	42.1	40.9	50.0	50.0	47.2

The data in Table 2 gives some indicative comparisons of household water consumption using older or standard appliances verses consumption where water efficient appliances are used. In New Zealand, the more efficient appliances are readily available.

6.1 Appliances

The main appliances targeted to reduce water use in the home are dishwashers and washing machines. There is a general consensus that an “in sink” waste disposal should just be avoided and no evidence has been found of attempts to rate water usage for different models. In the case of other appliances, an effort has been made to rate different makes and models for water use efficiency to allow consumer comparison. The work in New Zealand has largely piggy-backed on the extensive work done in Australia, where a “water efficiency labelling and standards (WELS)” scheme has been introduced. In Australia, from 1 July 2006, mandatory registration and labelling will apply to various products including washing machines, dishwashers, toilets, tap equipment, urinals and showers. The labelling will be optional for flow controllers. The New Zealand Government has released various discussion papers and cost benefit analysis on the adoption of a similar scheme here in New Zealand. Currently there are a number of appliances available with water rating labels attached. This is due to a number of local suppliers who also supply the Australian market and are pro-active in rating and labelling products distributed here.

The Environmental Defence Society website (www.eds.org.nz) has a link to the Water Services Association of Australia (WSAA) water efficiency rating scheme of Australia which lists the rating of all products rated under the scheme. This can also be accessed directly at www.wsaa.asn.au. Obviously these are products sold in Australia but many are brands and products also available in New Zealand.

6.1.1 Dishwashers

The formula adopted by the standard AS/NZS 6400 (Standards New Zealand, 2005) for water efficiency ratings for dishwashers is complicated and, in itself will mean little to the general public. What they need to know is that the more "A"s the product has been given, the more water efficient it is, and otherwise technical specifications regarding the volume of water consumed is likely to give the best guide. Under the Australian system, the maximum rating is five "A"s. The Consumers' Institute magazine scores water efficiency as one of the factors they assess while comparing different makes and models of dishwashers, however they use a score out of 10, rather then listing actual consumption. There is information available on water consumption on product websites (usually based on minimum possible use) and some websites also include a water rating for each model. The same information is available in brochures at sales outlets.

Other factors to take into consideration are the size of the dishwasher and the volume it can hold at one time (generally expressed in "place settings") which needs to be taken into account in conjunction with the actual water used, to assess whether it is more economical (lower water usage per wash, but having to wash twice as often will not represent a saving). The Consumers' Institute magazine (Wilson August 2005) suggests that the compact models available in some cases use more water and energy than their larger counterparts (one full sized model uses 14 L to wash 14 place settings, while a compact model uses 18 L to wash 9 place settings). Single drawer dishwashers appeared to perform better when washing smaller loads. To further confuse, some machines have "economical cycles" or "half cycles" available as wash options which also reduce the water used per wash.

Water can be saved by using good practices in conjunction with a dishwasher such as only rinsing when required, using a sink or tub when rinsing rather then running the tap, and filling the machine to cycle capacity before running. When installing a sink in the kitchen, using the models that incorporate a small separate rinsing sink will allow rinsing of dishes without a continuous flow of water.

Basic information is readily available to the consumer either at stores or on the internet in the form of either water efficiency rating or minimum litres consumed. By searching for more detail, studies by organisations such as Consumers' Institute provide assessments which can be tracked down at local libraries or via the internet. However due to the complexity of choice, and how the choices interact, (size, capacity, wash options etc) the information may not be as straight forward or as easily interpreted as may first appear. There is no right answer as each situation and use requirements will differ, however once a consumer has analysed their needs, there are a number of options available, and information to allow an informed decision about the most water efficient choice. Based on the assessments, price does not appear to be directly linked to water efficiency, as some of the cheaper models received good water efficiency ratings, but this obviously needs to be linked to a number of other features offered and the brand.

6.1.2 Washing Machines

As with dishwashers, the rating formula used for washing machines is complicated and it is likely the public will rely on the outcome (number of "A"s) rather than an understanding of how this rating is actually derived. The efficiency scoring must be viewed in conjunction with capacity and cycle options to assess whether the model is suitable for a situation. Good practices such as only running the machine when it is loaded to cycle capacity will assist with reducing consumption, as will using cycles that estimate water required rather then using standard volumes of water, or using economy cycles if available.

Front loaders are unanimously accepted as being both more energy and water efficient than their top loading counter parts (actual water used by comparable washing machines is estimated in 2005 to be 33.3 m^3 /household/annum for a top loader vs 19.6 m^3 for a front loader (George Wilkenfeld and Associates – raw data Australia)). They are also deemed to perform better, however tend to be more expensive than top loaders which may explain why they only comprise a very small percentage (estimated at 11.7% in 2005 – (Covec 2004)) of the market, and why Fisher and Paykel do not offer a front loading machine. From conversation with their sales department, they do import another brand, Whirlpool, which does include front loading machines in its range, but as far as they were aware, there was no immediate move to manufacture front loaders at Fisher and Paykel.

In a comparison of machines by the Consumers' Institute (Wilson. September 2005), four of the eight machines profiled were front loaders. These all received higher scores for water efficiency, and some were very price competitive, however this may relate to less desirable brands and less features, the impacts of which will vary with different consumers. As an overall rating from the Consumers' Institute (taking all their tested features into account such as water and energy efficiency, performance, price etc) the second and third rated machines were front loaders.

Information on the water use of different models is available in brochures at outlets, and a large number of appliances available in shops now have a water efficiency label attached.

6.2 Other Household Fittings

6.2.1 Taps and Shower Fittings

Shower heads are rated for water efficiency in Australia under the WELS system, and a number of makes and models in New Zealand carry the Australian water efficiency rating label. The rating system for shower heads is easy to follow moving from 16+ litres per minute gaining "No A's" to between 7.5 and 9.0 litres per minute having a three A rating. (Standards Australia 2006) The Australian Standards Board estimates that a standard shower head uses between 15 and 25 litres per minute so a water efficient shower head could use 40 percent less water. Not only are the savings made in volume of water used but energy required to heat the water can be reduced giving real dollar savings which may not be realised when saving water.

Information on shower head flow seems to be a little harder to obtain in New Zealand, although obviously in Australia, after 1 July 2006, all shower heads will need to have a water efficiency label. Brochures from local suppliers show that information on flow is not always available or complete. Searching on manufacturers web sites tends to yield more once technical details are accessed, however again in some instances

neither a rating or a flow is supplied. In one website, the rating and flow information is available under the “Australia” option but not on the “New Zealand” site.

In general discussions with service staff at plumbing outlets, there did not seem to be a lot of information available. The best advice obtained was to install a flow controller behind the shower head, which would then dictate flow regardless of the type of shower head used. This may give poor performance if done in conjunction with some types of shower head. Some packaged shower heads do recommend that a flow regulator be used in conjunction with the head, to restrict flow to an acceptable level It was noted that in some of the bigger “do-it-yourself” outlets where a wide range of shower heads were stocked, some were labelled with water efficiency labels, while others were not.

6.2.2 Flow Controllers / Restrictors / Pressure Limiting Valves / Aerators

Flow controllers can be fitted at a number of points in plumbing systems, including in the shower head, the pipes leading to the shower or in taps. Pressure limiting valves can be fitted at the point where the town supply enters the property to reduce water pressure to the house, such devices should be discussed with and fitted by a qualified plumber but they are generally cheap and easily obtainable.

Some showerheads in New Zealand are sold with built-in restrictors in the shower head (for example a number of models on the Methven website have a built in 14 L/minute flow restrictor). This information can be gained from the manufacturers or their brochures/websites.

Aerators can be fitted to taps or shower heads, which reduce the water flow by mixing air with the water to improve the quality of the water stream. A variety of different sizes and fittings are available. Taps can also be purchased that have aerators fitted and it is also possible to fit aerators to shower heads to reduce the required flow to give a good shower.

According to information from the Waitakere City Council, some companies offer comprehensive packages to retrofit homes with water-saving flow restrictors. However it does not appear easy to access companies in New Zealand that are offering these services. The information is more readily available if you search internationally (for example “Energy and Water Solutions” and “Green Plumbers” in Australia and “Rain Bird” in the USA). It is likely that both the valves and how/where they are best fitted to effectively control flow while still providing an adequate supply, can be found from local plumbers and plumbing outfits.

6.2.3 Toilets

The Australian rating system states that toilets that use more then 5.5L average flush volume exceed the maximum water consumption allowable and therefore do not get a rating (and do get a warning from the government). The product’s site (www.wsaa.asn.au) lists a large number of toilets by a variety of manufacturers that gain a four “A” rating (more than 3L but not more then 3.5L). Despite the fact that many of the makes were the same, when product sites in New Zealand were searched for toilets, the only information found on water flow was that they used 6 / 3 litres (full/half flush) while a number of products had no information about flow at all. A number of products at plumbing shops have the “A” rating stickers attached to the cistern with many showing a “AAA” rating (more then 3.5 but not more then 4.0L). All toilets sited either in stores or on New Zealand websites that carried information on flow, listed the toilets as 6 / 3, however it was noted that on the WSAA website listing of rated appliances, there were systems available that were 4.5 / 3 (AAAA rated).

However the 6 / 3 are a major improvement on the older style toilets which use up to 11 L per flush (over 70% reduction for a half flush), and in some cases the volume is higher!

For retrofitting or adjusting/reducing flow in existing toilets, there is no shortage of literature on cheap or free ways to achieve good results. In many cases it is possible to fit a dual flush cistern to an existing toilet. Other alternatives range from fitting a "gizmo" (very cheap and fitted free by some councils including Waitakere) which stops flow of water out of the cistern when pressure is removed from the flush button, allowing the user to dictate "full", "half" or "any where in between" flush. Other suggested alternatives are to bend the ballcock down to prevent the cistern from completely filling, or putting a bulky object in the cistern (e.g. a brick or a full 2 L plastic bottle) to again prevent the cistern from filling to original capacity before triggering the ballcock.

There are a number of toilet products available in New Zealand that use no water at all. They include the waterless urinal, which may not be a traditional option in the domestic household but is available for those who are serious about water savings. It is marketed in New Zealand by Waterless and information can be found on www.waterless.co.nz

Another option is to install a composting or eco toilet, of which there are a number of different makes and models available. Eco Toilets (contact www.ecotoilets.co.nz) offer both composting and electric toilets. The composting toilets are either waterless or low flush. The electric toilet is waterless and does not require the addition of organic material to use, however it does need to be connected to a power supply. Another company offering this kind of product is Eco Tech (contact www.ecotech.co.nz). These toilets are effective not just in water savings, but also in areas where there are issues with waste disposal or with constructing septic tanks such as in areas with very porous or sandy soils.

Vacuum toilets are used in Europe and America and use much lower volumes of water than conventional toilets, however they appear to be better designed for multiple dwellings rather than a single dwelling (apartment buildings or cluster homes). Estimated savings (Ministry for the Environment, 2003) suggest water used by a vacuum toilet may be less then 10% of that used by a conventional older style flushing toilet. They are not common in New Zealand, can be expensive to install and are noisy.

6.2.4 Rain Harvesting Systems

While a number of people in New Zealand rely on tank or bore water for all their water needs, it is relatively uncommon for people to supply part of their water requirements from their own collection when they also have access to a town supply. In Australia, where there are critical water shortages, and restrictions on use apply, the use of rain water collection systems in urban areas is common.

This aspect of our local market means that, while tanks can easily be sourced for the holding of water, they tend to be aimed more at rural users who require large tanks to supply all household needs rather than a smaller tank that can be easily and aesthetically incorporated into an urban dwelling/section.

It is also interesting to note that, when restrictions were placed on users in Auckland some years ago, sales of small water tanks and collection systems soared and then dropped off as soon as restrictions were lifted. Some councils are now offering rebates on rainwater tanks installed in urban areas (for example: Waitakere and Rodney), and this, coupled with increased water rates, may be a sufficient incentive

for the installation of tanks in urban areas. The charges for waste water disposal by council is based on a multiplier used against the volume of water consumed (for example Metrowater in Auckland assumes 75% of water consumed is returned to the waste water systems and charges levies accordingly) so therefore a reduction in consumption by using rainwater has a double effect on decreasing rates.

Once collected, rainwater can be used in a variety of ways depending on how sophisticated the system is. It may be as simple as having a raised barrel which uses gravity feed to water the garden, fill the children's swimming pool and buckets for car washing etc. It may be as advanced as a system that supplies all water for bathroom, toilet, laundry and garden, with the town supply only acting as a back up for these areas. Intended use will dictate the required tank size and other fixtures needed such as pumps and piping. Other considerations, particularly when retrofitting a system, is that some water tanks dependent on size may need a resource consent to fit. This is also the case where systems are fitted for dual use of water (house collection and town supply) in areas such as the toilet or laundry. Backflow preventers need to be used to prevent collected water entering the town supply system by backwash and potentially contaminating supply. There are some excellent brochures available on the Waitakere City Council website on collection and use of rainwater. The Sustainable Households Programme (www.sustainablehouseholds.org.nz) also has good information in their "Water Actions – Saving Water at Home" brochure (Sustainable Households Programme 2004).

There are a variety of tanks and collection systems available in New Zealand, and it is easy to access information on them. These range from the very basic system offered by Rain Saver Systems NZ (www.rainsaver.co.nz) which incorporates a gravity based PVC barrel to much more advanced systems offered by the likes of Jacobs Tanks (www.jacobstanks.com). Jacobs do offer a "city tank", 4,500 L tank (cost $2,980 including GST and all permits and installation). Marley (www.marley.co.nz) offer spouting solutions but not tanks. Such companies also offer a variety of related products such as leaf catchers, first flush diverters (devices that divert the initial volume of rainwater when it starts to rain away from the tank, to prevent any build up of pollutants on the roof being washed into the tank), pipe diverters etc. Again, requirements for such equipment will be dictated by the intended end use of the water collected. Where there is no effort made to keep the tank water free of pollutants (for example if the intended use is only gardening) then it is prudent to fix signs to taps indicating that the water is not suitable for drinking (non-potable).

There is more information and a wider variety of tank options available in Australia, driven by the size (and increased urgency) of the market. Good information on tanks can be found on the Ecological Homes website (www.ecologicalhomes.com.au) including a range of underground tanks (they need to be installed on a concrete slab and are non-vehicle bearing, but are well out if the way once installed). They also have a section on slimline space-saving tanks which are attractive, steel tanks designed to fit against the house and blend in or enhance the aesthetics of the property, available in a variety of colours. These are ideal in urban areas where space is limited and for retrofitting where there is not an area specifically designed to accommodate a water tank.

There is also an excellent range of products discussed on the website of BlueScope Water, (www.bluescopewater.com.au). They offer an excellent range of tanks, again including slimline and ultra slimline tanks ideal for the urban environment. They also have a product "Think Tank" which is a complete rain water harvesting system including first flush diverter, tank, mains water back up and pump. It is possible such products could be sourced in New Zealand through NZ Steel.

6.2.5 Grey Water Systems

Grey water systems are designed to recycle water within the household to allow more efficient use of water once it has been drawn from the local supply. It can be defined as waste water that does not contain human waste (as oppose to black water waste which does). There can be a variety of uses from outdoor use (gardening/washing the car) to toilet and laundry use depending on the source of the water. As toilets are a major percentage of domestic water use (20% in the Sustainable Households Programme 2004), then this can be seen as a direct reduction on both water required and waste water produced, if all toilet water is recycled from other household sources. The end use will dictate the types of cleaning products that can be used when producing the grey water (for example if the garden is a proposed end use, this may dictate the types of detergents and soaps used in the kitchen, bathroom and laundry).

One system sourced in New Zealand is the Eco Water Recycling System. Information on this can be found at their web site (www.wastewater-recycling.co.nz) including detailed specifications of the system, the water treatments, and the beneficial effects of the system in reducing water usage (30% in one example) and corresponding benefits in waste water disposal (particularly discussed for septic tank users but equally applicable to the town supply). There is also extensive discussion on treatment of grey water with potential problems (detergents and dirt) and how to deal with these.

Another New Zealand alternative is Watersmart, a system that uses the grey water specifically for gardening by attaching the collection system to an irrigation system. It also offers the option to switch from the irrigation system back to the town waste water disposal system if required. The website (www.watersmart.co.nz) has useful grey water recycling tips The system can be installed in new homes or retrofitted.

An Auckland-based company, Innoflow Technologies Ltd, specialises in waste water management. They offer a wide range of services in this area including designing systems for reusing and recycling water. Case studies on their website (www.innoflow.co.nz) include examples of developing grey water recycling treatment systems for small subdivisions.

Internationally there is a lot of information available on grey water systems and domestic water recycling. There are a number of sites offering systems in Australia, however it seems common for sites to offer systems that are just based on garden use rather the potential for toilet flushing or other household use. Examples are Grey Water Saver (www.greywatersaver.com) and the Water Recycle Group (www.waterrecycle.com.au).

6.3 Gardening Systems

One of the most obvious ways to save water in the garden is to use grey water or rain water on your garden by installing a system as outlined above. Another practical method is to design your garden or areas of your garden to be drought resistant therefore minimising watering requirements.

For areas that do require watering, there are systems available that can reduce water use while achieving good irrigation for the garden. One local supplier Hunkin Garden Products (www.hunkin.co.nz), offers the “Leeaky Hose”, a pipe constructed from old car tyres and recycled plastics, that sweats water through the walls at a controlled rate over long distances at low water flow. It is most effective when buried under ground and works off pressures of 4 psi or below (if your water pressure is

higher, the company also sell in-line taps to deliver reduced pressure). The Leeaky hose claims to cut watering needs by 70% and is suitable for use with grey water. Another device offered by the same company is a Water Timer Auto Shut-Off, which allows you to set and leave the hose and it will shut off at the end of the designated watering period which can range from 3 minutes to 3 hours.

Wellington Irrigation Services Ltd offer a design, supply and installation service for irrigation needs as well as a range of do-it-yourself products. Their website contains a link to software that assists you to design your own irrigation system.

Freeman Irrigation offers automated systems, where sprinklers can have different timers set up over up to 18 zones. They also have rain sensors, which will shut down the automated system when it rains. Another innovation is a Soil Moisture Sensor which measures the soil's actual moisture content and allows the controller to water only when necessary.

If you extend the search just to Australia, there is a vast amount of information on watering products designed to deliver effective results while reducing water consumption.

There are a range of options available for the low budget. Fitting drippers to an old hose, which will slowly release water at a pre-determined rate, is an effective and water efficient way to save water. If the plants requiring water are isolated, even easier is to fit a dripper to a container filled with water and leave it by the plant. The container could be as large as a bucket or as small as a bottle.

Where it is necessary to use a hose, ensure it has a hand operated spray nozzle (in some parts of Australia it is illegal to use a hose without one) to spread the water. There are guidelines available as to how often and how much water is required on a garden. Excellent tips are available on gardening sites such as Bestgardening (www.bestgardening.com) and a number of city and district council web sites. These include information on how to create a garden to minimise or eliminate the need for watering through choice of species and the layout and design. Again good practices can make a huge impact on the volume (if any) of water required.

6.4 Stormwater Source Control

Stormwater run-off can be managed both by the use of technology and by good practices. There can be a number of benefits including remediation of localised run-off issues such as ponding or flooding. It can also benefit users with septic tanks as these often struggle with heavy flow which can result in the tank flooding. The same issues are experienced with local area network infrastructure, where volumes catered for need to cover storm events, and where changes are made to the percentage of impervious area, the volumes of water run-off will alter. New housing will generally result in an increase in impervious area and therefore increased stormwater run-off where grass, scrub or trees are replaced by roofs and concrete or tarseal. There are a number of ways to mitigate the effects of impervious areas around a dwelling, and a number of New Zealand sources of literature on the subject. Examples are Waitakere City Council "Stormwater Solutions for Residential Sites" and New Zealand Water Environment Research Foundation 2004 – "On-Site Stormwater Management Guideline.

One method is already covered under the section on "Rain Harvesting Systems". Any use of storage tanks that prevents rainwater moving directly into the urban storm water drainage system will have a positive influence on total runoff. A second method is the creation of rain gardens. A rain garden is used to attenuate peak flows and

provide stormwater treatment, by the concept of bioretention, a water quality practice in which plants and soils remove contaminants. They are created in low-lying areas, with specific layers of soil, sand and organic mulch which naturally filter the stormwater. During the inter-event dry period, the soil absorbs and stores the rainwater and nourishes the garden's grasses, trees and shrubs (Waitakere City Council, 2004). Methods of construction and suitable vegetation can be found in literature discussed above.

Use of permeable pavement rather then impermeable surfaces such as concrete or asphalt will also improve levels of runoff. Permeable surfacing is defined (Waitakere City Council, 2004) as "a surface that is formed of material that is itself impervious to water but, by virtue of the voids formed through the surface, allows infiltration through the patterns of voids." This is distinct from a porous surface which is defined as "a surface that infiltrates water across the entire surface of the material forming the surface". Use of porous surfaces in place of impervious surfaces, such as grass, sand and gravel, will also be effective at reducing storm water runoff however is not always practical in an urban environment. Permeable surfaces are ideal for high traffic areas on a residential site such as car parking areas, walkways and driveways. Again, methods of effectively constructing such areas can be sourced in literature. Paving materials required are easily sourced in New Zealand.

Other suggested methods are the use of swales or roof gardens. Swales are similar to a shallow drainage ditch but have a dense continuous vegetative cover. Roof gardens can be constructed by covering the roof with a layer of waterproof material, followed by a layer of soil and vegetation. Details and discussion on construction and potential associated issues for both of these methods can be found in the literature cited above.

7. COST BENEFIT OF ADOPTING WATER SAVING TECHNOLOGIES

It is difficult to perform a true cost benefit for adopting water saving products and habits, as any cost associated with the technologies or changes are borne by the individual, but much of the benefit falls to local government and therefore community. Although in most parts of the country, for most of the year, there would appear to be a plentiful supply of water, the limits which do exist are the ability of the infrastructure to meet future demands, particularly peak demand which may stretch to 1.45 times average demand. The current estimated capacity of the total local authority water supply is 668 million m^3 compared with water demand of 380 million m^3. Capacity utilisation ranges across the country from 22% to 92% with an average of 56%. The projected demand for 2021 is expected to be 457 million m^3, an average of 20% increase across the country. (Covec Limited 2004). In some areas augmentation to infrastructure is required to meet forecasted demand, involving major capital outlay from the supplying network. Reduction of total water consumption can delay this requirement, which result in savings to the local bodies concerned.

A reduction in wastewater, which is costly to treat and manage, will also result in direct savings to the Local Authorities, and thereby to the community. These potential savings are not necessarily represented directly by the cost of water / waste water to the domestic user. In 2004, only seven Local Network Operators were charging variable rates for water consumption. Of those, only two were charging an additional levy for waste water (calculated as a percentage of water used). In other areas, the cost of providing and removing household water is built in to property rates. Cost savings from water demand reductions have been estimated in the Water Efficiency Labelling for New Zealand: Cost Benefit Analysis prepared by Covec (Covec Limited

2004), which include discounted benefits from delays in implementing infrastructure, and the added benefit of reduced waste water, however these do not apply directly to the domestic consumer. In the case of appliances that use hot water, there will be direct energy savings to the consumer.

The cost of using more water-efficient appliances is also difficult to ascertain, as water efficiency is one desirable feature of a number (energy efficiency, performance, wash options, dimensions, aesthetics to name a few) that impact on a consumer's decision to purchase. Given that the availability and level of each feature differs with every make and model and the desirability of a given feature will vary with consumers, it is virtually impossible to isolate the cost of including water efficiency as a desirable feature when purchasing a new appliance. Based on Consumers' Institute assessments of appliances (washing machines and dishwashers) (Wilson.H. August 2005, Wilson.H. Jan/Feb 2006, Wilson.H. September 2005), the most water-efficient are not necessarily the most expensive, and in some instances represented some of the cheaper models available. Although this is only a sample of machines available, and may represent the lower end of the market, it does indicate that water-efficient appliances are cost competitive in this range. There are also a number of water saving devices and practices that cost little or nothing to implement.

8. SUMMARY AND CONCLUSIONS

There is a wealth of information about water-efficient technology and practices available to the public, should they choose to look for it. Access to the internet makes the search relatively easy, but a visit to most local bodies will result in obtaining published information on water efficient types of domestic appliances and consumer actions that can be altered to reduce water consumption. The quantity and content will vary with region, but via the internet, there are excellent publications.

Over the publications viewed, similar information was found in most, however some were more extensive and detailed then others (the best information found was either from the Sustainable Households Programme or the Waitakere City Council). Neither of these places are likely to be the first port of call for consumers from other areas, but again should become available through a routine internet search. Many of the changes suggested were low or no cost, and easily adopted by the average householder. The information in all cases was well laid out, and very easy to follow.

While such publications gave general information regarding available technologies, and indications of the most efficient types of technology, they all refrained from specifics regarding brands and sources. This meant that additional searching, either via the internet, telephone or appliance and plumbing shops was required to actually source the required technology. In Australia there are examples of websites where businesses specialising in water efficient technologies can list products and services (for example www.greenplumbers.com.au) however there did not appear to be the same type of centralised information base in New Zealand.

For all technologies looked at, there were options available in New Zealand for the consumer, although in some instances such as the installation of a grey water system, the options are limited. Looking across the Tasman, there is both more information and more technology as a reflection of the greater demand for a reduction in water consumption.

The introduction of water efficiency labelling on a number of appliances also helps act as a guide for the consumer, with very little active input required to ascertain how appliances compare when making a purchase. If such labelling becomes mandatory,

it will make this process easier however it still requires the consumer to consider this a desirable feature in their appliances, so there is a need for public education and awareness.

An estimate of average household water consumption (Sustainable Households Programme 2004) showed that the garden and toilet together comprise over 45% of total water consumed, these are the obvious areas where a major impact can be made on consumption, and they are also the areas where a number of very cheap or free technologies or actions can be implemented to make a difference. Although the serious water saver can invest in options which add additional cost to a traditional home (grey water or rainwater systems for example) for many of the other technologies (washing machines, dishwashers, toilets, shower heads) the purchasing cost difference is negligible (unless the product is being purchased to replace an existing product specifically to reduce water consumption. In this instance, there are low / no cost options to reduce consumption of old technologies such as flow restrictors for shower heads, and ways to reduce the volume of old cisterns).

As the information and the technology is available, public interest, awareness of the issue, and buy-in to take action to reduce water consumption is needed. As in many areas, there are currently no direct dollar savings in reducing household water use, this may be a hard message to convey. In line with this, a repository that brings together both information on available products, information on new technologies and information on changes to actions and lifestyles that result in reductions in consumption would make the information gathering process easier and therefore more likely to be followed. The current information and technologies available is sufficient to make a huge difference in water consumption even with only a limited uptake. The difficulty will be changing the culture and mind set of a country that believes it has unlimited free water.

There is work being done in the area of water use, efficiencies, waste water production and storm water by a number of organisations including regional, district and city councils, local network operators and government organisations. Examples are the Parliamentary Commissioner for the Environment, Ministry for the Environment, The New Zealand Water Environment Research Foundation and the Sustainable Households Programme. In promoting change in the way New Zealanders view and use water, a collective drive from all interested agencies is likely to give the most effective results. It will be important to investigate all areas where work is being done to prevent duplication and to concentrate effort and resources. Therefore the next step should be to assess the work being done both regionally and nationally and by both the public and private sectors to raise public awareness of water efficiencies. It would also be useful to investigate how public awareness has been raised in other countries aimed at reducing water consumption. The New Zealand example may differ from many areas in that this country does not have a shortage of water in many areas, so the public needs to become aware of the cost of providing potable water to households and treating waste water, and the environmental and community costs to providing such services, and the distinction between this and an actual shortage of water.

The second step would be to determine the best method to raise public awareness on the issue of water use, and to encourage consumers to use some of the practices and technologies available to provide results in reducing consumption. At this point, assessments of existing products could assist consumers in making more water efficient choices. While there is information available on appliances, easily accessible information on the efficiencies of bathroom and toilet products including toilets, taps and showerheads would be beneficial. This work could be done by the Consumers'

Institute however this such work and the terms and conditions would need to be discussed with that organisation.

9. REFERENCES

Covec Limited 2004. Water Efficiency Labelling for New Zealand: Cost Benefit Analysis. Prepared for Ministry for the Environment

Enviro Solutions NZ Ltd 2001. Public Attitudes and Action towards Environmental Issues – A National Survey. Survey commissioned by Sustainable Management Fund No. 7063

Ministry for the Environment 2004. Fresh Water for a Sustainable Future – Issues and Options

Ministry for the Environment June 2003. Sustainable Wastewater Management: A Handbook for Smaller Communities.

North Shore City Council, 2006. Sustainable Living – Water Info. www.nscc.govt.nz

North Shore City Council, 2006. Sustainable Living – Water Actions. www.nscc.govt.nz

Standards Australia. www.standards.com.au

Standards New Zealand, 2005, AS/NZS 6400:2005

Sustainable Households Programme 5th August 2004 Edition. Document SH4_Water2_Actions.doc www.sustainablehouseholds.org.nz

Waitakere City Council, 2006. Gardening with Water. www.waitakere.govt.nz

Waitakere City Council, 2006. Saving Water. www.waitakere.govt.nz

Waitakere City Council, 2006. Wastewater. www.waitakere.govt.nz

Waitakere City Council, 2006. Using Rainwater. www.waitakere.govt.nz

Water care Services Limited. Watercare Asset Management Plan 2006/07

Wilson.H. August 2005. Small & Thirsty. Test: Compact Dishwashers. Consumer Institute Magazine. Issue 450. Page 34 - 35

Wilson.H. Jan/Feb 2006. Clean or Green? Test: Dishwashers. Consumer Institute Magazine. Issue 455. Page 27 - 29

Wilson.H. September 2005. How Big is your Wash? Test: Washing Machines. Consumer Institute Magazine. Issue 451. Page 36 - 39