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Best practice water efficiency policy and regulations

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About This Report

Title

Best Practice Water Efficiency Policy and Regulation

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Abstract

This report is an in-depth investigation into demand management practices in New Zealand and overseas and the regulation and other policy approaches that impact on the degree of success of their uptake.

The need for a new water supply is the key driver for councils to consider demand management. What this study clearly shows is that the technologies required to reduce water use are readily available. It is the quantity and quality of our water conservation policy and regulations that is lagging behind and that need further development if they are to better support the adoption of such technologies.

Reference

Lawton, M. et al. 2008 Best Practice Water Efficiency Policy and Regulation. Report 7060/3 for Beacon Pathway Limited.

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1 Executive Summary

This report documents the findings of the second stage of research within Beacon's overall water research strategy. The overall purpose of the project is to identify best practice intervention potential for water management to reduce demand for centralised reticulated water by 40% for all homes.

The first stage identified key policy intervention points to mandate for the use of urban water tanks for non-potable uses in new homes.[1] This research focuses on policy and regulatory instruments used, both throughout New Zealand and internationally, to identify successful policy approaches to urban water conservation. The report aims to assist local governments involved in water supply to assess their needs for demand management and determine what demand management strategy best suits their situations. It also considers how a greater national focus on water management could assist at the local level.

The research has identified that many councils throughout the country are implementing a variety of water conservation programmes, from voluntary approaches such as education, to economic instruments such as charging for both water and wastewater, and mandating rain water tanks for non-potable supply. The most significant driver identified by councils is the need to establish a new water supply, while the greatest obstacle is the perception that water resources are free and plentiful.

What emerges from this and other overseas studies is that there is a pathway that can be followed to make water demand management a successful alternative to providing a new supply source, a pathway with options that take account of local context and which are more appropriate for the 21st century in an environment that is increasingly water constrained. The pathway includes education and awareness raising as basic requirements but requires other forms of policy including supportive regulation to be effective. Studies show that there can be some price elasticity in the water supply business, despite the relatively low price of reticulated water compared with other commodities. However the response to price is fickle, unless the signal is clear and compelling, such as with well structured block charging with disincentives for higher water use.

Some general conclusions that can be drawn from the research are:

- Fixing leaks is a given and unless the leakage rate is of an acceptable level, there can be little credibility in asking consumers to moderate their water use habits.
- Education alone has not proved effective in getting significant on-going behaviour change in demand management.
- Where resource conservation is required and in the absence of strong market mechanisms, regulations will be required to gain uptake of technologies which provide for water efficiency, i.e. from requiring low-flow showerheads to using rainwater as a supplementary

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1 Lawton M., Birchfield D. and Kettle, D. (2007). Making policy and regulation rain tanks friendly. Report PR 205 for Beacon Pathway Limited

supply. Regulation also gives more certainty in that market and can lead to volume based price reductions.

- Regulation by itself to include water efficient technologies could result in perverse behaviour, with homeowners being more profligate with water by for example, taking longer showers.
- A suite of policy instruments is required including pricing which sends a financial signal to conserve, regulation to gain uptake of new technologies and education which provides the rationale for conservation and the understanding of its financial and wider benefits.

The United Kingdom experience suggests that policy and regulation should be addressed at both the national and local levels. New Zealand is a small country and there are efficiency gains to be made through a national approach to some key issues. Beacon's research "National Value Case for Sustainable Housing Innovations"[2] demonstrates that there is a national economic advantage for investment in some interventions which have private benefits.

The conclusions reached by this research have identified the following recommendations for national and local interventions which will assist in achieving effective water demand management.

National interventions for consideration include:

- Developing a national agency along the lines of EECA which develops and overviews water strategy and influences legislation and implementation of national policy such as the National Water Initiative in Australia.
- Clarifying and amending if required, any potential conflicts between legislation which inhibits an appropriate level of resource use efficiency and/or,
- Creating a Water Services Act which recognises the value of water to New Zealanders' wellbeing and assists local government to easily adopt the water conservation methods appropriate for their particular context.
- Ensuring that appropriate demand management interventions are advocated for and feature strongly in the National Policy Statement for water that is currently under development.
- Considering how a domestic water supply might be configured to minimise water and energy use and plan for its roll-out over a suitable period, 10–25 years and even beyond.
- Setting national targets for leak reductions, ensuring pricing structures send clear signals on the value of water that are fair and equitable.
- Requiring water metering through national legislation.
- Setting a water use efficiency performance standard similar to that being introduced in the United Kingdom of 125 litres per person per day (pp/pd) for all new homes.
- Setting water efficiency performance levels for showerheads and toilets.
- Clarifying health issues and requirements around greywater recycling to enable it to be encouraged through the building consent process for new homes.

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2 ***National Value Case for Sustainable Housing Innovations. Beacon Pathway, October 2007***

- Requiring homes to achieve a health standard for water supply and wastewater management but without specifying how they achieve it. Give people the opportunity to utilise water other than mains water if they can access a suitable alternative.

Recommendations at the local scale include:

- Introducing water metering (if not required through national legislation).
- Setting pricing policies that send signals for water efficiency and use volumetric pricing for both water supply and wastewater.
- Ensuring that demand management is assessed as an alternative in considering additional water supply and that a comprehensive, comparative cost/benefit analysis is carried out.
- Having well targeted educational and incentive schemes for water efficiency and remove any barriers for water efficiency in current policies and procedures.
- Setting regulatory requirements for new homes and encouraging retrofit activities through other policy initiatives. With new homes being water efficient and consumers paying on a volumetric basis, eventually the market will favour increased water use efficiency and there will be an incentive for existing homes to be retrofitted to meet market requirements.

As outreach to this research Beacon will partner with councils with a water supply function and assist in developing a demand management strategy for their constituencies. It will also develop a decision making framework that any water manager could apply, taking into account their specific situation. Beacon will also use the information gathered to inform policy and plan revisions as they take place throughout New Zealand over the next couple of years to positively influence the uptake of demand management to make our water resources go further.

2 Introduction

Water plays such an essential and integral role in every day life on Earth that the true value of its services is often forgotten, as are the consequences of what would happen if we no longer had access to it. At the same time, this life-giving and essential resource is coming under increasing pressure the world over from both anthropogenic and natural processes, in particular increased urbanisation and consumption, industry, agriculture, and the uncertainties of climate change. These factors combined are threatening the availability and quality of the world's waters, a situation which requires urgent attention internationally.

It is frequently not until a country starts to run short of water that there is consideration about how to better conserve and protect such a precious resource. At this point it is often difficult to achieve change and it can be at great expense, as New Zealand's neighbours across the Tasman are discovering. It is imperative that New Zealand, with its present level of access to fresh, relatively high quality water, doesn't miss an opportunity to effect a paradigm change with respect to urban water management, and step up its efforts to better value, conserve and protect its water resources.

Indeed as New Zealand comes to terms with predicted climate variations and how to reduce its carbon footprint, it would also be prudent not to forget other environmental and natural resource constraints. Water is a key asset upon which the country's entire economy depends. To date there has been considerable interest in rural water allocation and water quality issues, particularly in Canterbury where there are many competing interests on water resources. In the North Island many of the freshwater lakes provide a sober reminder that nature can withstand a certain degree of pressure but once a threshold has been reached, the consequent degradation in water quality is very difficult to reverse.

In contrast with rural concerns, water issues in cities are often less widely discussed in the public arena although water pricing makes the headlines on occasion. Access to good quality, plentiful water through a reticulated network is taken as a given by the majority of the 80% of New Zealanders who live in cities or towns. Ministry of Health guidelines indicate that about 5 litres/per person/per day (l/pp/pd) need to be biologically and chemically safe[3] **yet all of our household reticulated water supply is cleaned to a potable standard which meets that level.** In effect, this means that New Zealanders flush their toilets and water their gardens with high quality drinking water. A key tenet of demand management is that whatever water is used should be fit for purpose.

Because of a lack of universal metering it is not possible to be absolutely sure what New Zealand's average daily domestic water use is. Previous studies have indicated that the figure

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3 Ministry of Health (updated 2006) Household Water Supplies. The Selection, Operation and Maintenance of Individual Household Water Supplies

lies between 180–300l/pp/pd[4]. Given that our present water use levels have been achieved with minimal regulation it shouldn't be too difficult to achieve a significant lift in our household water efficiency. To date, policy has mainly depended on education and has not included a wide uptake of water efficient devices and appliances. Using a range of the many approaches detailed in this report, New Zealand could easily reduce its domestic water use and at the same time achieve a significant reduction in its related energy use and greenhouse gas emissions.

2.1 Why we need water use efficiency & demand management

The principle drivers for water use efficiency and demand management include:

Cost savings

- Saving on capital costs through delaying or eliminating infrastructure development.
- Achieving cost savings in wastewater management through reducing the water that goes through the system.
- Saving costs associated with energy through reducing in-house hot water use.
- Saving costs associated with energy and maintenance in both the treatment of water to a potable standard and its reticulation.
- Saving energy and maintenance costs in the reticulation and treatment of wastewater.
- Delivering customer benefits from lower water and power costs.

Building resilience

- Reducing competing demands for water in parts of the country where water resources are constrained.
- Reducing the need for further large water supply systems which cause changes to the water cycle and do not operate in harmony with natural water cycles and water catchments. In the long term such systems are inherently unsustainable, being designed at a time when both the human population and economy were considerably smaller and less resource intensive than the present day.
- Anticipating potential climate related changes and resulting water cycle disturbances and the need to improve the resilience of our supply system to cope with greater variability in climate patterns.[5]
- Reducing the contribution of leaks and spills from wastewater on declining water quality in New Zealand.
- Recognising that some water sources are not renewable in the short term; for example groundwater is generally non-renewable for practical purposes.[6]
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4 Parliamentary Commissioner for the Environment. 2001. "Beyond Ageing Pipes—Urban Water

5 IPCC. Climate Change 2001: Impacts, Adaptability and Vulnerability. McCarthy, O.F., et al. Geneva, Switzerland.

6 Rogers, P., 1985. Fresh Water in: The Global Possible Resources, Development and the New Century. (R. Repetto Ed.) New Haven, Yale University Press.

Social considerations

- Ensuring customers' expectations that alternatives to major capital works have been investigated when a major new water supply source has been signalled as required.
- Being a good global citizen. Worldwide demand for water is doubling every 21 years—developed countries in particular have a social and ethical obligation to reduce the amount of water their societies use (and waste) in the same way that emissions reductions are now actively being sought to limit the effects of climate change.
- Adhering to the principles of the Local Government Act—thinking sustainably across the four pillars of wellbeing—cultural, environmental, social and economic, is now a legislative requirement.

Against those reasons to have demand management there are some perceived drawbacks which include:

- The potential need for water managers to modify their financial forecasts, rates and/or rate structures.
- A lack of expertise in some utilities on how to implement water conservation programmes.
- The requirement for a billing and water use monitoring system which supports use data and analysis.
- Amendments to regulations that can be time-consuming and costly to achieve.
- New policy initiatives which will incur increased costs, although these generally stack up financially if weighed against the need for a future new water supply.
- The work involved in challenging Business as Usual.

Many New Zealanders have a perception that water is an abundant resource. While from a historical and localised perspective this has to some extent been the case, the trend both nationally and internationally is towards significantly higher levels of scarcity for water resources. This in turn will make New Zealand's water resources increasingly valuable in the not to distant future, potentially providing a significant economic advantage for the country compared with our major trading partners. However, such an advantage is unlikely to manifest itself if the present types of management and supply systems remain in place.

Underlying the lack of imperative to change is that piped water supplies have been available in parts of New Zealand since as early as the 1860s while centralised wastewater treatment was first established a couple of decades later. As such, New Zealand towns have not had to concern themselves with conserving supply and, as a result, the emphasis of much water policy in the country has been focused on rural water quality and water allocation issues. Since the mid-1990s there has been an emphasis on improving the quality of urban drinking water and the adoption of drinking water standards but consideration of how to reduce consumption overall has still not featured strongly on the radar.

More recently, however, the Ministry for the Environment (MfE) noted that demands on freshwater in some regions for farming, hydroelectricity, industry, recreation and tourism are

increasing and in many cases are exceeding water availability beyond a sustainable level (MfE, 2006a[7]). At the same time the quality of our water supply is declining (MfE 2006b).[8]

The apparent availability of fresh water sources in groundwater, rivers and lakes masks the actual availability of water, especially as many sources are not readily available for use or abstraction. In most cases tapping new sources requires piping the water across significant distances and at the risk of significantly impacting the overall ecology of the waterways being used. In many New Zealand communities including most of our major towns, most easily accessible water supplies are over-allocated. Debate about the way our water supply is being managed is starting to take a more prominent place at the policy table, with acknowledgment from MfE that "we have until now possibly taken our abundance of freshwater for granted".[9]

Indeed the domestic and industrial water sectors in New Zealand are predominantly in growth mode across most regions, driven by an expanding population base and a growing production sector. The latest OECD Environmental Performance Review of New Zealand notes that the country's GDP has grown by 30% since 1996 while the total population has increased by 9%.[10]

The Ministry for Economic Development predicts that the trend out to 2021 is to see 10 of New Zealand's 16 defined regions experiencing significant population growth.[11] Nowhere is this more apparent than in the Auckland region which is forecast to increase in population size by an estimated 36% by 2021 against 2004 population figures. Other significant growth areas include the Bay of Plenty (25%), Tasman (19%), Nelson (17%), and the Waikato and Canterbury (11%). Nationally water allocations increased overall by 50% between 1999 and 2006 but for Canterbury the rate of increase was 92%.[12]

The effect of this growth on water supply and quality is being felt in a range of ways with the intensity of water, fertilizer, and pesticide use increasing substantially over the same time period. To counter some of these environmental effects two of three key recommendations from the OECD review highlight the need to:

- Strengthen national policy guidance, in the form of policy statements and national environmental standards in the interest of promoting a level national playing field and improving regulatory efficiency.

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7 Ministry for the Environment. 2006a. "Freshwater for the Future" (information sheet). Available www.mfe.govt.nz. Accessed May 2006.

8 Ministry for the Environment. 2006b. "Gentle Footsteps, Boots n All". Wellington, Ministry for the Environment.

9 MfE. 2006. "Freshwater for the Future". MfE Sustainable Development New Zealand Programme of Action.

10 OECD. 2007. Environmental Performance Review of New Zealand. OECD, Paris, 2007.

11 MED Future Trends in Water Use accessed: 30 October 2007 http://www.med.govt.nz/templates/MultipageDocumentPage____12538.aspx

12 MfE. 2006. "Snapshot of Water Allocation in New Zealand". Ministry for the Environment, Wellington.

- Further integrate environmental concerns into economic and sectoral decisions, particularly by using economic instruments to internalise environmental costs of economic activities.

The OECD review specifically addresses freshwater and wastewater issues and calls for the acceleration of national environmental standards for freshwater and national policy statements on coastal waters and freshwater. The review also recommends a shift toward volumetric user charges for fresh and wastewater services, noting that it is a key opportunity to utilise economic incentives for resource conservation and efficiency. The review notes that at present incentives to conserve water for both farmers and householders are "weak" and that this is largely because use is not linked to volume abstracted or consumed.

For cities expecting high growth, the outlook without a significant increase in water use efficiency over the next 50+ years will mean the need to increase supply. In Auckland that means a new supply in 2026 and further requirements in 2043 and 2062.[13] The effect of this is a growing dependence on other water catchments and regions to ensure security of supply for New Zealand's largest city and will mean the need to treat and pump ever greater quantities of water from the Waikato River into the city's water supply. In Auckland, 62% of the water supply is allocated for domestic use highlighting the significant opportunities for a demand management approach at the household level.

New Zealand is not without regulatory and other mechanisms that it could call on to change the paradigm for water management in the country; Section 5 of this report details some of these. At the same time the Parliamentary Commissioner for the Environment (PCE) also notes four key areas of challenge that need to be addressed[14]. These include:

- The fragmented nature of water systems management and the lack of a clear central government "home" for water policy and related legislation for managing the resource.
- The lack of stakeholder awareness and understanding of urban water systems and involvement in their management. The PCE notes there is no dedicated body such as EECA addressing water conservation issues. Could EECA's role be expanded to include water conservation?
- The community and political tensions surrounding the way we currently construct our water businesses: who owns, who manages and how water is valued and priced.
- The lack of appreciation for an integrated "three waters" (water supply, wastewater and stormwater) approach in New Zealand managed according to ecosystem principles.

Clearly these areas of water management are diverse and all encompassing. However, much of the expertise and knowledge is already available within the country. As this report shows, there

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13 Watercare Services Limited. 2006. "Watercare Asset Management Plan, 2008–2027". WSL, Auckland.

14 Parliamentary Commissioner for the Environment. 2001. "Beyond Ageing Pipes – Urban Water Systems for the 21st Century". Parliamentary Commissioner for the Environment, Wellington

are plenty of international examples that can be drawn on to assist the transition. That said, it is the lack of political and institutional recognition of the importance of the need for change that is often constraining innovation. Findings from a recent study into Asian water management strategies from the Asian Development Bank could just as easily be applied here. The report concludes "…commitment and leadership need to be further developed among senior managers and officials. Finding champions who recognise the importance of implementing water management reforms and having the vision and courage to promote them may be the greatest challenge of all".[15]

The PCE also notes that rising demand, higher drinking water standards and stricter discharge conditions are requiring more investment in water systems.[16] At the same time growing household resistance to rates increases is putting local government under pressure to reduce expenditure. Real rate increases of 38% (over the rate of inflation) in the period between 1993/94 and 2006/07 and further projected annual increases of 8% projected for the next few years highlight the funding pressure local government is coming under.[17]

The recent Local Government Rates Inquiry sponsored by the Department of Internal Affairs concludes that local government needs to show more restraint in its expenditure, while improving their planning functions that in turn drive these expenditures. The Inquiry Panel states that in particular "…[councils need] to give more rigorous consideration to the desirability and prioritisation of expenditures, including consideration of deferral or pushing out of expenditures to later years".[18]

The Rates Inquiry Report finds that management of the three water services is 29% of total council expenditure. Investing in improved water efficiency is quite possibly the most promising area for councils to realise real monetary savings for their constituencies and yet to date, few councils have given serious consideration to more than minor changes about the way those services are delivered. There does not appear to have been a good appraisal by many councils on whether there is a better way.

A critical factor in addressing these trends and delivering more sustainable water supply options lies in the implementation of well thought out and managed water conservation programmes. Indeed Turner and White (2006) assert that demand management programmes are "amongst the

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15 ***http://www.maximsnews.com/107mnunnovember28waterasiandevelopmentbankavoidcrisis.htm. Accessed 9 May 2008.***

16 ***PCE. 2001. Ibid***

17 ***Local Government Rates Inquiry Panel. 2007. "Funding Local Government: Executive Summary". Local Government Rates Inquiry, Department of Internal Affairs, Wellington, 2007.***

18 ***Ibid.***

cheapest, least resource intensive, long lasting and beneficial options to society and the environment that can be chosen by any regional water planner."[19]

There is little doubt that there is money to be saved through pursuing a conservation approach. With around 85% of New Zealand's population receiving water, wastewater and stormwater services through local authorities, that infrastructure in 2001 was valued at approximately $7.5 billion with around $600 million spent on operational costs each year. The level of estimated investment required was approximately $5 billion over a 20 year period to upgrade water, wastewater and stormwater infrastructure.[20]

When taking all the above factors together it isn't difficult to see why demand management should become a key component of any strategy to address water supply and scarcity issues.

It is clear that the opportunity currently exists for New Zealand to develop a more resilient and sustainable system for the delivery and use of water resources, but only if we move away from the "business as usual" model. Demand management is the first and easiest step for councils to take into a new paradigm of sustainable urban water management and, as this research suggests, is an approach that can have a demonstrable impact on the bottom line.

Opportunities abound in the transition to a more sustainable urban water management system; yet, as said, institutional inertia and an inability to move beyond water solutions that are well known are still significant barriers. The Parliamentary Commissioner for the Environment's office suggested what the change from current to more sustainable urban systems might involve (Box 1).

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19 ***Turner, A. & White, S. 2006. "Does demand management work over the long term? What are the critical success factors?". Paper written for Sustainable Water in the Urban Environment II Conference, Sippy Downs, Queensland. Aaccessed December 200. Source: http://www.isf.uts.edu.au/publications/pubsbysubj.html#water***

20 ***Parliamentary Commissioner for the Environment. 2001. "Beyond Ageing Pipes – Urban Water Systems for the 21st***

Box 1: Traditional vs sustainable urban water systems

Traditional urban water systems have the following characteristics:

- Meet increasing water demand by building more dams and pipelines
- Provide few incentives to reduce water use
- Utilise large pipe networks and treatment systems to meet increasing wastewater and stormwater loading from urban growth
- Depend on ecosystem services always having spare capacity to absorb stormwater and effluent discharges from pipe and treatment plant systems
- Do not maximise opportunities for water recycling and reuse, and
- Give highest priority to the views and values of designers, builders, owners and operators of pipe network and treatment systems.

Sustainable urban water systems, in ecological, social and economic terms, have the following characteristics:

- Developed and operated in harmony with natural water cycles and water catchments through integrated management and life-cycle approaches
- Aim to increase the efficiency of water use thereby reducing the need for new dams, pipelines, and treatment plants
- Reduce wastewater by decreasing total potable water supply, reusing greywater and recycling biosolids from wastewater treatment plants
- Reduce stormwater through better site design, with reduction in the proportion of impervious surfaces, onsite collection use, and retention of natural streams and waterways
- Sufficient water flows are allocated to natural and modified systems to maintain ecosystem health
- Involve consultation with the whole community of interest including residential users, industry, agencies, tangata whenua, agriculture, and recreational users, and
- Residents are guaranteed access to a minimum supply of potable water to maintain basic human health.

Reference: "Beyond Ageing Pipes" Parliamentary Commissioner for the Environment, 2001

3 Scope of the report

This project contributes to Beacon's overall water research strategy. The underlying premise of Beacon's water research is that the increasing cost and decreasing availability of water supply will require a more efficient and conservation-oriented supply and management approach, as a critical component of achieving household sustainability.

In accordance with Beacon's goal of achieving a high standard of sustainability in 90% of New Zealand homes by 2012, the organisation has created the following water demand target:

> *"90% of homes reduce water demand for reticulated water by 40% per capita and Council supply to domestic uses is reduced by 50% per capita by 2012; and use of water within dwellings is appropriate for the quality and use."*

Of the various facets of the water supply industry identified in the water research strategy, the role of local government is pivotal in not just supplying water but setting the policy and regulations which determine how the water is supplied. Local government and the relationship between demand management approaches and interventions and the required policy setting to encourage demand management is therefore the main subject of this report. It also comments on an enhanced role for national government where in the promotion of demand management.

The focus of this report is to:

- Consider water conservation and intervention strategies that have had strong interest and uptake overseas and in New Zealand, and consider the policy mechanisms by which that uptake was achieved.
- Identify policy and regulation to best support the above strategies.
- Identify transition pathways that will best promote the uptake of sustainable water supply models that are more appropriate for the 21st century.

Policy in the context of this report refers to a wide range of policy tools, from education to regulation and market-based approaches.

Complementary components of this project will involve the following:

- Partner with councils to implement identified policy and regulation to support greater water use efficiency.
- Establish what best practice demand management would be for a variety of council contexts to develop a decision support framework to assist them.
- Submit amendments to national and local policy which supports demand management.

3.1 Method

After surveying New Zealand's territorial authorities and their respective water supply organisations, using the survey outlined in Appendix 5, four quite different water supply authorities were selected to provide a more in-depth appraisal of their regulatory and policy approaches to water demand management and water use efficiency.

The study also scanned the international situation; in particular the United Kingdom, United States, Canada and Australia, for their water demand management approaches and the degree to which New Zealand can learn from their successes or failures. It also outlines the various types of water demand management techniques available and comments on some national and local initiatives that could be applied more generally in New Zealand.

3.2 Related research

The research builds off the base of previous investigations. Beacon and its collaborators have produced a number of reports which provide a good basis from which to extend the research and examine the detail of how we promote a range of water conservation technologies and ensure barriers to their uptake are removed. Initial investigations are shown below in Table 1.

Project Report	Focus
TE 160 (2006) *Water Efficiencies Report on existing technologies/expertise in New Zealand.* Sarah Heine	Considers the breadth and scope of demand management water conservation/retrofit initiatives taking place within and across New Zealand
TE106B (2007) *Demand management through water retrofit programmes.* Damon Birchfield	Investigating the scope of water demand management being undertaken by local and central government in New Zealand to reduce domestic water consumption through the use of water retrofitting programmes
PR201 (2007) *Local Council Sustainable Building Barriers and Incentives—Further Case Studies.* Chloe Trenouth and David Mead.	A review of three territorial authorities—Christchurch City Council, Kapiti District Council and Hamilton City Council. Considers the barriers to implementing sustainable residential development created by residential and subdivision requirements within district plans and codes of practice
SH4705 (2007) *Best practice water efficiency policy and regulations.* Maggie Lawton, Damon Birchfield, David Kettle and Chloe Trenouth.	This study provides an in-depth consideration of the policy and regulations that are applied in New Zealand and elsewhere to promote water conservation and water use efficiency through demand management. It surveys all New Zealand Councils, provides four national case studies, and an international literature review covering the United Kingdom, the United States, Canada and Australia
PR 240 (2007) *National Value Case,* Allen & Clarke Policy and Regulatory Specialists, Infometrics, Eco$ense, Martin Jenkins, Beacon Pathway	Provides the value case for transforming a significant proportion of the New Zealand housing stock to a high standard of sustainability with beneficial social, health, environmental and economic outcomes
BRANZ Study Report No. 159 (2007) *Water End Use and Efficiency Project [WEEP] – final report.* Matthias Heinrich.	Report summarises the findings from eight months of water end use monitoring, conducted in a sample of residential homes on the Kapiti Coast, and the findings from the initial pilot and testing phase
PR 205. (2007) *Making policy and regulation rain tanks friendly*. Maggie Lawton, Damon Birchfield and David Kettle.	Investigates the legal and policy pathways for mandating the inclusion of rain tanks for water conservation in new homes in the Auckland Region. Recommends steps that would be most effective in making policy and regulation rain tank friendly.

Table 1 Previous related Beacon research

3.3 Research focus

The hypothesis for this research is that "barriers to water use efficiency can be overcome by well designed policy and regulatory approaches, specific to end-user requirements." To test the hypothesis, policy and regulation relating to demand management approaches both in New Zealand and overseas were investigated for their effectiveness.

The first part of the research had a New Zealand focus with the following components:

- A nationwide survey of territorial authorities to establish the extent of water conservation programmes across the country and the key drivers for those programmes.
- Four case studies through in-depth interviews, written and web based information resources of New Zealand councils that have demonstrated results attributable to demand management approaches.

The research also briefly reviewed the current state of water supply management in New Zealand including consideration of different types of management models, legislation including the 2007 Building Code review, health issues and recommendations.

The second part of the research consisted of a literature review of demand management approaches being used overseas. It included a systematic review of the international literature which led to a number of case studies included in this report. The review focused on water conservation technologies and the policy and regulatory instruments used in homes and/or neighbourhoods to save water.

The aim of the literature review was to investigate and identify demand management approaches that were having acceptance and success with consideration of:

- the aggregate water savings achieved
- the per capita water savings achieved
- the spread of take-up of demand management
- the rapidity of take-up of demand management
- the ease of implementation of demand management
- the ease of administration of demand management

Demand management initiatives from the United Kingdom, United States, Canada and Australia were considered, because of their similarity with New Zealand in terms of standard of living and hence infrastructure availability expectations. Clearly they had other drivers as well which were not necessarily the same as in New Zealand such as more intense climate and population pressures. In some instances those additional drivers shed light on developing issues for New Zealand as our own climate shifts and population increases substantially in some areas.

3.4 Outreach and dissemination

To assist with uptake of the information in this report part of Beacon's outreach will be through a small number of council workshops. The workshops will contribute to demand management strategies and also help inform the overarching research goal of developing a decision making framework that councils in New Zealand can use to help kick-start and guide the most appropriate demand management pathway for their own specific situation.

A critical outcome of this process is that councils responsible for water infrastructure would be able to defer and delay the need for new or additional water supply sources, hence reducing the cost of putting new infrastructure in place and associated ecological impacts.

Beacon will also use the information gathered to inform policy and plan revisions as they take place throughout New Zealand over the next couple of years to positively influence the uptake of demand management to make our water resource go further.

3.5 Auxiliary information

During the course of the research a vast amount of information was collected, much of which has been summarised in this report. More detailed information, either on research publications or methods of implementation, is presented in Appendices 1–4 and the authors of this report strongly encourage readers to also read and make use of these informative resources.

4 Demand management interventions

Demand management and supplementary supply are included in a wider range of approaches to water use efficiency which are summarised in a paper by White and Fane, 2001, (see Box 2 below).[21]

Box 2: Water Use Efficiency Approaches

Increase system efficiency No change in resource usage by consumers but less system losses. Examples: leakage detection and repair; change in system operations such as pressure reduction and changes to mains flushing and reservoir cleaning; installing peak balancing capacity.

Increase end use efficiency Less resource used by the consumer to provide the same service. Examples: Regulating for AAA rated shower heads and dual flush toilets in new developments; enforce minimum performance standards on new appliances (dishwashing machines, clothes washing machines); offering financial incentives for water efficient purchase and installation; programmes to retrofit efficient equipment into existing buildings.

Promote distributed sources of supply Provide services via a locally sourced resource not currently being used. Examples: encouraging household rainwater tanks and greywater reuse systems; provide recycled effluent for non-potable uses via dual reticulation.

Substitute resource use Provide same service without use of the resource in question. For example planting indigenous plants adapted to local rainfall or use of waterless sanitation.

Improve the market in resource usage Inform the consumer about the full costs of their resource use. Examples: full cost recovery charges for water use; volume-based pricing set at or above the long run marginal cost; providing better feedback on the level and cost of ongoing water usage by universal metering with at least quarterly billing or smart metering with instant feedback; remove perverse incentive for increased resource use such as declining block tariffs; provide comprehensive information on the environmental impacts of water use, run education campaigns; conduct detailed water use analysis (audits) for water customers in key sectors.

Reference: "Designing Cost Effective Water Demand Management Programs in Australia", by White, S.B. and Fane, S.A.,2001

Of the above approaches demand management tends to concentrate on end-use options. Local contexts such as demographics, climate and political environment will have a bearing on the particular demand management interventions that are best adopted. The regulatory and policy framework, current and potential, will also have a significant bearing on what is implemented.

21 ***White, S.B., and Fane, S.A., 2001. Designing Cost Effective Water Demand Management Programs in Australia.***

An understanding of consumer preferences and the potential degree of market penetration that any intervention can achieve should also be tested prior to any significant financial investment.

Having said that there is usually some low hanging fruit, for example an improvement in unnecessary leakage will show an immediate reduction in water consumption. Residual leakage will be harder to reduce. Other approaches such as improved technology may result in reduced water consumption although there is a slight risk that the better the technology, the more water people will use, showing "perverse" behaviour which neutralises the water efficiency gains. This might occur for example when people decide to take longer showers because they know they are using a water efficient showerhead.

Some interventions rely more significantly on behavioural change or possibly financial investment from the householder. Certainly it isn't a case of one size fits all, the type or combination of interventions are situation specific, even within a small country like New Zealand. To encourage water conservation there has to be a driver; it might be financial through saving on water rates or bills, or simply due to water shortages and hence restrictions over a dry summer. Drivers may vary throughout the country and will impact on the success of demand management approaches. Finding the best package of interventions to achieve sustained water conservation is the holy grail of many water managers and success has often been elusive.

Demand management measures aim to minimise either the overall or peak demand for water (or energy or other resource). Measures can be categorised as shown below.

Water demand management interventions have been considered under the following key areas:

- maintenance—leakage
- economic tools—pricing, tariffs, incentives/rebates and cost-benefit analyses
- water efficient technology—rainwater tanks, wastewater reuse, appliances and plumbing fixtures
- education, awareness and social marketing—promotional materials and education programmes
- regulations
- synergies between combinations of approaches.

4.1 Maintenance

Identifying unaccounted for water and minimising leaks is integral to water conservation. A study by Makropoulos and Butler (2004) [22] has leakage reduction as the most important and financially viable method of water demand management. Domestic water consumers are not likely to take their own demand management seriously if water is unnecessarily wasted by their water suppliers. Pipe leakage is not only a waste of potable water but it can have a high nuisance value as well and can be potentially dangerous, where the lost water undermines roads

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22 ***Makropoulos, C.K., and Butler, D., Planning Site Specific Water Demand Management Strategies, The Journal, Volume 18 Number 1, 2004.***

or homes. In addition, chlorinated water in large quantities is not good for aquatic biota if it finds its way into streams.

Key causes of leakage are ground movement, pipe corrosion, soil conditions, or pipes damaged by others such as contractors working underground as well as high and fluctuating water pressure in the supply network. Reducing or moderating mains pressure to achieve the optimal consistent rate of flow is a key aspect of the water supply system that is under the control of water managers and will help minimise unnecessary system leakage. Reducing the leakage rate into single digits is a goal for many water managers and those who achieve that level need to be vigilant to retain it.

Inside the home leaks can occur through worn out washers in taps or a leaky toilet cistern. Fixing these leaks presents some of the simplest, least cost options to achieve greater domestic water efficiency.

4.2 Economic tools

Water is an absolute necessity of life but there is a difference between what is required for reasonable daily requirements and unlimited demand, the gap that demand management is trying to bridge. Despite being available in lakes, rivers, rain and groundwater there is a financial and ecological cost to delivering and treating water for domestic use.

4.2.1 Metering and water charging

Studies have shown that the introduction of water meters results in a reduction of water use.[23,24] In most parts of New Zealand our survey and investigations showed that water is charged for in the general rates and households are often not individually metered. Because of that there is limited ability to measure water use at the household level. In turn, consumers of water by and large don't know how much water they are using or how much it has cost to produce. If a commodity like water appears to cost the same regardless of how much is being used, then there is clearly no incentive to conserve water, either financially or even for conservation's sake.

For water managers, having information on water use at the household scale means that they can better identify losses through leakage, consider consumption patterns and consider charging regimes which promote water conservation. Knowing household consumption patterns and levels of use is a necessary prerequisite to reducing water use. To achieve that, metering is essential, while charging on a per unit basis provides the necessary incentive to ensure consideration of how much water is being used and its associated value. To date in New Zealand there is metering and per unit water charging in some parts of the country, notably the Auckland Councils, Tauranga District Council and Nelson City. Christchurch City meters but doesn't charge on a per unit basis.

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23 BMP Costs & Savings Study. Author: A & N Technical Services, Inc. 2000. A guide to the data and methods for cost-effectiveness analysis of urban water conservation Best Management Practices (BMPs).

24 Inman, D. and Jeffrey, P., 2006. Urban Water Journal, Vol 3, No 4 127–143

Public resistance to paying for water has been an aspect of local body governance for many years and a key strategy for overcoming that requires better informing consumers about the benefits of water conservation. Even when paying the full direct costs of water supply and disposal, the ecosystem costs (which include degradation of the source and receiving environment) as well as the opportunity cost of using the water for other activities, are generally omitted.

4.2.2 Tariffs

Tariffs provide a useful pricing tool to send a conservation signal. For example there are various tariffs, such as a stepped pricing system, which reward low water users and penalise high users. Tariffs could take account of ability to pay, seasonal demand or indoor/outdoor use. The key is using pricing mechanisms to ensure that consumers have enough water to meet their reasonable daily requirements at a fair and equitable price while still encouraging water efficient behaviour.

Water utilities could use different rates over summer and winter to try to limit the amount of water used for outdoor uses over the drier summer period. A concern in the United Kingdom with water charging was ensuring that low income families, sometimes with several children, have the ability to pay when they are likely to be higher users of water. The United Kingdom specifically tried to deal with that issue through The Water Industry Charges, Vulnerable Groups Regulations 1999, which caps the payment for water for certain families[25].

4.2.3 Wastewater charging

Another economic tool includes flow based charges which enables water managers to charge on a unit basis for wastewater. The cost of getting rid of wastewater can be over double the cost of supply, making it the most expensive aspect of the integrated system. Water supply and wastewater are directly related (unless the householder uses water from laundries, showers, and bathroom hand basins for outdoor irrigation purposes—greywater recycling) as water supply to a household is discharged as wastewater.

Using good clean treated water to flush away waste products makes little sense from a sustainability standpoint. However with the billions of dollars tied up in the underground pipes or “assets”, change to a less water based system will not come quickly. In the meantime, charging for wastewater on a per unit basis, as opposed to the general rates sends a clear signal about the cost of managing wastewater and makes water conservation more attractive.

As with all changes in charging systems there will be winners and losers so innovative policy is required to ensure the right signals are sent, the council costs and consumer financial equations balance, and that those who may be genuinely unable to immediately meet the charges are assisted through that transition.

4.2.4 Incentives and rebates

Many water managers have offered financial incentives to encourage better water conservation, including the following range of approaches:

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25 ***http://www.opsi.gov.uk/si/si1999/19993441.htm***

- Subsidising water efficient technologies, everything from rainwater tanks to washing machines to new showerheads, to get householders over the price hurdle and make the payback period seem reasonable. Ideally, rather than an on-going programme, subsidisation may be a mechanism to engage interest within the community which has the potential to lead to more widespread uptake with householders contributing to retrofit costs.
- Providing retrofitting programmes which may target special needs groups or lower socio-economic households that could least afford a retrofit themselves.
- Providing the up-front cost of a new water efficient appliance which is repaid through the water rates over a reasonable pay-back period.
- Reduced building or resource consent charges or reducing processing periods and providing greater certainty through the process.
- Offering rebates to development contributions or rates for the installation of water efficient technologies.

4.2.5 Comprehensive cost/benefit analysis

The council survey results, Section 6.1, showed that the need to establish a new supply or treatment plant is often the major step change that motivates water managers to consider demand management. Options usually come down to a new supply source, demand management, or a combination of both. A new supply brings major costs, along with inevitable social and/or environmental issues; while demand management can require a range of interventions and can be regarded as having uncertainty and therefore risk because of new technologies or required behavioural change. The immediate contribution of demand management is to supply the headroom to domestic and other water requirements, including environmental flows.

Overseas studies have frequently shown that the economic justifications which have led to new water supply developments are often not based on well founded data which costs all options and therefore are biased towards a new source of supply. [26]

There are three main perspectives in determining who accrues the cost and who gets the benefit:

- the water utility
- the customers or water consumers
- society and the environment

The cost/benefit analysis should be consistent in its approach, analysing one perspective at a time. Two or more of the perspectives can then be combined to get a wider consideration of the overall cost/benefit for the proposed approaches. An appropriate discount rate also needs to be used and any ideal assessment should take account of the whole of life-cycle environmental,

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*26 **Institute for Sustainable Futures, "ACT Water Strategy, Preliminary Demand Management and Least Cost Planning Assessment Final Report" October, 2003. Report for ACTEW Corporation Ltd.***

social and economic costs of traditional systems against a conservation approach so that more accurate comparisons between the two can be made.[27]

4.3 Water efficient technology

Improved technologies include an array of water use appliances and plumbing fittings. There are those that can be cheaply retrofitted to replace existing systems such as low-flow shower heads,[28] there are new more water efficient appliances such as front loading washing machines, and there are also on-site options for supplementing the reticulated water supply such as urban rainwater tanks. The other side of the coin is to provide a facility to recycle water on site by utilising greywater reuse systems and thereby reduce wastewater flows. Urban rainwater tanks can also provide a stormwater prevention mechanism.[29]

4.3.1 Rainwater tanks

Harvesting rainwater provides an extra water supply and greatly increases resilience in the overall water supply system through providing a secondary water source that is localised and located in situ.[30] It is fairly common in New Zealand with the majority of rural dwellers' water requirements still being supplied from rainwater tanks.[31] Tanks come in several sizes and styles:

- Large, 25,000 litre readily available tanks that have been routinely used in rural areas cost approximately $3,000 plus pump and installation.
- Smaller, with sizes ranging from 1,000–10,000 litres, slimline and often attractive "urban rainwater tanks" as regularly used in Australia with limited but growing availability here, approximately $2,000 plus pump and installation.
- and finally rain barrels, which are simple tanks holding between 300–400 litres and are generally used without a pump for outdoor uses, approximately $300, no pump or installation required.[32]

In rural areas tanks can be the sole water supply and with prudent use, in a climate with rainfall averaging about 1,350mm/annum and with a large roof collection area, can supply all of a household's water needs including potable uses[33]. However, water quality *E. Coli* standards under the Health Act for potable water raise health concerns about the use of rainwater tanks for

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27 Maddeus,W.O., et al., AWWA Journal November 1996

28 Birchfield, D. 2007. Demand management through water retrofit programmes. Beacon Report Series.

29 http://www.arc.govt.nz/albany/fms/main/Documents/Environment/Water/Stormwater/Stormwater%20factsheet%20-%20Rainwater%20Tanks.pdf

30 Pollard, A., French, L., Heinrich, M., Jaques, R., Zhao, J., Waitakere NOW Home®: Second Year of Performance Monitoring, Beacon Pathway Report.

31 Ministry of Health (updated 2006). "Household Water Supplies—The Selection, Operation and Maintenance of Individual Household Water Supplies".

32 http://www.rainsaver.co.nz/rain_saver.shtml

33 Ministry of Health. 2004. Annual Review of Drinking-Water Quality in New Zealand.

potable uses. While those concerns should be able to be overcome by simple water purification procedures integrated with the on-site supply system, the current pragmatic approach is that it is better to avoid debate over potential health issues and therefore promote rainwater tanks for non-potable uses, such as garden use and/or indoor use for the laundry and toilet. That said, there is little recorded evidence of a connection between the use of raintank water as a potable supply and public health outbreaks. What is evident is that many rainwater tanks are badly maintained and that it is the maintenance rather than the tanks themselves which is the main cause of health concerns.[34]

The difficulty of accommodating large tanks on urban sections is an obstacle, potentially conflicting with district plan rules such as boundary height restrictions and requiring resource consent in addition to a building consent. This increases costs and uncertainties providing a strong deterrent to proceed for all but the most determined. This was an issue to be overcome in constructing Beacon Pathway's second NOW Home® in Rotorua.

Tank sizes between 3,000 and 10,000 litres and which can lie against a wall or be hidden under a deck are more suitable than larger 25,000 litre tanks. Relatively small tanks, 3,000–10,000 litres, can supply a significant percentage of the non-potable water demands. The actual percentage of water supplied by the rainwater tanks depends on the size of the roof collection area, size of the tank, and both total volume and daily/seasonal rainfall patterns. Figure 1 shows the average yearly percent of water supplied for a water use of 325l/pd for a roof area of 100–250m^2, illustrating that relatively small, additional benefits are obtained from rainwater tanks sizes above 10,000 litres.[35] Actual reported savings from the Waitakere NOW Home® which used a 13,500 litre rain water tank for non-potable indoor and outdoor use as well as the shower, showed that approximately 50% savings were made in mains water over the two years of monitoring.[36]

34 Eason, C.E., 2007. A review of rain tank water quality and human health. Report for Landcare Research as part of the LIUDD programme.

20 Kettle, D and Diyagama, T. Does Higher Density Offer Better Hydrological Neutrality?, NZWWA and SIA 2002 Stormwater Conference, 27–28 June 2002, Hamilton, NZ.

36 Pollard, A., French, L., Heinrich, M., Jaques, R., Zhao, J. 2007. Waitakere NOW Home®. A report for Beacon Pathway

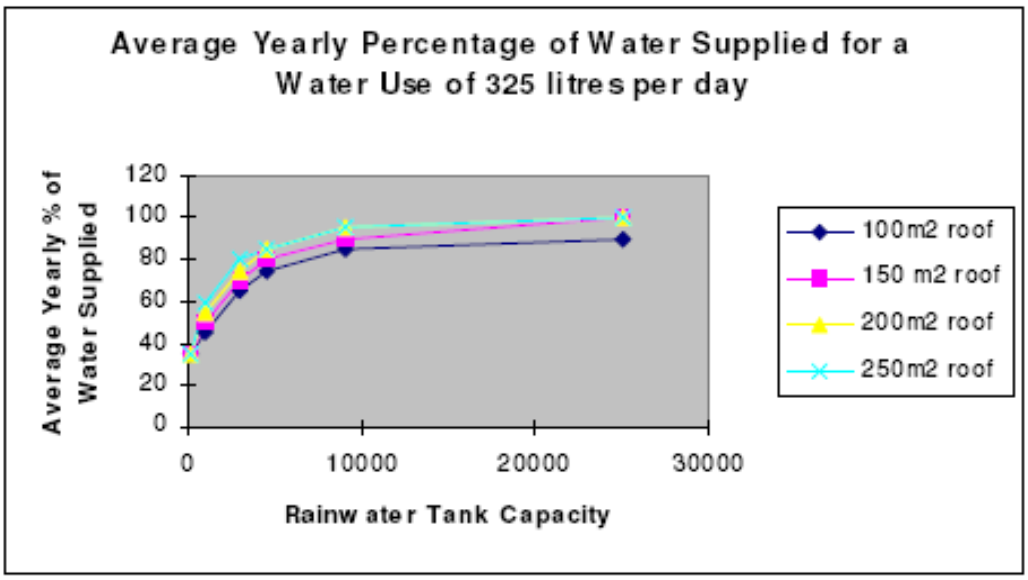

Figure 1 Average Yearly Percentage of Water Supplied for a Water Use of 325 litres/day

4.3.2 Greywater reuse

Water that has been used in showers and washing machines is referred to as greywater and can be redistributed for other uses, typically toilet flushing and outdoor irrigation applications. Greywater is not widely reused in urban situations where a wastewater connection is available.[37] In Australia, given the current water crisis, recycling of grey and even black water is being considered by many councils particularly for parks and sports fields.[38] However, in New Zealand and without the same pressing drivers, wastewater recycling tends to be a little favoured option. It could however, with adequate controls, be a useful addition to the "toolbox" of supplementary supply for toilet and garden use. It could be particularly useful at a neighbourhood scale where sound maintenance systems can be built into the community requirements.

Greywater recycling has the benefit over rainwater supply of being available as a secondary use of mains supply, so it is available even in dry weather (see Section 6.3). The costs of a greywater recycling system are equal to or slightly less than those of a rainwater tank.

4.3.3 Reduced or low flow devices

Low flow showerheads will typically reduce water flow from 15–20 litres/per minute to 9 l/pm saving as much as 50 litres on a six minute shower and cost between $50 and $250 to install. Good performance low flow showerheads help reduce water use, but don't lower showerhead pressure. They should preferably have a water rating of AAA or more, or four stars or more on the proposed WELS system. An alternative to putting in a new showerhead is to use a shower

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37 Pers. Comm. Ian Gunn, March 2008

38 http://waterweek.wordpress.com/2007/09/22/plethora-of-projects-to-raise-south-australias-use-of-recycled-wastewater-to-45pc-says-premier/

flow regulator, a device which fits in the arm of the showerhead and restricts water flow, a very cheap and easy way to save water.

Bathroom, kitchen and laundry taps can also be exchanged for lower use varieties or modified, which generally means including aerators. A basic aerator can be fitted to all taps and substitute for needing to buy new. This is a cheap and easy option for reducing water in the home.

4.3.4 Dual flush/low flush toilets

There has been a significant improvement in the amount of water modern toilets use (3.5–5l per flush) compared with the older single flush standard toilet which uses about 15l per flush. Average domestic water use indicates that toilet flushing makes up between 20–30%[39] of a person's domestic water use; therefore any reduction in the amount of water in a flush can have a significant impact. There are simple gadgets which can be installed in a toilet to reduce the volume of water used per flush. A number of councils provide customers with "Gizmos" for free which reduces the amount of water used per flush by about 25–30%. However, over time water consumers should be encouraged to substitute/upgrade their old toilets for new, more efficient ones. With a cost of between $200 and $400 a new dual flush toilet can be installed, with savings in the range of 10–15% of total per person domestic water use.

In other countries such as the United Kingdom, a wider range of retrofit gadgets are readily available, some of which convert the single flush to a double flush option[40]. They can also conserve water through a delayed action inlet valve which ensures that the cistern doesn't start to refill until the flush is completed.

Waterless urinals are available for commercial premises and composting toilets that use no water. As yet these solutions are not widely accepted although waterless urinals are gaining some support as exemplified by a number of public buildings (including the Council's own building) in Waitakere City. With 80% of new homes in New Zealand now fitted with dual flush toilets[41] it is likely that retrofitting existing homes could provide a large saving in household water supply and wastewater management as well as substantially reducing the environmental costs of such an inefficient and expensive approach to human waste management.

4.3.5 Water efficient appliances

Appliances such as dishwashers and washing machines have also made significant efficiency improvements over the last decade so anybody going to buy a new appliance should be encouraged to choose carefully to help save water and costs.

New Zealand has signalled that it will introduce a mandatory water efficiency labelling system (WELS) this year, in line with Australia, that will assist consumers in choosing appliances that are more water efficient.[42]

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39 ***http://www.ccc.govt.nz/Waterwise/Conservation/HowMuchWaterWeUse.asp***

40 ***http://www.hippo-the-watersaver.co.uk/***

41 ***Ministry for the Enviroment.2008. Water Efficiency Labelling System. BUILD April/May.***

The regulations will require that washing machines, dishwashers, toilets, showers, tap equipment and urinal equipment are labelled with water efficiency information which must be disclosed on supply to a consumer. The regulations will also require that water efficiency information is provided on any product specification, brochure, advertising, magazine, catalogue or website where the product is profiled and also at showrooms, as well as display homes or display units. Water efficiency labelling based on accurate, comparable and relevant information will help householders make good water conservation decisions.

The WELS water rating label will be similar in appearance to the energy rating label (which clothes washing machines and dishwashers must also carry). The more stars out of a total of 6, the better. As well as a star rating the labels also show a water consumption or water flow figure. They will only apply to new appliances; second hand appliances will be exempt.[43]

At present there is a voluntary labelling system administered by the Water Services Association of Australia and known as the National Water Conservation Rating and Labeling Scheme. This system is expected to be phased out once the mandatory WELS system has been established. The scheme covers a range of appliances from washing machines to water flow regulators. It uses a scale of 1 to 5 "A"s to show increasing water efficiency.

4.4 Education, awareness raising and social marketing

Education or awareness raising is an important aspect of water demand management and is by far the most common response to alter consumers' water use in most western countries. Some examples include:

- Schools programmes—using the school as a laboratory or through involvement in stream restoration or other parts of the water cycle as an introduction to value the resource. The National Waterway Project is a good example.[44] Another approach is to develop teaching modules for schools, particularly for primary school level to educate children about the water cycle and efficient water use.
- A water wise website is one form of information dissemination. Several New Zealand councils have them as well as central government sponsored websites such as SmarterHomes.[45]
- Community activities—either focused on water issues or wider sustainability issues. Project Twin Streams[46] in Waitakere has recently been extended to include demand management activities. They will use a social marketing approach with incentivised retrofits through people who have shown leadership in their communities and whose advice and opinion is well respected.

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43 ***http://www.mfe.govt.nz/issues/water/wels-scheme.html.***

44 ***http://emap.rsnz.org/studyareas/hydrology.html***

45 ***http://www.smarterhomes.org.nz/***

46 ***http://www.waitakere.govt.nz/Abtcit/ne/twinstreams.asp***

- Booklets, flyers and other promotional material are sometimes included with the rates bill to focus the opportunity to save water and money. This may also include public displays at the council or in libraries.
- Seven New Zealand councils now have eco-advisors who have a wealth of material to provide for people interested in retro-fitting or building a new home. This is in part funded through the sustainable management fund administered by MfE.
- In addition, an educational package and one-on-one advice could be given to all people applying for a building consent. One-on-one advice while resource intensive has been shown to have the best uptake.

4.5 Regulations

The regulatory framework for water demand management is outlined in Section 5 of this report and covers both the local and national scale. There is a range of legislation that has the ability to be used for demand management but these have rarely been used for that purpose.

Regulations available include local bylaws to manage nuisance, development controls under the district plan, and national regulations associated with legislation such as the Building Act or Health Act or RMA. Given the minimal legislation directly applied to water demand management in New Zealand at present[47] there is a case to be made for regulation in some situations to assist the introduction of water efficient technologies. That being the case it is easier to apply regulatory approaches to new homes and make significant savings in the amount of water otherwise forecast as being required for the increasing population base. This is because new houses provide easier opportunities to include water efficiency, with several water efficient features able to be included in the overall house price without contention—such as smart taps, water efficient appliances, low flow showerheads and dual flush toilets. There are other options that consumers are less familiar with, including rainwater tanks and greywater recycling systems that could also be considered through regulation.

What is essential is that if councils or water utility operators want to encourage water efficiency they have to make it as easy as possible for the consumers. A barrier which has been mentioned on several occasions and reported previously by Beacon is the inconsistent messages from within a council; often meaning that one part of the council is trying to encourage demand management while another is not aware of the change in attitude.[48] An example of this is the conflict between a decision to promote the use of urban rainwater tanks at the same time as requiring a building consent for installation, a requirement under the Building Act, and development contributions for stormwater disposal. Councils have so far responded by adopting policies that waive consent fees, or enable a development contribution rebate, therefore minimising any perceived bureaucracy.

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47 Lawton M., Birchfield D. and Kettle, D. (2007) Making policy and regulation rain tanks friendly. Report PR 205 for Beacon Pathway Limited

48 Easton L., Mead D., Trenouth C., Fullbrook D., and Arnold P. (2006) Local Council Sustainable Building Barriers and Incentives – Auckland City Case Study

5 Water management in New Zealand

5.1 Government direction

Successive New Zealand Governments have been seeking a transition towards more sustainable utilisation of resources with reduced social and environmental impacts. This is evidenced in the steadily increasing range of key resource management related legislation and policy. The Resource Management Act 1991 (RMA), the Local Government Act 2002 (LGA), and the Building Act 2004 all make direct reference to promoting greater sustainable management and/or development outcomes as their principle purpose.

The essential nature of water requires a high level of public consultation and community concerns are an integral part of the regulatory environment.

At a strategic level the current Government's Sustainable Development Programme of Action (SDPoA) outlines an expectation that a shift towards more sustainable behaviour must be reflected in the way resources are managed and needs to be made mandatory across all levels of government activity. Relevant to water related issues are the SDPoA's policies and principles for decision making which include:

- Seeking innovative solutions that are mutually reinforcing, rather than accepting that gain in one area will necessarily be achieved at the expense of another.
- Decoupling economic growth from pressures on the environment.
- Respecting environmental limits, protecting ecosystems and promoting the integrated management of land, water and living resources.[49]

Because of the various Acts relating to domestic water there are also a variety of organisations that have responsibility for differing aspects of water management. There is little integration of these organisations across the country except through the Building Code which has little to say about water use efficiency, a situation that will hopefully change when the current review of the Building Code is finalised in 2008.

5.2 Key Acts

There are a number of Acts that impact on the delivery of water services as shown in Figure 2, but the principal acts are the Building Act (2003), the RMA (1991), the LGA (2002), and the Health Act (1956). The Beacon research report, "Making Policy and Regulation Raintank

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49 Department of Prime Minister and Cabinet, 2003. "Sustainable Development for New Zealand—Programme of Action". Source: http://www.beehive.govt.nz/hobbs/30199-med-susined-developm.pdf.

Friendly"[50] provides an in-depth evaluation of regulatory pathways for the adoption of water conservation measures—particularly focusing on the regulatory requirement for rainwater tanks.

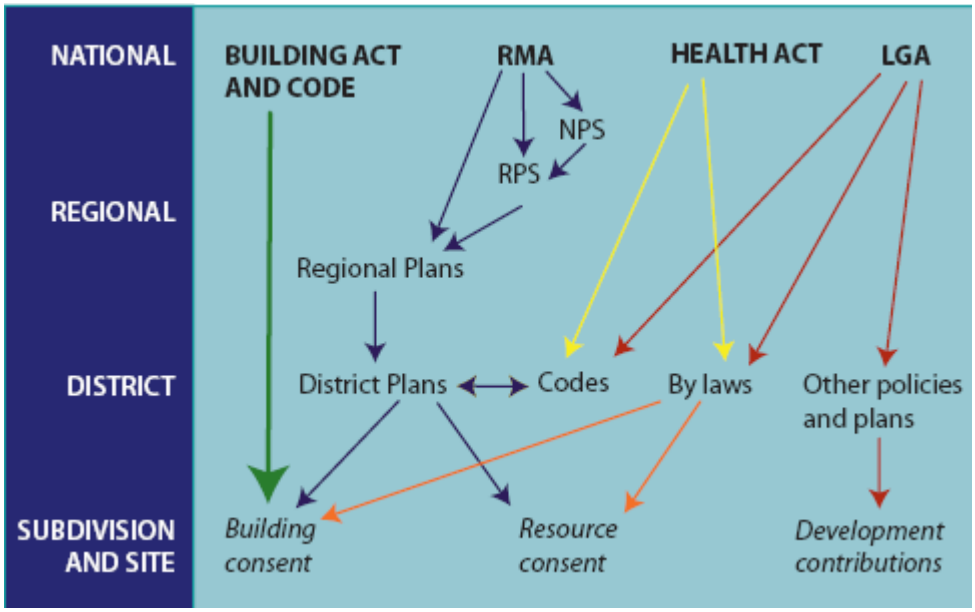

Figure 2 Regulatory Framework that can influence on–site water supply

5.2.1 The Building Act

The Building Act 2004 is the key piece of legislation that governs the building industry in New Zealand.

The Act aims to control and encourage better practices in building design and construction. The Department of Building and Housing is responsible for the administration of the Building Act. The purpose and principles of the Act include requirements for sustainable development and for buildings to help people stay safe, healthy and comfortable. Clause 4(2)(o) states "the need to facilitate the efficient use of water and water conservation in buildings". However, no specific detail is provided on how the sustainable development principles will be achieved—and this would be expected to become more apparent in the Building Code.

The Building Code is the primary mechanism for the implementation of the Building Act and currently being reviewed to take account of the new Building Act's requirements for sustainable development and to provide for buildings that help people stay healthy and comfortable. Under provisions within the Building Act there are requirements "that buildings are designed, constructed and used in ways that promote sustainable development."[51] Again, what this will mean for water demand management is unclear. A consultation document on the Building Code

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50 Lawton M., Birchfield D. and Kettle, D. (2007. Making policy and regulation rain tanks friendly. Report PR 205 for Beacon Pathway Limited.

51 http://www.dbh.govt.nz/bcl-building-code-review

proposed changes has been released.[52] This did not propose any immediate changes to the Building Code to promote water efficiency and instead recommends it to be included as part of wider Resource Efficiency provisions for which few details have been worked through, and these are not likely to be developed until 2011.

5.2.2 The Resource Management Act (1991)

Section 5 of the RMA states that the purpose of the Act is: *"to promote the sustainable management of natural and physical resources"*.

The RMA's emphasis on sustainable *management* as opposed to sustainable *development* has led to an Act that is strongly focused on managing the undesirable effects of development as opposed to promoting a form of development that is sustainable per se. As such the RMA aims to avoid, remedy or mitigate unwanted environmental outcomes, but generally doesn't promote a more holistic interpretation of what constitutes sustainable behaviour or the sustainable use of resources.

With regard to water use, its application to date has tended to focus on maintaining water quality in contributing and receiving waters rather than the consideration of how to promote the longer term sustainability of the supply. Hence the traditional focus has been on stormwater issues and the allocation, mainly rural, of freshwater resources as opposed to municipal water supply and demand management which are more pertinent to the LGA. That situation is beginning to change with the development of a National Programme of Water and concerns relating to water allocation, including domestic supply.[53]

The RMA contains a hierarchy of statements and plans, each with a guiding principle that must be applied in all resource management frameworks, including:

- National Policy Statements—e.g. the NZ Coastal Policy Statement.
- Regional Policy Statements and the Regional Coastal Plan. These must be consistent with National Policy Statements.
- Optional Regional Plans—on water, land and air.
- District Plans—which must give effect to regional policy statements and are not to be inconsistent with the regional plans and policy statements.

5.2.2.1 National Policy Statements

A National Policy Statement (NPS) is a document prepared under the RMA. The Ministry for the Environment can prepare a national policy statement to provide direction to local authorities on a matter of national importance. However, this is optional under the RMA.[54] The Parliamentary Commissioner for the Environment has been calling for a National Policy Statement relating to the management of urban water supplies for the best part of a decade.

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52 ***http://www.tenancy.govt.nz/bcr-2007-consultation***

53 ***http://www.mfe.govt.nz/publications/water/water-programme-nov03/water-programme-action-nov03.html***

54 ***http://www.mfe.govt.nz/issues/biodiversity/initiatives/nps.html#what***

5.2.2.2 Regional Policy Statements

Section 30 (1a) of the RMA states that a regional council's function is "the establishment, implementation and review of objectives, policies and methods to achieve integrated management of the natural and physical resources of the region". A regional council does this initially through the Regional Policy Statement (RPS) by providing an overview of the resource management issues of the region and policies and methods to achieve integrated management of the natural and physical resources of the whole region. Regional policy statements must be reviewed after 10 years, and most regional councils are in the process of doing this at the moment.

5.2.2.3 District Plans

The RMA requires each Territorial Authority (TA) to prepare a district plan under Section 73 The District Plan must comprise objectives, policies, and rules (if any) to implement objectives. Nearly all TAs now have operative district plans in place, which must be reviewed after 10 years. The RMA provides a process for amending plans during their lifetime and in addition to plan changes many councils are in the process of considering what the next generation plans will comprise. With sustainability becoming such a critical issue it is likely that second generation plans will contain greater recognition and provision of sustainable initiatives.

5.2.3 Local Government Act (2002)

Part 2 Section 10 of the Local Government Act (LGA) states that the purpose of local government is to:

- Enable democratic local decision-making and action by, and on behalf of, communities; and
- Promote the social, economic, environmental and cultural well-being of communities, in the present and for the future.[55]

Section 103 of the LGA places an obligation on councils to maintain water services to their community while Section 10 requires them to take a sustainable approach which promotes economic, environmental, social and cultural well-being. The LGA explicitly integrates water, wastewater and stormwater issues in the new "Water Assessment" provisions. "Water Supply" within the Act means "the provision of drinking water to communities by network reticulation to the point of supply of each dwelling house and commercial premise to which drinking water is supplied" (s124).

Under the LGA territorial authorities are required to prepare a Long Term Council Community Plan (LTCCP) (every three years) setting out desired "Community Outcomes" and actions for achieving these over a ten year time horizon. The process of preparing the LTCCP provides an opportunity for public involvement in discussions of matters of importance to the community and could be used to raise awareness of the need for water efficiency measures.

Also under the LGA, there is a requirement for territorial authorities to undertake regular Water and Sanitary Services Assessments (WASSAs). The WASSA requires councils to describe the

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55 LGA, section 10, 2001.

means by which water is obtained by residents and communities and also the extent to which water will be supplied by the territorial authority, and as such are directly related to Asset Management Plans (AMPs). AMPs describe practices and costs associated with asset portfolios capable of delivering the agreed service levels usually during a period of up to 20 years.

5.2.4 The Health Act (1956)

There is only a minimal reference to public water supply within the Health Act, with a requirement under section 39(1) for all dwellings to provide access to "an adequate and convenient supply of wholesome water". There is also a requirement for dwellings to provide "suitable appliances for the disposal of refuse water in a sanitary manner"; however, there is no definition of what an adequate and convenient supply actually constitutes.

The Ministry of Health's role in relation to the public water supply tends to focus on water quality. In that role the Ministry works alongside the Department of Building and Housing (DBH) in developing the provisions related to the requirements for providing water services into dwellings and buildings contained within the Building Act and Building Code.

For the past decade there has been a lot of focus on improving New Zealanders' access to higher quality drinking water in response to the poor quality of many reticulated water supplies. The Ministry publishes a range of information booklets for the public pertaining to water quality, most often about how to maintain the quality of water from non-reticulated water sources such as rainwater tanks and underground bores.

In 2005 the Ministry released a revised Drinking-water Standard for New Zealand (DWSNZ2005) with the standards focusing on a broader approach of "quality assurance" rather than "quality control".[56] Underpinning this quality assurance approach is a requirement for drinking-water suppliers to develop Public Health Risk Management Plans (PHRMPs), which systematically assess the requirements for providing safe drinking-water. The PHRMP is a management tool suppliers can use to identify, manage and minimise events that could cause water quality to deteriorate.

In 2005 the Ministry also developed a "Drinking Water Assistance Programme" which is a fund totalling $154 million aimed at assisting rural communities to improve their water quality.[57]

5.2.5 Bylaws

A bylaw is a rule or regulation made by a local authority which affects the public, which orders something to be done, or in some cases, to not be done. Local councils are given the power to make bylaws by a number of statutes, for example, the Local Government Act, the Transport Act and the Health Act.

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*56 **Source: Ministry of Health. http://www.moh.govt.nz/moh.nsf/by+unid/12F2D7FFADC900A4CC256FAF0007E8A0?Open. Accessed 2 November 2007.***

*57 **Ministry of Health. 2005. "Drinking Water Assistance Programme". Source: http://www.moh.govt.nz/moh.nsf/indexmh/drinkingwaterinnz-assistanceprogramme. Accessed 2 November 2007.***

A territorial authority may make bylaws for its district, covering among other things, the following:

- protecting the public from nuisance
- protecting, promoting, and maintaining public health and safety.

5.2.6 Conflicts between Acts

The two enabling Acts which have sustainability and resource management as overarching principles are the Building Act 2004 and the RMA 1991. The Building Act is concerned about the structure of the building, its safety, human health and comfort while the RMA is about sustainable management of the environment. These two Acts meet in buildings and immediate surroundings but there is not a clear understanding of how they interact. The potential for legal disagreement arises from Section 18, previously Section 7, of the Building Act which states:

> *"Section 18 of the Building Act 2004 precludes the imposition of performance standards for building work additional to or more restrictive than those specified in the Building Code. Therefore a person who carries out any building work is not required by this Act to:*
> - *achieve performance criteria that are additional to, or more restrictive than, the performance criteria prescribed in the Building Code in relation to that building work: or*
> - *take any action in respect of that building work if it complies with the Building Code. (2) Subsection (1) is subject to any express provision to the contrary in any Act".*

This is an important potential impediment to the use of regulations in helping to drive the uptake of water use efficiency in the home and hence requires some discussion. The general interpretation of that statement is that the RMA through the District Plan cannot require a "Rule" in the Plan which is more restrictive than the Building Code, nor require a higher performance in a resource consent. However that interpretation is not universal. An excellent review of the potential for legal conflict over this issue is presented by Ceri Warnock, a barrister and lecturer in the Faculty of Law at Otago University in her paper on "Sustainable Construction in New Zealand"[58]. In this paper Warnock examines the only legal test of this provision, in *Christchurch International Airport Ltd* v *Christchurch City Council*[59]. The case was concerned with noise attenuation in a development close to Christchurch Airport, where the buildings could have been constructed to Building Code standards, but would not have received a resource consent, as they were not fit for use. The ruling allowed a higher level of insulation performance than was specified through the Code to counter noise from the airport.

The paper quotes Judge J. Chisholm who, inter alia, stated that *"The key is the purpose of the functions performed. If the exercise of the power relates only to the physical building structure*

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58 ***Warnock, A. C., "Sustainable Construction in New Zealand" (2005) 9 NZJEL, 337.***

59 ***[1997] I NZLR 573.***

then it will be caught by s 7 (2). On the other hand , if the exercise of the power relates to the control of activities or the effects of activities in terms of the Resource Management Act it will not be caught by s 7 (2)."

Warnock makes the case that *"…in the absence of clear authority to the contrary, it is apparent that local authorities will be able to introduce rules to ensure that sustainable management of natural and physical resource even if these directly influence the construction process."* … *"Carefully drafted rules, emphasising their valid resource management function are likely to be safe from legal challenge despite s 18 BA04."*

The uncertainty surrounding the interpretation of Section 18 of the Building Act is a barrier which impacts on more resource issues than just water use efficiency and requires clarification.

5.3 Non statutory documents

To enable any regulation to be successfully administered there needs to be the appropriate documentation of engineering standards and guidelines. There are several "levels" of engineering standards and different types of engineering standards and manuals used throughout New Zealand. In general, the different levels of engineering type standards are:

- Council Engineering Manuals/Standards
- Verification Methods and Acceptable Solutions
- Information Pamphlets and Brochures
- Practice Notes/Design Guidelines

Engineering manuals/standards provide advice on "how to build" but are not statutory documents. They detail desired development standards as resolved by the local TA. Such standards are often referred to in the district plan (e.g. the development must comply with the Council's engineering standards).

Practice notes and guidelines provide the majority of the existing design engineering information on water management. These are less formal guidelines and generally have a collection of design guidelines for specific technologies such as rainwater harvesting, stormwater rain gardens, swales, etc. and have no legal status. Such guidelines may lay out acceptable methods to inform developers about the types of built outcomes desired by the council for easy consenting.

5.4 Management models for water

Beacon's survey of Local Government identifies that council management models for delivering water services are of four types:

- Managed in-house
- Council Controlled Organisation
- Public Private Partnerships
- Other—generally a contract arrangement with an external supplier

Below is a brief description of the characteristics of each model.

5.4.1 In-house

This is effectively the traditional provision of water utility services in-house by the council itself; as such it is not a separate entity but part of the overall structure of council.

5.4.2 Council Controlled Organisations

A council controlled organisation (CCO) is established under the LGA[60] as a company with a majority council shareholding, or a trust or similar organisation with a majority of council-controlled votes or council-appointed trustees, unless designated otherwise. More than one council may be represented in a council-controlled organisation. Any profits made are generally required to be reinvested into the business or paid to the shareholders as some form of dividend.

Before a council can set up a CCO under the LGA they must undertake a public consultation process. Section 59(1)(c) also requires CCOs to:

> *"exhibit a sense of social and environmental responsibility by having regard to the interests of the community in which it operates and by endeavouring to accommodate or encourage these when able to do so."*

An example of a CCO is Metrowater, established to deliver water services for Auckland City. Metrowater is required to return an annual dividend to the council at the end of each financial year. Only councils that have set up a CCO are able to charge for wastewater disposal as a demand management intervention under the LGA.

5.4.3 Public Private Partnerships

Also under the LGA[61], councils can enter into Public-Private Partnership (PPP) for the delivery of some services. A PPP describes a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. With a PPP arrangement the council maintains ownership of water assets while the management, maintenance, and operation of the system is undertaken by a private company.

Under a PPP management model the council has an obligation under the LGA to demonstrate how the local authority will assess, monitor, and report on the extent to which community outcomes are furthered by any provision of funding or other resources in a partnership with the private sector. An example is the contract between United Water and Papakura District Council, where United Water has a 30 year contract to manage the Council's water assets.

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60 Part 5 of the LGA. Formally referred to as Local Authority Trading Enterprise, a non-profit organisation owned by the authority.

61 Local Government Act, Part 6, subpart 3

6 New Zealand demand management approaches

6.1 Local government survey

Territorial authorities were surveyed to obtain an understanding of the level of water conservation activity across the country. The questionnaire (see Appendix 5) also identified potential case studies of four local councils in New Zealand and their respective approaches to water conservation. To that end questions were asked about:

- the types of water supply management models being used
- whether water metering was used
- whether the council ran water conservation programmes
- the types and methods of implementing those programmes; and
- the principle drivers for the programmes

The questionnaire was sent by email to water managers in all 76 of the territorial authorities across the country. The survey was designed to show up some clear differences in council approaches which would provide the basis for the selection of the case study candidates for further investigation.

The survey was undertaken in July and August of 2007 and received a response rate of 55%. Water managers were also subsequently contacted to try to obtain per capita water use figures for each council; however the response rate to this question was much lower and the methodologies used to arrive at water use figures differed, again emphasising the difficulty in getting hold of credible data from those areas where household water use is not metered.

Table 2 represents the data collected to date:

Council	Daily Per Capita Water Use Figure
Nelson	160*
Waitakere	167*
Rodney	179*
Manukau	189*
Papakura	190*
Tauranga	216*
Upper Hutt	227
Christchurch	333
South Taranaki	450
Kaikoura	648
Kapiti	650
Queenstown Lakes District	750

**Metering with volumetric charging*

Table 2 Per person water use data by council

The survey was designed to be relatively short and easy for councils to fill out to ensure a good response rate. The downside of this approach was the lack of further detail obtained around key subject areas. While the survey shows a high level of need for water conservation approaches in many districts, the responses do not clarify the level or extent of these water shortages.

Responses from most of the major centres were received as well as a number of smaller councils providing a relatively broad sample in terms of population size and urban/rural contexts. As a result there appears to be a level of universality with regard to the issues around water supply. It also follows that some of the trends from the data might well be able to be extrapolated out to provide a percentage figure that is in keeping with the broader situation across the country.

As can be seen in Figure 3 below the most common form of management model being used is the Council Controlled Organisation, followed by in-house (41%). Where "other" was indicated this meant asset management services were outsourced, usually to a council physical works contractor or similar.

Future investigations might consider the reasoning behind why councils came to select the management model they are currently utilising, e.g. what do they perceive to be the benefit of a CCO over a PPP or managing the system in-house. This aspect was not covered by the survey though characteristics of management models are considered in more detail in Section 5.4 of this report. Perhaps one of the critical differences between management models from a demand management perspective is that under the Local Government Act only council controlled organisations are able to charge for wastewater disposal. As such councils that are managed in-house and that wish to employ wastewater charging as a demand management intervention are presently unable to do so. Just why such a legislative barrier is in place and how it is justified is presently unclear.

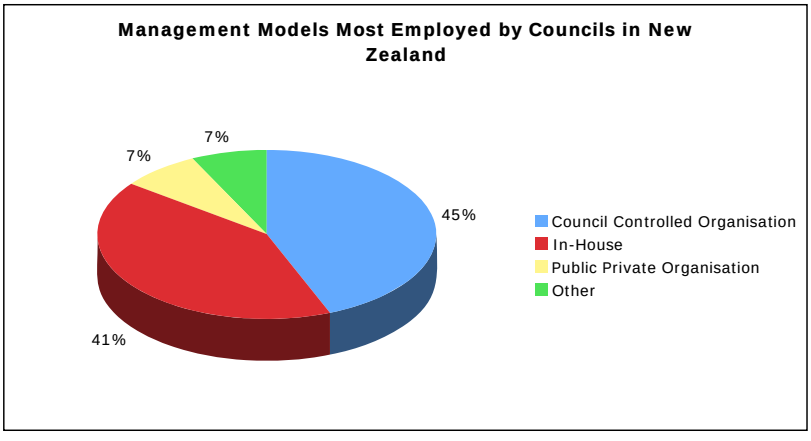

Figure 3 Water management models

The extent of water metering undertaken by respondents is illustrated in Figure 4. Although over 40% do use metering the questionnaire did not ascertain whether this comprised metering of individual households or whether water usage is charged.

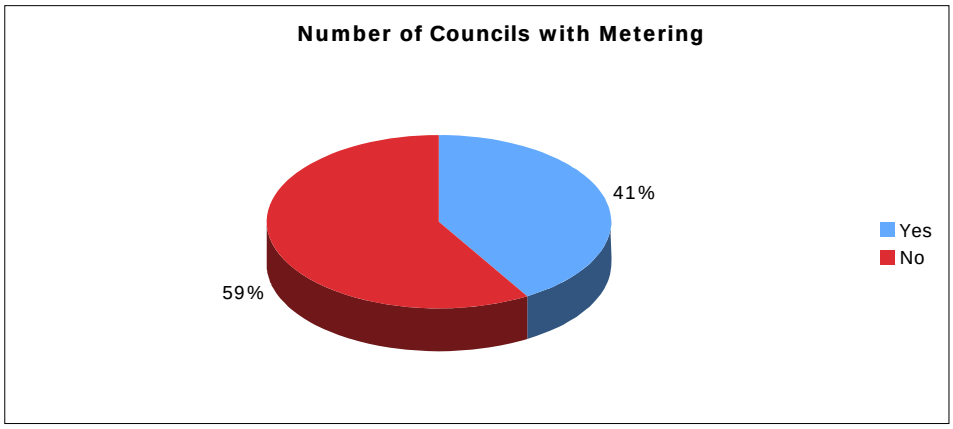

Figure 4 Percentage of councils using water metering

Figure 5 illustrates the range of water conservation techniques utilised by councils, with 68% of respondents considering that their council have a water conservation programme. This figure also shows that councils' preferred methods for conserving water are the use of voluntary measures, although resource consents (i.e. conditions requiring low flow devices) and/or district plan changes (i.e. applying to new growth areas) to reduce water use are also being used. Other methods identified included a surcharge for excessive consumption (Franklin District) and compulsory restrictions (Stratford District).

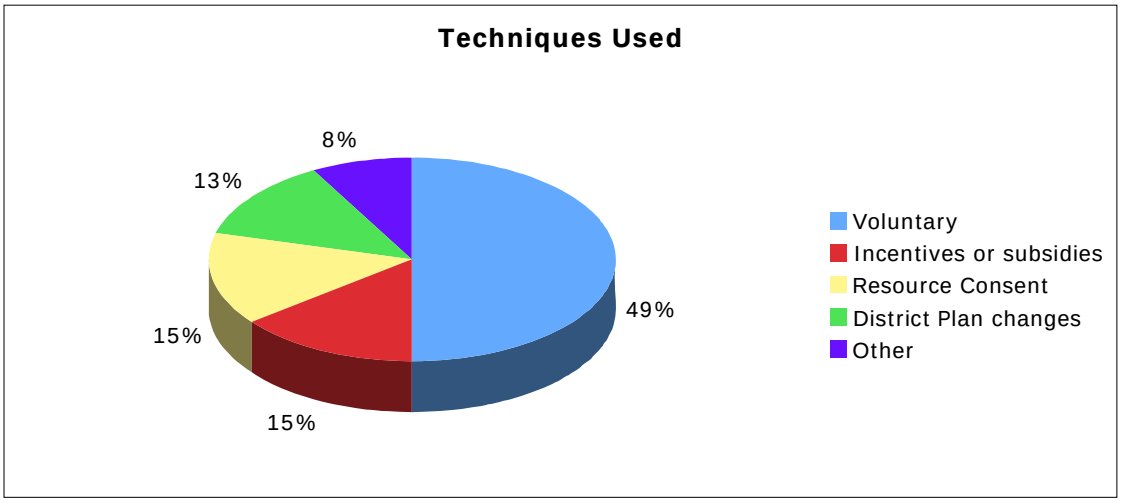

Figure 5 Water conservation techniques used

Figure 6 illustrates that most councils identify shortages of water supply as the key driver for water conservation programmes; many others identified infrastructure constraints. Although the level of shortages were not defined within the questionnaire this illustrates that water supply is a substantial concern and a significant driver for water conservation programmes for councils.

A number of councils indicated a growing interest in the area of water conservation and a need to step up efforts to reduce demand in the coming years. Some of these discussed the critical role they saw leakage reduction programmes taking to reduce water demand.

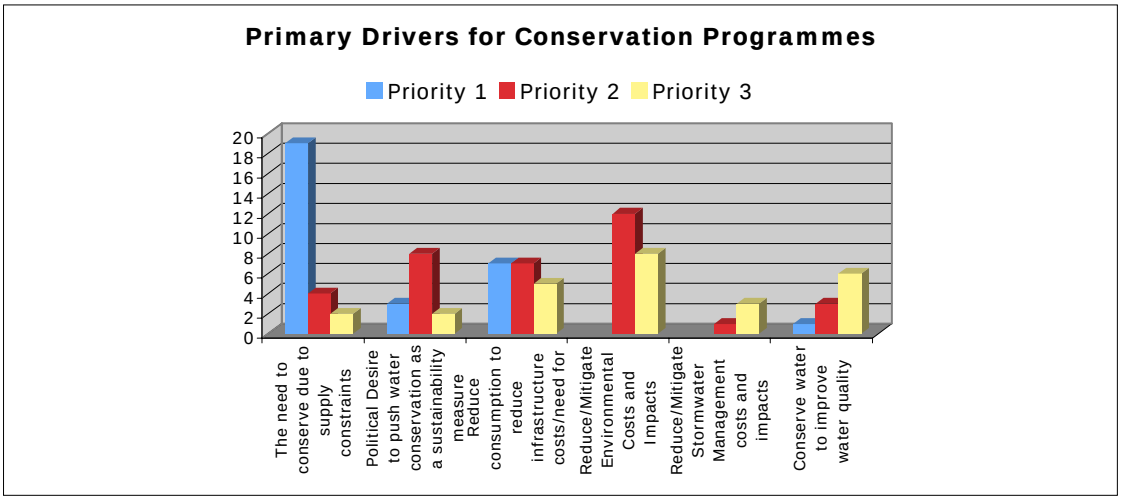

Figure 6 Drivers for water conservation programmes in New Zealand Councils

In summary, the survey, which was intended to provide an overview of some key water conservation approaches, showed some key trends. These are:

- The number of councils metering individual households appears to be increasing with nearly 40% of homes now metered—and more councils indicated metering was being considered for the future.
- 68% of councils run water conservation programmes.
- Councils are using a range of water conservation programmes however the great majority are only voluntary.
- As many as 63% of the councils running water conservation programmes are doing so due to some level of water supply constraint with 46% of councils rating it as their most significant driver.
- Information gained on domestic water consumption, (see Table 2) also shows that those councils which meter report using less water. However, that conclusion has to be tempered by the fact that some of the non-metered councils may be reporting gross water use as they can't be sure of the level of domestic use. There could also be a correlation reflecting the level of outdoor water use against climate and which needs to be considered.

6.2 Case Study—Tauranga City Council

6.2.1 Key findings

- The introduction of water metering and charging on a volumetric basis reduced average daily water demand by approximately 25%.
- Metering and other water demand management initiatives enabled Tauranga City Council (TCC) to defer investment in a new $40 million water source by 10 years and has meant existing water resources will be able to serve more than 50,000 additional people in future years.
- Without DM interventions TCC estimates that with the high population growth in Tauranga together with the allowance for an "unrestricted supply" of water to customers, peak daily demand (PDD) would have reached approximately 104,000 m^3/day by 2011. Latest estimates predict the PDD to be approximately 60,000 m^3/day.
- Residential average daily water demand is approximately 216l/pp/pd.
- Personal information exchange with the community has had a sustained effect on water demand management.
- TCC made a conscious decision to avoid referring to global water shortages and focus on providing practical information to improve water use efficiency locally.
- A positive and inclusive branding of the water efficiency programme has been successful—"Water—Let's make every drop count".
- Schools programme provides specific modules into the curriculum to address water efficiency and raise awareness, including how to fix leaks.
- International Leakage Index of between 1–1.5 for five years between 2002/03–2006/07.

Metering was introduced by a TCC policy prior to requirements for consultation under the LGA 2002.

Summary of Water Demand Management activities

- Waterline—this free advisory service helps customers identify losses and wastage on their systems and offers a free leak detection service for residential properties.
- Schools education programme—an important long-term investment in water conservation is improving the awareness of young schoolchildren in the subject.
- Universal water metering—the introduction of an equitable pricing structure for water services and giving customers the ability to be aware of their consumptive use of water.
- Water consumption and meter reading information for customers—high usage notification and follow up leak detection services are freely available to all TCC customers.
- Monitoring real water losses in each supply zone by conducting night flow testing.
- Active Leakage Control involving manual field checks using leak detection equipment. This programme is managed on a continuous two-yearly cycle whereby all management zones within the city are covered.
- Distribution maintenance and passive leakage control—rapid response to customer calls and reported pipe breaks have been built into performance based maintenance contracts.
- Pressure management whereby service levels are not compromised but pressure (and leakage) is reduced during off peak periods.
- TCC measures its leakage performance and achieves an Infrastructure Leakage Index within the "good to excellent" category.
- Operational surveillance and reporting via telemetry and Supervisory Control and Data Acquisition (SCADA) systems—a continuous awareness of production and distribution.
- Partnerships with plumbers, merchants and garden centres to promote water efficiency.
- TCC has retrofitted all automatic flushing urinals in its buildings and facilities with motion-detection actuators.
- Bulk metering, water supply management systems and network models—these are management tools used to identify the extent and location of system losses that can be reduced.
- Variable seasonal water restrictions (sprinkler, hand held hoses etc.)—although TCC has adopted water metering as the preferred method of regulating water demand, the option of water restrictions remains available in periods of drought or other extreme conditions.
- Alternative water sources and emerging technologies—TCC has investigated alternatives such as greywater reuse, rainwater harvesting and recycling waste effluent through a recent joint study by MWH (NZ) and CSIRO (Australia) for the Papamoa East growth area. The study considered sustainability and cost effectiveness as well as the social and cultural acceptability of such options by the community. TCC has successfully developed a reclaimed water supply from its Chapel Street Sewage Works for irrigation purposes.

Source: Asset Management Plan—Water, Tauranga City Council (2005)

6.2.2 Background information

Tauranga City is located in the Bay of Plenty on the east coast of the North Island, New Zealand. The city has a current population of 105,060 (2006 Census) and has been experiencing

significant growth over the past 15 years. Since 2001 the population of Tauranga increased by 14.4%, which although slower than the 17.3% of previous census results is still significantly higher than the country's average annual growth of 7.8% during the intercensoral period between 2001 and 2006.[62] The population of Tauranga is anticipated to grow by 3% per annum over the next ten years,[63] and to reach about 122,000 by 2014.[64]

Tauranga has an average annual rainfall of 1,240ml with a low summer rainfall of around 250ml. Water supply is currently provided from two catchments, the Tau Tau and the Waiorohi in the Kaimai foothills providing access to a total of 91,000m^3 per day. Surface water is taken from these two streams, which are spring fed from ignimbrite sheets and have a steady and reliable base flow. TCC owns large areas of land within these catchments and manages it to protect the streams and maintain a quality water source. Along with Western Bay of Plenty District Council, TCC is currently considering how to protect the catchments through the district plan, by creating "water supply zones" to manage various activities.[65]

Water supply is managed in-house by the Water Services Department of TCC. The city is fully reticulated, with approximately 150 households supplied by bores and rainwater tanks. All households connected to the reticulated supply are individually metered. Water is supplied by two water treatment plants.

The growth experienced in Tauranga over the past 10 years has put significant pressure on the water supply. TCC considers itself to be at the forefront of water treatment standards, but to address the pressures of growth, including extension of infrastructure, TCC has undertaken water demand management and conservation in support of a sustainability goal. Initiatives include active leakage control, pressure management, renewal of pipes in poor condition, community liaison, schools programme, and installation of tap washers.

Before implementation of water demand management the peak daily demand was estimated to reach 108,000m^3 by 2014 resulting in the need for an additional water supply at a cost of $40,000 million. Instead the need has been delayed by 10 years with a peak demand of approximately 60,000m^3 in 2005[66] and existing raw water resources will be able to serve more than 50,000 additional people in future years. Average gross annual daily water consumption is approximately 350l/pp/pd. Peak demand is approximately 500l/pp/pd. The residential average daily water demand is approximately 205l/pp/pd. Figure 7 illustrates the composition of Tauranga's water supply in 2005.

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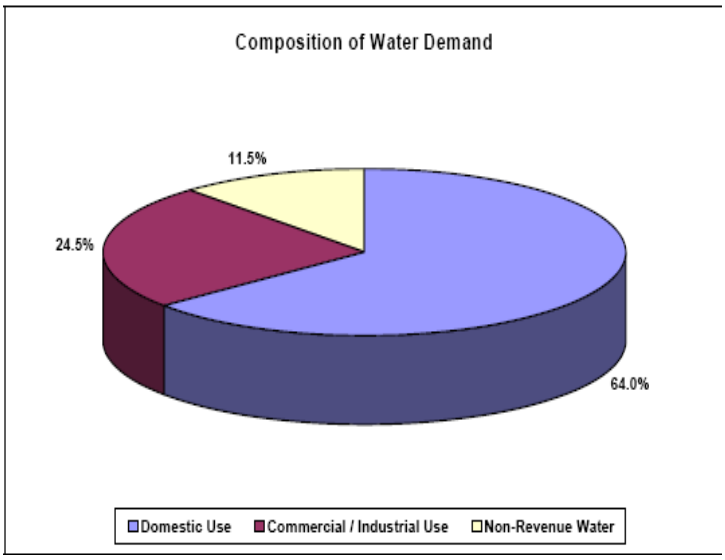
62 Statistics NZ. (2006)."Demographic Trends (2006) – reference report", Statistics NZ, Wellington, 2006. Source: http://www.stats.govt.nz/analytical-reports/dem-trends-06/default.htm, acccessed 12 December 2007.

63 Long Term Council Community Plan 2006–2016, Tauranga City Council (2006)

64 Asset Management Plan—Water, Tauranga City Council (2005)

65 Water Supply Strategy, Tauranga City Council (2005)

66 Asset Management Plan—Water, Tauranga City Council (2005)



Source: Asset Management Plan—Water, Tauranga City Council (2005)

Figure 7 Tauranga Water Supply Composition

TCC aims to provide an unrestricted water supply to its customers. The overall water supply strategy for the city is primarily driven by the following:[67]

- growth in demand (both quantity and spatial distribution)
- water quality/public health (PHRMPs)
- sustainable use of water resources (RMA, EBOP Land and Water Plan)
- Levels of Service (for Flow, Pressure, Continuity of Supply, Fire Supply)

In recognition of the need to investigate an additional water supply for Tauranga, in 1989 Beca Consultants recommended the Waiare Stream near Te Puke as an option. The Waiare Stream provides an assured stream flow and is the closest surface water source to the coastal growth area at Papamoa East.[68] Western Bay of Plenty District Council (WBOPDC) currently uses the Waiare Stream to supply their district with water which presently supplies on average just under 8,000m^3 per day. TCC are working in partnership with WBOPDC on a sub-regional plan for water resources and the infrastructure required to develop the Waiare Scheme to meet SmartGrowth projections of future populations for the next 50 years. The joint scheme will supply water to approximately 126,500 people.

The current arrangement with WBOPDC is for TCC to share the existing consent to service Papamoa East. Joint applications are currently being prepared for resource consents and designations to develop the Waiare Scheme to service both WBOPDC and TCC. Although construction is expected to commence in 2011, TCC anticipates that the consent for additional water take will not be required until 2020. A cost of approximately $38,500,000 for the Waiare Scheme is identified in the LTCCP over three years (2010–2013).

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67 ***Water Supply Strategy, Tauranga City Council (2005)***

68 ***Ibid, Water Supply Strategy***

The use of rainwater tanks is not currently promoted as a conservation measure as TCC considers there to be a number of unresolved risks associated with tank water, cross contamination, unhealthy water supply and issues around distinguishing between potable and non-potable supplies. However using tanks for non-potable water supply is not necessarily discouraged and investigations have been undertaken to determine the benefits of using tanks to supplement the potable water supply. MWH Ltd has undertaken a study on behalf of TCC to consider options for water supply to the Papamoa East area; this included rainwater tanks and wastewater recycling as well as the Waiare Scheme. The MWH study identified that the cost differential between an additional water supply and requiring rainwater tanks was significant, therefore this option was not supported. TCC is currently interested in identifying ways to encourage rainwater tanks as a voluntary option.

6.2.3 Goals and targets

TCC's water efficiency target is to manage its current supply to provide for a growing number of water users. A key element of efficient water use is the reduction of leakages, as this results in a direct loss of revenue making this an important area for TCC to focus on.

The following targets are provided in the Long term Council Community Plan 2006–16:

- 70% customer satisfaction with water quality; and
- water losses should not exceed 15% of total production (from baseline of 11.3%)

6.2.4 Demand management approaches

6.2.4.1 Introduction of water metering

Water metering is recognised by TCC as having contributed significantly to the efficient use of water as consumers can moderate their usage in response to the volume used as reported by water bills. When water meters and volumetric charging was introduced in 2001, water usage dropped by at least 25%. The pricing of water is therefore identified as an important incentive.

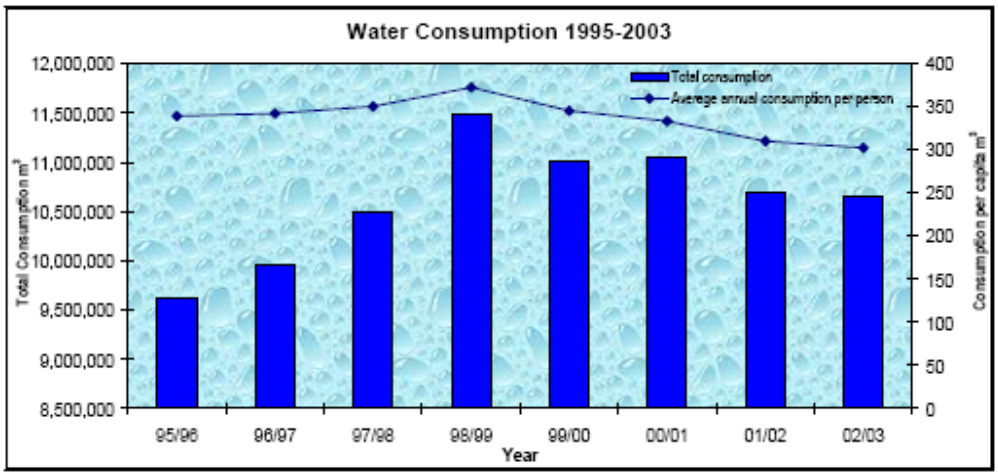
TCC sought to introduce universal metering through a referendum in 1996, after amalgamation of Mt Maunganui and Tauranga (Mt Maunganui was already metered). Although not supported by the community at this time, TCC continued to consider how meters could be introduced. To address the community's negative perception of metering, TCC promoted the fact that the introduction of water meters would help avoid the need to bring online an additional water supply, and sought to educate the public on the benefits of water metres—illustrating that the cost of water would in fact decrease for many households. This was achieved by comparing the price differential of the $226 annual charge for water in Tauranga and the average water bill in Mt Maunganui for using the same amount of water—which was almost half.

A progressive approach was then taken to installing meters, introducing policies by council resolution (at that time policies were not required to go through a special consultative procedure).

- In 1999 it was resolved to amend the Code of Practice for Development to include a meter as part of a water connection, requiring meters to be installed for each site at the time of subdivision.
- In 2001 a special policy was resolved introducing quarterly water billing from 1 July 2002 for all meters.

Currently TCC applies two charges for water, an annual base charge at $25 per household as part of the general rates, and then a separate water bill on a volumetric basis invoiced quarterly. Since the introduction of water metres, prices have not been increased. Through the LTCCP (2006–2016) TCC has indicated that it plans to increase prices over the next 10 years to $1.30/m^3 resulting in an average household of two adults and two children paying approximately $260.00 a year for 200m^3 of water.

TCC has included a policy in the "Asset Management Plan—Water" around monitoring to ensure meters operate efficiently. Water metering is also used to monitor what is happening on a site by site basis to identify leaks. This enables TCC to understand water consumption but data is not currently used for any other purpose. Electronic meter reading is being introduced to provide instant consumption to customers, reduce costs of reading, and provide more regular billing. Although it is not intended to use data for targeted demand management, the enhancement of the monitoring system could in the future be used to identify further water efficiencies.



Source: Asset Management Plan—Water, Tauranga City Council (2005)

Figure 8 Tauranga Water Consumption

6.2.4.2 "Waterline" Programme

The water conservation programme implemented by TCC is branded as "Waterline". Initially in 1997 the focus of the programme was to install free tap washers into households to reduce leaking taps in 1997. Based on voluntary mechanisms, the programme has developed with a focus on face-to-face contact with the community to raise awareness of water use. The full programme and branding of Waterline was established in 2001.

Water demand management is recognised by TCC as essential to extend the life of water resources and infrastructure in response to the significant growth of the city. Figure 8 illustrates the change in water production around the time water meters and volumetric charging for water use was introduced including leaks and commercial consumption. Figure 9 shows the change in average and peak daily production.[69]

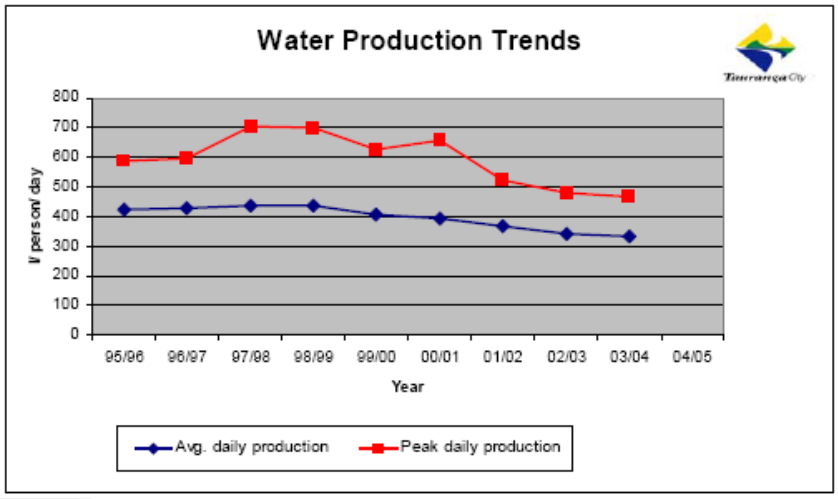


Figure 9 Tauranga Water Production Trends

Three staff are employed directly with the Waterline programme (two FTE) to provide advice to domestic and commercial customers. The programme is funded entirely from water charges with a budget of $83,817 in 2006/2007.[70] However, the programme is considered to save approximately $1 million for every year that the new water supply is delayed. The various elements of the programme are all funded as part of this budget with no political decision making processes required to implement them.

Waterline is a service driven conservation strategy, designed to promote the efficient use of water by:

- providing a range of advisory and support services to households and businesses
- schools programme
- improvements to system efficiency

The programme aims to change behaviour and present efficiency as a positive rather than a negative concept and to be inclusive—"Water—Let's Make Every Drop Count" being created as the brand. Council officers indicate that a conscious decision was made to avoid referring to global water shortages and focus on providing practical information to improve efficiency. The Waterline programme represents a direct action by TCC to meet its obligations under the RMA in terms of sustainable management of water resources.[71] The programme does not aim to

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69 Figures 8 & 9 Source: Asset Management Plan – Water, Tauranga City Council (2005)
70 Asset Management Plan—Water, Tauranga City Council (2005)
71 Waterline—Getting the Water Efficiency Message Across, Tauranga City Council (2001)

reduce the average annual demand, and the LTCCP assumes that water consumption will remain constant over the next 10 years.

Waterline has been promoted through press, radio, schools, Council publications, addresses to service groups, cinema advertising, displays and fridge magnets. Research undertaken by TCC on communication of the strategy found that face-to-face contact with the community has had a sustained effect, while advertisements in one-off publications and articles provide useful stimuli but with relatively short-term impact. Between 1998 and 2004, 8,700 households were visited and 13,000 school children participated in the schools programme.[72]

TCC intends to continue Waterline over the next 10 years—pursue international best practice in the area of water demand and water loss management, and align customer awareness programmes to suit.

6.2.4.3 Advice to households

Free assistance is provided for fixing leaking taps and complementary measures to reinforce actions, such as meter testing, gizmos and aerators. Providing a free service to replace tap washers has provided opportunity for face-to-face contact within the home, enabling a review of water use including identifying leaks and discussion around efficiency. A variety of channels are used to reach different segments of the community including presentations to community groups, which result in word of mouth dissemination of information and people contacting the domestic advisor for advice. The domestic advisor is able to share experiences and practical solutions amongst his customers. Through the implementation of water efficiency measures or testing of star rated appliances, the domestic advisor has also developed a table outlining the cost savings that can be achieved through improved efficiency. This way the figures are relevant to Tauranga, rather than using international standards.

The domestic water advisor uses a van to meet with members of the community, which acts both as advertising of the Waterline programme but also as a reminder of water conservation measures. Other triggers provided to households to continue reminding them of water conservation includes fridge magnets and toothpaste squeezers. In addition, a mobile display vehicle has been introduced that can be driven to shopping centres and events to provide information on water conservation and demonstrations. The vehicle, (see Figure 10) is branded to provide ongoing advertising and includes displays on leak detection, metre reading and water efficiency devices.

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*72 **Asset Management Plan—Water, Tauranga City Council (2005)***

Figure 10 Allan Dale Domestic Advisor

A Waterline information pack is available for the public and contains information sheets on the programme, water use in the garden, how to fix leaking toilets and taps and how to test shower efficiency. Included with the information sheets is a plastic bag to measure water flow from a shower, tap washers, and a fridge magnet.

6.2.4.4 Schools Programme

An education programme has been specifically developed for TCC since 1999, and provides three modules for years 5–8 called “Water—Let’s make every drop count”. The programme provides activity books for each of the modules that explain the water cycle and how water is used. Tasks involve measuring the water use at home, changing tap washers and answering questions on how to reduce water use at home.

The schools’ Waterline programme was established in 1998 and is wholly funded by TCC. It has its curriculum reviewed regularly to keep it relevant and to ensure it continues introducing new water conservation concepts. Within the first three years the programme had been delivered to 29 schools.

Audits are undertaken, identifying savings opportunities. It is then the property owner's decision to install devices. Audits are usually undertaken by schools and club premises.

6.2.4.5 System efficiency programme

Focusing on system efficiency ensures that the bulk water supply is being appropriately allocated and is not being lost through leakage. A water loss monitoring programme achieves the international benchmark standard of 100l/pd. Over the past five years TCC has maintained a low Infrastructure Leakage Index (ILI) of between 1–1.5, with 1.04 achieved in 2005/06. ILI is a measure of the effectiveness of management of real losses from the network infrastructure (ratio of real losses to unavoidable losses). In a “perfect” system the ILI would be 1.0. As a percentage of total water supply, non-revenue water loss was 13.4% in 2006/07 and achieves TCC’s target of less than 15%. However the following work is being undertaken to reduce non-revenue losses:

- Flow testing, on-going maintenance, leak detection, property audits, backflow/cross connection.
- Leak detection is being identified through meter movement; a non-metallic pipe locator for use on plastic piping was purchased to assist in the location of leaks as often property owners don't know where pipes are located.
- A more detailed demand management strategy is being developed.

6.3 Case Study—Kapiti Coast District Council

6.3.1 Key findings

- Kapiti has taken a strategic approach to managing its water supply by taking a 50 year view, beginning by recognising the finite limits of the resource within Kapiti's catchments and making decisions accordingly.
- Rainwater tanks and greywater systems are being actively encouraged and being considered as a requirement in all new developments.
- A demand management approach is integrated into the ethos driving supply.
- Community buy-in to demand management has largely been achieved through ongoing consultation.
- Plan change provisions are backed up with robust scientific data.
- Strong community backlash against the introduction of water metering.

Summary of Water Demand Management activities

- Green Plumber: 10% of homes visited, household water education opportunity, leak reduction, popular community service, can reach lower income households, minimal investment for good return, annual investment $13,000 plus salary.
- Green gardener: opportunity to target schools and homes with small investment for good return, popular with the community, changed behavior for outside water use and reduced summer peak flows, annual investment $8,000 plus salary.
- Advertising water restrictions: promotes water conservation during the summer dry spells and ensures that demand remains below supply capacity with an annual investment of $8,500.
- Have consulted via the LTCCP on demand management
- Have introduced a Subdivision Code of Practice which promotes low impact urban design
- Water conservation brochures: easy to distribute through the rates bills, educative tool with potentially long-term benefits through behaviour change and minimal up-front cost.
- District Plan Change: potentially excellent long-term water conservation achievable, anticipated 40% per capita reduction for new homes deferring the need for capital expenditure.
- Household water conservation measures: modelling for Kapiti suggests that dual flush toilets can save between 20 and 31% of toilet water use and low water use washing machines reduce water use for that purpose by 50% giving approximately15% reduction in household water use.

6.3.2 Introduction

Kapiti Coast District Council (KCDC) has made significant improvements in the field of water demand management in recent years. The shift to a more holistic system of managing water constraints in the region should bring considerable benefits to the District financially, environmentally and socially over the coming decades. The KCDC case study quite probably provides the best demonstration of the extent to which a council can start to turn around a traditional approach to managing an urban water system to taking a more sustainable approach—principally through the use of robust contextual analysis coupled with some courageous leadership. From considering only traditional approaches to managing its water supply to becoming something of a trailblazer for demand management in New Zealand in just a few short years, the Council's initiatives are already having a roll-on effect. Other councils are now starting to look at the lessons from Kapiti and its decision to use demand management approaches to defer capital investment.

6.3.3 Background information

The Kapiti Coast District has experienced steady growth in population during the 2001–2006 census period, a continuation of the trend for the area since at least 1991[73]. The "usually resident population" increased by 8.8% during the last five year period, following a 10% increase in the 1996–2001 period. This compares with the Wellington regional average of 5.9% for the same time period.[74] The usually resident population for Kapiti now sits at 46,200 (2006 census figures) and could well break the 50,000 mark by the next census in 2011. Unless growth increases in Porirua City it is also likely that KCDC will overtake it as the third most populous territorial authority in the Wellington Region by 2011. The effect of these growth pressures on the water supply for the district need to be carefully managed and this is driving many of the water saving initiatives being seen in Kapiti.

The five main townships on the Kapiti Coast include: Paekakariki, Raumati, Paraparaumu, Waikanae and Otaki. The Paraparaumu/Raumati and Waikanae settlements account for 74% of the usually resident population, Otaki 14%, Paekakariki 4% and other rural areas make up the final 7% of the population.

6.3.4 Goals and targets

Water use in the Kapiti District has traditionally been high, due in part to its moderately dry climate (800-900ml annual rainfall) and sandy soils with outdoor uses being a major driver of summertime peak demands. KCDC operates water supply systems in the four main urban areas and also in Paekakariki. The system is comprised of three surface water intakes, eight groundwater bores, eight treatment plants and eight pumping stations, ten service reservoirs, trunk mains and distribution reticulation (KCDC, 2000). Otaki has two bores for the town system and the Waitohu Stream for the Plateau area. Waikanae, Paraparaumu and Raumati abstract water from the Waikanae River and during dry periods can draw on water from the

73 KCDC. 2006. "Community Profile—Census 2006". Kapiti Coast District Council, 2006.
74 Ibid.

Waikanae borefield. Despite very high per capita water use in the Otaki catchment, of these two systems the demand management initiatives being used by KCDC mainly seek to reduce water consumption from the Waikanae catchment.

The council has proposed to make a district plan change under the RMA that would see the mandating of rainwater tanks and/or a greywater system for all new residential development in the district. This would make Kapiti the first council in the country to require a greywater recycling system and is a marked turnaround from the Kapiti Council of the 1970s that had a policy of actively incentivising households to remove their rainwater tanks or bore water supply and connect instead to the mains water system.

In fact the Council's present emphasis on demand management and water conservation has in no small way been driven by earlier criticism of a strategic decision to pipe water across catchments to provide the ability to increase supply. The lack of consideration for other approaches to meet demand led to an enquiry into the Council's water system practices by the Parliamentary Commissioner for the Environment in 2001. In that report, "Whose Water Is It?—The Sustainability of Urban Water Systems on the Kapiti Coast" the plan to supplement (via a pipeline) water supply for Waikanae, Paraparaumu and Raumati by piping water from the Otaki catchment was criticized for a number of reasons including:

- the lack of an integrated approach to water management
- the need to examine water conservation and metering in more detail
- uncertainty over the future of the Otaki River and the potential for negative impacts on the "mauri" of the river
- the potential for ecological impacts if the water take keeps increasing; and
- the mixing of water between catchments.[75]

The Council's decision to favour the building of a pipeline that would mix waters from two catchments was also unpopular with local iwi who claimed that the Council's consultation processes had shown disregard for their interests and role as kaitiaki for the river systems in question. This prompted the iwi to request the PCE's investigation.

The PCE's investigation highlighted that the Council had not investigated the potential for demand management approaches despite Kapiti having some of the highest per capita water use figures in the country. The PCE applied principles and concepts developed in an earlier piece of work, the Ageing Pipes and Murky Waters report, to critique the Council strategy and concluded their approach was "strongly traditional with some components moving slowly towards a more sustainable system"[76]. The Council is to be commended for taking up the

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75 ***Parliamentary Commissioner for the Environment. 2001. "Whose Water Is It? – The Sustainability of Urban Water Systems on the Kapiti Coast", Parliamentary Commissioner for the Environment, Wellington.***

76 ***Ibid Parliamentary Commissioner for the Environment. 2001. "Whose Water Is It? – The Sustainability of Urban Water Systems on the Kapiti Coast", Parliamentary Commissioner for the Environment, Wellington.***

challenge issued by the PCE to rethink their water policy and has gone a long way to fulfilling the two key recommendations made by the PCE, those being:

1) *To develop and implement a long-term water services strategic plan in consultation with tangata whenua, the Kapiti community and other stakeholders such as the Wellington Regional Council and the Regional Public Health Service.*
2) *To investigate opportunities for improving integrated water catchment management planning in both the Otaki and Waikanae Rivers and catchments (this recommendation was made to both KCDC and the WRC).*

KCDC published its Sustainable Water Use Strategy, "Water Matters", in 2003, largely as a response to the PCE enquiry. The document sets out a vision for the management of the District's water resources over the next 50 years. Importantly the strategy advocates for a demand management approach being a central plank in the Council's overall water supply strategy.[77] It states that supply for the area is to be secured within a framework of demand management.[78]

> *"The strategy also seeks to shift from a reactive approach to water management to one of leadership… This strategy takes up this leadership challenge by attempting to develop a more cohesive, comprehensive and holistic approach to water management."*[79]

From that position the Council has moved through a range of demand management solutions, with a view to reducing overall per capita demand down to 400l/pd (based on a peak demand standard of 650l/pp/pd and a 435l/pp/pd average demand). The reduction target is therefore in the area of 40% of present peak consumption.

6.3.5 Key demand management approaches

A major initiative is obtaining the mandatory inclusion of rainwater tanks and/or greywater systems in new homes. Kapiti also runs a range of other water conservation programmes. These include the use of billboards, pamphlets or public information/newspaper and radio advertising over summer, offering a free Green Gardener and a Green Plumber service, and an annual garden show that focuses on water efficient gardening practice. Water restrictions are also put in place over the dry summer months.

6.3.5.1 Proposed District Plan change

The Council's proposed "District Plan Change 75: Water Demand Management" suggests that the district has enough capacity to supply water for new development for at least the next 45 years, assuming demand management approaches are utilised. With no demand management the

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77 ***The Council's demand management is also reported on in Beacon Pathway Report TE106b, "Water Retrofit Programmes".***

78 ***Kapiti Coast District Council. (2003). "Water Matters – Kapiti Coast District Sustainable Water Use Strategy". Kapiti District Coast Council.***

79 ***Ibid***

limit will be reached in 20 years with some immediate pressures to be felt before 2008. To help achieve that KCDC has had a high level of public consultation, identification of the issues in the LTCCP, a Sustainable Management of Water Strategy, and newsletters and fact sheets, all of which have prepared the community for mandatory water conservation measures within the District Plan.

As stated earlier, Kapiti's strategy is focused on reducing the average peak demand for reticulated potable water to 400l/pp/pd by 2013. This figure accounts for 250l for essential uses and 150l for non-essential uses.[80] The Council notes that these figures are still high in comparison with many other councils. For example, Waitakere City Council has an average daily per capita use of 168l/pp/pd[81] and Christchurch City is at about 333l/pp/pd[82]. There is therefore the opportunity to achieve greater reductions in the overall target further down the track.

For KCDC, the Waikanae, Paraparaumu and Raumati centres are key water management areas as these rely on supply from the more constrained Waikanae River system. These areas currently have access to 23,000m^3 of water per day from either the river, borefield, or combination of both.[83] The current resource consent abstraction of water from the river, granted by the Greater Wellington Regional Council, means that water cannot be taken from the supply if residual flows fall below 750 litres per second.[84] When the Waikanae River flow falls below 1,000 litres per second, the Council uses water from the Waikanae borefield to supplement the river intake.[85] When the river flow rate falls below 705 litres per second, the water supply relies completely on the borefield. Council can take up to 23,000m^3 from the borefield for a period of 90 days.[86]

KCDC in conjunction with Newcastle University and SKM Consulting, utilised the PURRS method (Probabilistic Urban Rainwater and wastewater re-use simulator) to model the likely demand for water into the future and to ascertain the potential savings possible by utilising demand management approaches such as those stated. The PURRS tool was developed by Professor Peter Coombes of Newcastle University in Sydney. The performance of rainwater storage tanks was undertaken by modelling a range of tank sizes being utilised for a range of different end uses. The model found that for a 200m^2 house occupied by three people in a Kapiti-like climate, a water tank would provide the following savings in average demand:

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80 KCDC, Water Matters.

81 Waitakere City Council, Pers Comm. 2007.

82 Christchurch City Council. Pers Comm. 2007.

83 KCDC (year), "Waikanae/Paraparaumu/Raumati Water Management Plan", KCDC.

84 Ibid KCDC (year), "Waikanae/Paraparaumu/Raumati Water Management Plan", KCDC.

85 Ibid KCDC (year), "Waikanae/Paraparaumu/Raumati Water Management Plan", KCDC.

86 KCDC, Pers Comm. 2007

Tank size (litres)	% Saving: Tank connected to toilet and outdoor tap	% Saving: Tank connected to toilet, laundry and outdoor tap
4,420	26.5	35.3
5,681	28.6	38.6
8,475	31.1	43.1
12,000	32.6	45.7
15,535	33.5	47.3

Table 3 Water savings related to tank size

The Council also found that:

- All the tanks provided a significant saving over the course of a year.
- Utilising rainwater tank water for laundry significantly increases the efficiency and water savings of the system.
- The savings increase with the larger the storage tank; however benefits in relation to costs start to flatten out over the 8,475m^3 size tank.
- The modelling suggests that the size of the tank should be based on the size of house rather than the number of bedrooms as this is not necessarily correlated to the number of occupants.
- Rainwater tanks have less impact on peak demand as a 10,000 litre tank can be emptied out in a few days if used for outdoor irrigation.[87]

The performance of greywater systems was also assessed. The system is intended to be utilized for irrigation uses alone with water being sourced from bathroom sinks and laundries only as these are considered a much lower health risk.

Modelling showed that greywater systems could reduce average demand by a further 20% so that overall water savings when combined with the use of a rainwater tank reached 40%. Perhaps even more importantly the greywater system provided the Council with a much better solution for reducing peak flow demands.

Figure 11 below demonstrates the effect of a 12,000 litre rainwater tank plumbed for toilet, laundry and outdoor uses alongside a 4,420 litre tank plumbed for indoor uses and a greywater system for outdoor uses. As can be seen again, the greywater system has far greater effect for reducing peak daily demand.

[87] ***KCDC, 2007. "Proposed District Plan Change 75".***

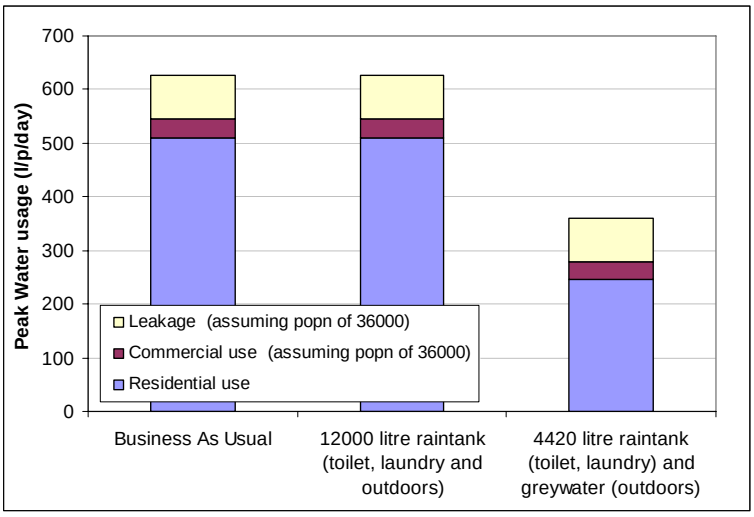

Figure 11 Impact of three scenarios on peak flows

Some of Kapiti's conclusions are:

- Rainwater storage tanks reduce average load if used to supply toilets.
- Rainwater storage tanks have limited impact on peak demand.
- Rainwater storage tanks and greywater re-use combined have a significant impact on peak demand.[88]

The Council notes that the greywater system provides significant reductions in peak demand combined with a reduction in base load. The other benefits the Council identifies within its RMA Section 32 cost/benefit analysis required for the plan change includes:

- The presence of (4,500+) rainwater storage tanks on residential properties increases community resilience in the event of natural disaster.
- The tanks provide additional storage for stormwater and can help manage smaller storms by smoothing the discharge.
- There are potential savings in infrastructure costs through a reduction in the need for additional treatment and storage facilities.
- There is an improved level of service when compared to current provisions for rezoned land as they will enable an unrestricted supply to be provided for indoor use.
- The presence of rainwater tanks on private sections reinforces the need to use water wisely.

The Kapiti plan change raises concerns around the lack of national standards for greywater re-use in New Zealand but Kapiti is using the New South Wales Health Greywater documents as an interim standard until a national standard has been developed. KCDC aim to have complying greywater systems installed in accordance with the New South Wales standards for Pump

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88 Kapiti District Council (2007), Proposed District Plan Change 75: Water Demand Management".

Diversion Devices, specified in Part B of the NSW Government's *"Guidelines for Greywater Re-use in Sewered Single Household Residential Premises"*.[89]

The conclusion of KCDC with respect to the plan change is therefore to offer two "acceptable solutions". One option will be for developers to install a 10,000 litre tank without a greywater system. This option would achieve a 30% reduction in base load but would do little for reducing peak flow demand. The second option is to allow a smaller 6,000 litre raintank to be installed coupled with a greywater dispersal system for outdoor subsoil irrigation. This solution reduces base load but as explained has the added benefit of reducing peak demand. Developers have generally indicated a preference for the greywater systems, and KCDC has already seen one new subdivision utilize the system.

Kapiti expects the cost of a 4,500 litre tank and greywater system to be approximately $5,500 (installed) whereas a 10,000 litre tank would be around $6,200 (installed), though there would be additional costs for buried tanks. These figures are high by some estimates. Both options are thought to be around 2.5% of the average cost of building a 200m^2 house.

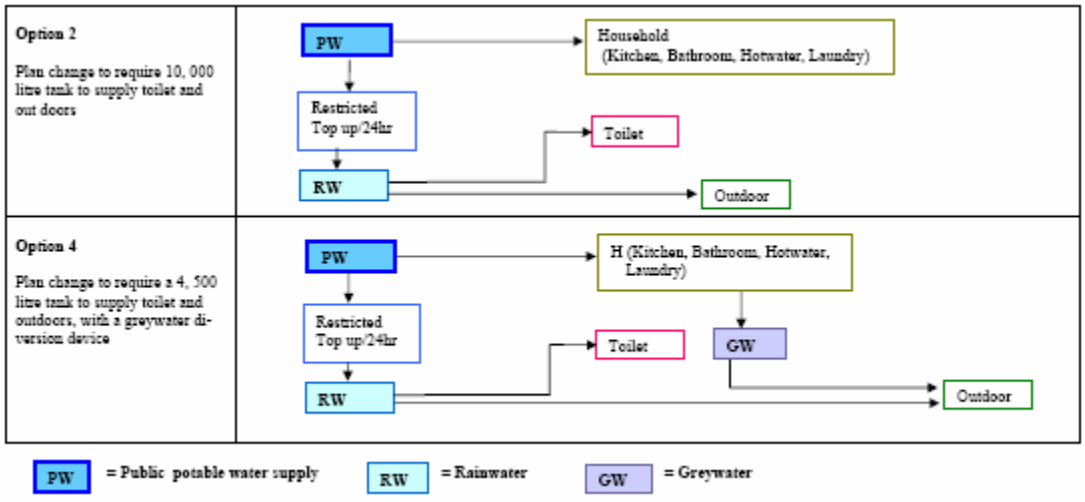

Figure 12 The preferred raintank/greater options for Kapiti District Council

Under the proposed system rainwater tanks would be automatically topped up by the mains supply system at a rate of 600l/pd.

Figure 13 below demonstrates the modelled reduction in average water usage using the same two scenarios used in Figure 12. As can be seen both systems significantly reduce mains water use with the greywater system and smaller rainwater tank offering the most significant overall reduction.

89 KCDC, Pers Comm. 2007.

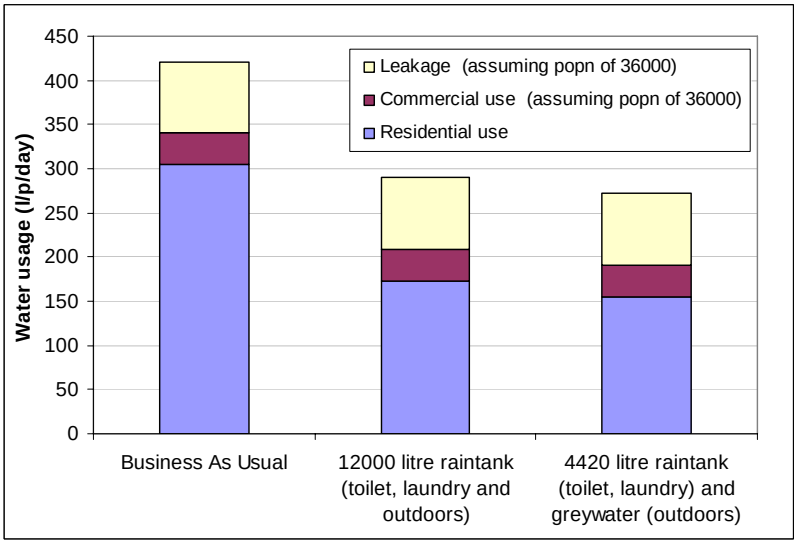

Figure 13 Average reductions in mains water use in two scenarios

Finally, Figure 14 demonstrates the relative merits of using rainwater for laundry use as opposed to just toilet and outdoor uses. The addition of laundry use can clearly have a significant effect, however the Council is concerned about reports from the North Shore that rainwater from tanks had in some instances been responsible for the staining of clothes and so may not pursue that option.[90]

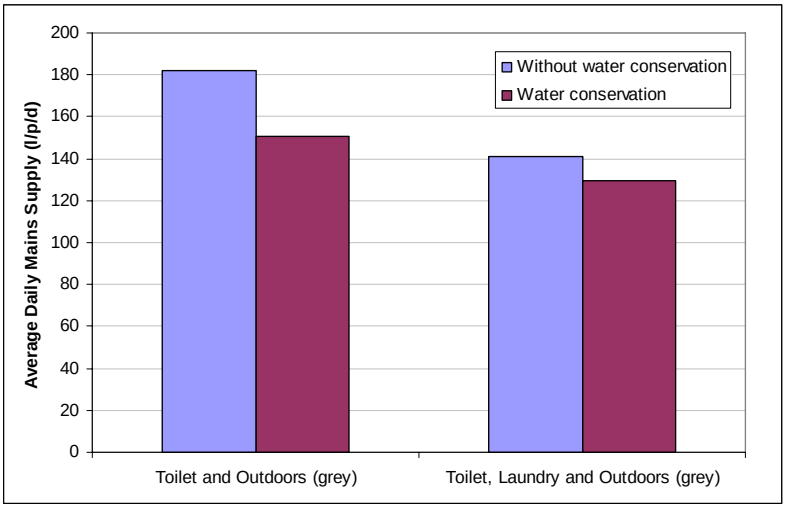

Figure 14 Addition of laundry use

In conclusion, with respect to the plan change being pursued Kapiti has demonstrated a good deal of rigour with ensuring that its preferred solutions are backed up with sound reasoning and science. In addition the council also works hard to keep the community abreast of where the water conservation programme is heading, particularly around the perception that privatisation

90 Kapiti District Plan Change 75.

of the water supply would necessarily follow any introduction of metering and volumetric charging.

6.3.5.2 Kapiti Coast Expo—Our Place Our People

Kapiti District Council runs a biannual expo aimed at providing the community with high quality advice for achieving water conservation goals by considering the types of gardens most appropriate for the weather conditions in Kapiti. The expo enables residents to discuss their issues with specialists in the field of eco-garden design.

The cost of running the show is approximately $50,000, about two thirds of which is met by the Council and the other third met by sponsorship and business partnerships. The focus is no longer solely on water issues, but is moving to a broader appreciation of a range of sustainability issues facing the district. Promotion for the event costs the council about $7,000 and roughly 20% of attendees come from outside the district. KCDC sees that the benefits from the expo accrue over the short, medium and long term, largely through improved community buy-in to rethinking the style and types of gardens appropriate for the district, remembering that outdoor water use in the summer is the biggest challenge for the Council to keep its peak water demands underneath the maximum allowable daily intake.[91]

6.3.5.3 The Green Plumber and Green Gardener services

Kapiti District Council also funds a green plumber and green gardener service. The Green Plumber is funded through the Customer and Assets Group and works on average about 10 hours per week. The Council estimates that the plumber has reached about 10% of existing households. Residents in the area can book the service by phone or through the Council website.

The cost of running the service is $13,000 per year, and the plumber will often work in households that would otherwise struggle to afford the cost of a plumber. The service principally includes fixing leaks by changing washers. The plumber also plays an educative role by talking to households about how they can save water in and around the house.

Whilst the level of water savings achieved by the programme are hard to quantify, there is certainty that the service can have a significant impact on water conservation efforts. In one extreme instance a household leak that was losing around $24m^3$ of water per day was fixed once the green plumber identified the leak and referred the job to a plumber. The leak had been ongoing for a number of years.

The Green Gardener is a service that involves employing a part-time well-known local organic gardener. In 2007 the focus of the programme has been on encouraging organic gardening in schools but in the past has also involved going into existing gardens and improving the design and layout to reduce the level of watering required. This is achieved through promoting the use of more water resistant plants, better garden design, and education about organic materials such as mulch which assists with preserving moisture levels in Kapiti's sandy soils. The annual cost of the programme is $8,000, paying the gardener $30 per hour.

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91 KCDC, Pers Comm. 2007.

6.3.5.4 Water conservation brochures

From time to time Kapiti produces water conservation brochures either for sending out with rates bills and/or for use in libraries, Council or other public places. KCDC says the brochures provide good information about water conservation available but are not a particularly strategic approach as it is uncertain how many people actually read them and to what level the measures are taken on board.

The cost of producing 2,000–3,000 brochures when designed in house is between $1,000 to $2,000. Taking the design out of house is likely to increase the cost but might mean the final output is of a higher standard. Kapiti assumes that their voluntary water programmes will reduce consumption by about 3–4%.

6.3.5.5 Water restrictions

Every summer KCDC has to apply water restrictions in the Waikanae catchment to ensure that water taken from the river stays below the 23,000m^3 per day limit set up by the Wellington Regional Council. The Council's success in achieving this for a number of years despite a growing population is testament that the programmes are effective. The water restrictions usually occur between December and April and are promoted through three advertising mediums: billboards, radio and newspapers. Annual costs for running the water restriction advertisements are about $8,500 annually.

With the ability to supplement supply in the Waikanae catchment due to the borefields, the Council says it has been able to soften the message with its advertising and is moving from less "heavy" language to a more positive reinforcement of the message. Hence "sprinkler ban" has been replaced with "hand held hoses at any time" and "evening sprinkler use" is now used as opposed to "sprinkler restrictions".

6.3.5.6 Household water conservation

Kapiti also used the PURRS model to demonstrate potential household savings through the use of in-house water conservation measures. This considered the use of dual flush toilets, water efficient washing machines, low-flow showerheads. A breakdown of savings from each is given in the table below. Total benefits associated with household water conservation are estimated to be 15% of total indoor water use.

Water Saving Device	Percentage Saving
Dual flush toilets	20–31
Water efficient front loading washing machine	51
Efficient showerheads	20

Table 4 Summary of water savings from water efficient appliances

6.3.6 Issues with water metering

Kapiti has signalled an intention to meter for water for close to a decade. The capital cost of installing the meters is expected to be $8 million for the district; however there is a great deal of

political debate about the merits of universal metering within the community with a number of people associating the measure with privatization.[92] Others have concerns about the equity issues associated with metering with one article headlined, “Paying for water—the rich will fill pools”.[93] There are also letters of support for metering while others suggest that water conservation is very important to the community and would provide a cheaper and better mechanism than metering.

In this regard there appears to be a climate of suspicion within a section of the community about metering and a Kapiti Water Action Group has been set up to oppose universal metering. A spokesperson for the group suggested that: “the conservation argument was being used as a Trojan Horse to introduce water metering and user charges and once they were in place private public partnerships (PPPs) would be initiated”.[94]

92 The Kapiti News has published a number of articles and letters about water metering

93 Gurunathan, K. (2007). “Paying for water: ‘the rich will fill pools’”. Kapiti News, Thursday August 9, 2007.

94 Ibid. Gurunathan, K. (2007). “Paying for water: ‘the rich will fill pools’”. Kapiti News, Thursday August 9, 2007.

6.4 Case Study—Auckland City Council

6.4.1 Key findings

- Important to ascertain the economic value of water conservation to focus efforts on most effective water demand management.
- Metering introduced by council resolution and supported by bylaw.
- Focus of water conservation programme is on reducing unaccounted for water—leak management.
- Recognises an apparent price elasticity for volumetric water charging.
- Wastewater charging is identified as the most significant demand management initiative.
- Segmentation of customer base to understand how to influence water demand will assist.
- Developing a "third pipe" scheme to reticulate treated stormwater to a non-potable standard to supply to toilets and outdoor taps, being applied at the Mt Wellington quarry development.
- Water supply constraints is most significant issue—a new supply required by 2026.

Summary of demand management approaches

- Lead the industry in the implementation of wastewater volume charges, which in Metrowater's experience has been the most significant demand management initiative.
- Promote water-efficient appliances, both through supporting water efficient appliances legislation and through the investigation of water efficiency rebates through the network upgrade charge.
- Promote customer behavioural change, through an education/incentive based marketing campaign.
- Monitor the elasticity of tariff changes, and through the calculation of the long-run marginal cost of water.
- Understand current consumption patterns and drivers.
- Continue with existing initiatives, such as the reduction of Non Revenue Water and pilot third pipe water reuse initiatives.

Source: Metrowater Asset Management Plan 2007

6.4.2 Background information

Auckland City is the largest territorial authority in New Zealand, with a population of 404,658 (2006 Census). Between 2001 and 2006 population growth of 10.0% was experienced compared with a national growth rate of 7.8%.[95] Auckland's growth is largely occurring through intensification as the city has few greenfield development areas.

Auckland City's population is expected to increase by the equivalent of Wellington or Hamilton by 2021, with an additional 140,000 people (using the medium population growth scenario—see Figure 15). The Auckland Region is expected to grow by 40% over the next 20 years (2026).

95 *Statistics New Zealand, 2001 Census*

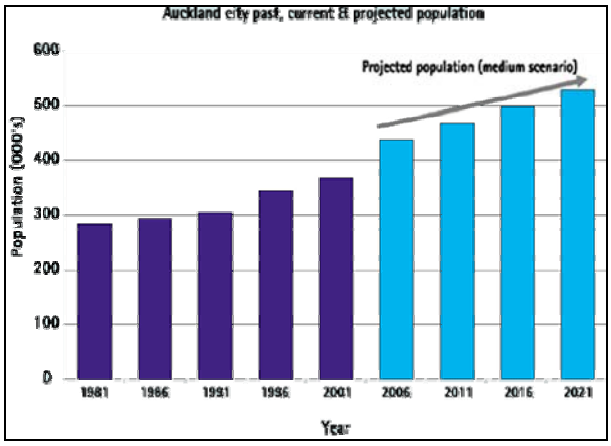

Figure 15 Auckland City Population Projection to 2021[96]

Auckland City is situated on a narrow isthmus between the Manukau and Waitemata Harbours, with 11 volcanic cones. The city includes the Hauraki Gulf Islands, such as Waiheke and Great Barrier, as well as a number of smaller uninhabited or marginally inhabited islands. While the isthmus is fully reticulated, the islands are not reticulated and rely largely on rain tanks for water supply.

Water supply in Auckland City is managed by Metrowater, established in 1997 as a Local Authority Trading Enterprise—now known as a Council Controlled Organisation as Auckland City Council's water and wastewater utility. Auckland City Council is the 100% shareholder of Metrowater. Bulk water supply is purchased by Metrowater from Watercare Services Limited, also a council controlled organisation—established in 1992 and owned by the six territorial authorities within the Auckland Region (Auckland 41.6%, Manukau 25.1%, Waitakere 16.7%, North Shore 11.5%, Papakura 3.7% and Rodney 1.4%).

Metrowater has a total of 420,000 customers (residential and business) and supplies 54 million m^3 water per year.[97] Domestic water consumption is identified by Metrowater to be 1,84l/pp/pd (2007)—Figure 16 illustrates the comparative domestic water consumption in the Auckland Region in 2005/2006.

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96 Source: http://www.aucklandcity.govt.nz/council/documents/growthstrategy/part2.asp

97 Statement of Intent 1 July 2007 – 30 June 2010, Metrowater (2007)

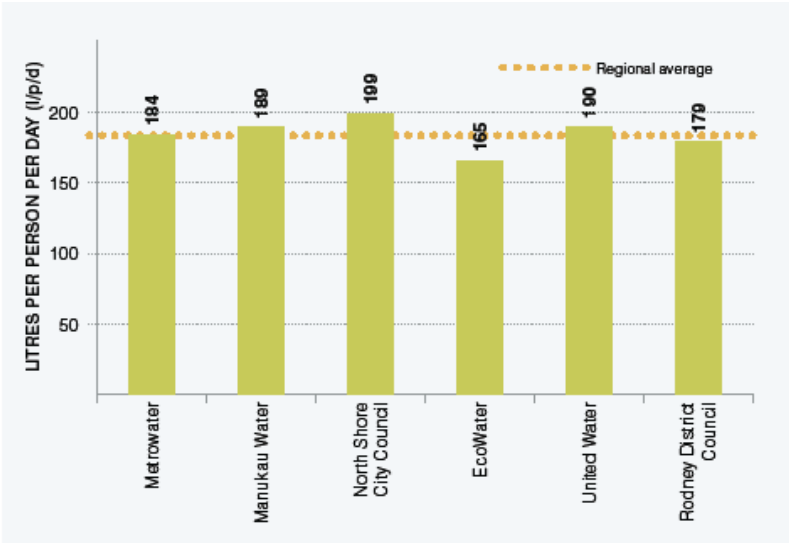

Figure 16 Comparison of domestic consumption in the Auckland Region 2005/06[98]

Both Metrowater and Watercare are subject to a Statement of Intent that defines the strategic direction and key objectives, which are agreed every three years in accordance with the Local Government Act 2002.[99] In addition to goals and objectives, the Statement of Intent for Metrowater also defines the profit targets and dictates that all profits not reinvested in the business must be paid to the Council as a charitable payment.

The cost of operating the water reticulation network and water supply in Auckland City is paid for through water and wastewater charges (including a service charge), in addition to any development and financial contributions from new development to pay for growth.

Water supply to the Auckland Region is primarily sourced from 10 dams; five dams in the Hunua Ranges (60%) and five dams in the Waitakere Ranges (25%), with additional sources obtained from the Waikato River (10%) and the Onehunga aquifer (5%). Auckland's water supply is a gravity/pressure fed system, with the Ranges and the volcanic cones creating a variety of water pressure zones.

Water supply to Auckland City is generally sourced from the Hunua catchment and the Waikato River, while the south western suburbs are supplied by the Waitakere catchment. Water sourced from the Onehunga aquifer only supplies the area of Onehunga. Water is treated at one of six treatment plants and then fed to reservoirs throughout the region.

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98 ***Source: Metrowater Annual Report 2007***

99 ***Local Government Act, Section 64 and Schedule 8***

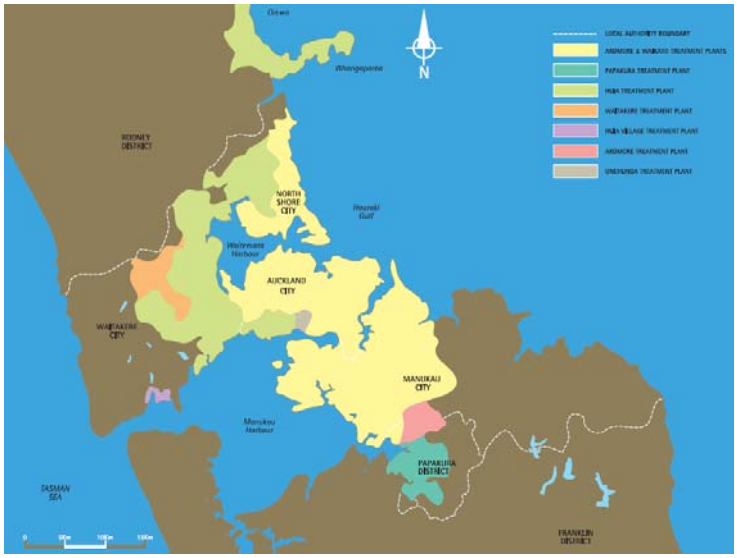

Figure 17 Auckland Region water supply distribution[100]

The Waikato River water source was established in 2002 and is taken from near the mouth of the river before it discharges to the sea. Water is treated at Tuakau by a four stage ultra-filtration process using membrane filters and is one of the most advanced in the southern hemisphere. Currently a total of 75,000m³ daily is supplied by the Waikato pipeline with a total capacity of 150,000m³.

The Onehunga aquifer was developed by the former Onehunga Borough Council and is pumped from the Onehunga springs, treated, then pumped to the level required for supply in the Onehunga area. In 1997 the capacity was increased to 21,000m³ per day.[101]

Water supply constraints

In 1994 the Auckland Region experienced a severe water shortage, and this event is identified by the Regional Water Management Plan as having had a significant impact on the way water is now managed and used. Immediately prior to the water shortage gross (including non-domestic) per capita water consumption in the region was about 330l/pp/pd. Today this figure is 300l/pp/pd and a wide range of demand savings initiatives have been implemented since 1994 (low flow devices, dual flush toilets, rain tanks for non-potable supply).[102]

In addition to water demand initiatives, the 1994 water shortage initiated serious consideration of an additional water supply to provide drought security, and resulted in the development of the Waikato pipeline to supplement the existing supply in 2002. However, this supply will not be sufficient for future demand and a further water source will be required by 2026. Future water

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100 ***Source: From the Sky to the Sea***

101 ***http://www.watercare.co.nz/default,102.sm***

102 ***From the Sky to the Sea, Watercare (2004)***

supplies are programmed in the Asset Management Plan, and work to bring a new water supply on-line will commence by 2012.[103] Figure 18 illustrates the water demand projection to 2067.

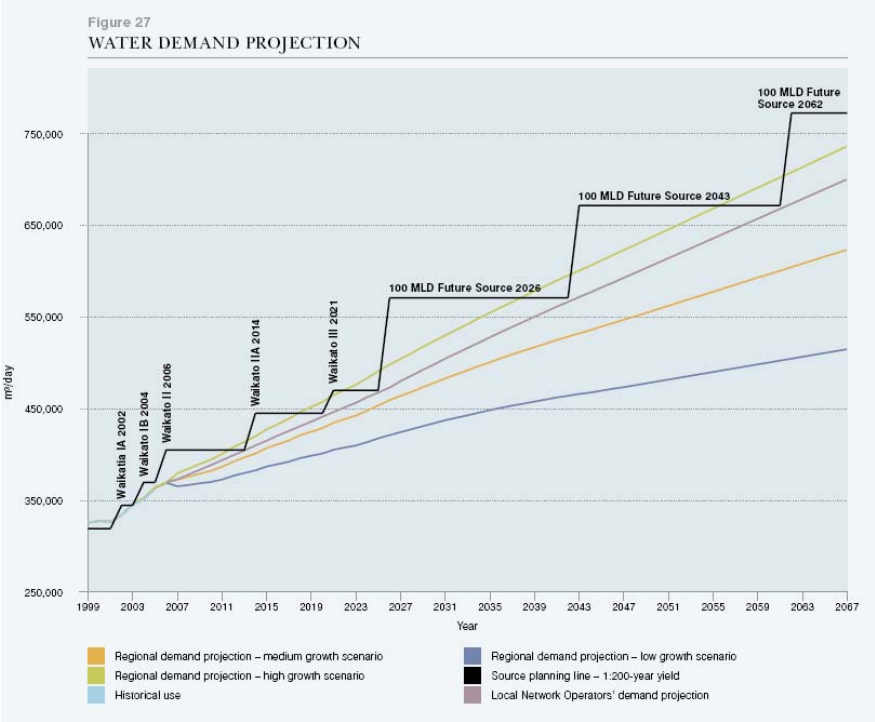

Figure 18 Auckland Water Demand Project[104]

Although it is identified that water conservation to reduce water use would contribute to deferring the need to bring online future additional water supplies, Metrowater does not consider that demand management will have a significant influence on the timing of the scheme due to the high growth rates still being experienced in Auckland.[105] However, Watercare indicates that deferral of additional water supplies would result in interest cost savings in excess of $26m per annum.[106]

6.4.3 Key demand management approaches

As Metrowater is first and foremost a business established to supply water, it is not necessarily part of its ambit to consider alternative water supplies such as rainwater tanks. However opportunities for alternative water sources are starting to become relevant, such as reticulation of greywater and rainwater tanks.

103 Asset Management Plan, Metrowater (2007)
104 Source: Metrowater Annual Report 2007
105 Annual Report, Metrowater (2007)
106 Asset Management Plan, Watercare (2007)

6.4.3.1 Rainwater tanks

Metrowater has a development contribution rebate for rainwater tanks for stormwater detention, $1,000 + GST as of 2007. From the manual[107] it would appear that they provide for the use of that tank water for non-potable internal use as well. However Beacon's report PR200[108] identified that the Auckland regulatory process was not especially supportive of urban residents installing rainwater tanks.

The Housing NZ redevelopment of Talbot Park at Glen Innes have included rainwater tanks and were funded by a $550,000 grant from Infrastructure Auckland to implement a range of Low Impact Urban Design Devices with the aim to use the development as a demonstration project.

6.4.3.2 Third pipe

A recent initiative in Auckland City involves the reuse of stormwater to provide a non-potable reticulated water supply to households via a "third pipe". This has been implemented at the new Stonefield housing development near Lunn Avenue (Mt Wellington Quarry) to manage stormwater rather than to conserve water.

Stormwater from the development is filtered into the ground through swales and then feeds into a wetland system at the lowest point of the catchment. Water is then treated to a non-potable standard and pumped to reservoirs at the high point of the site, and reticulated by the third pipe to households.[109]

The infrastructure has been designed and is being installed by Landco as the developer, and will be vested with the Auckland City Council—it will then be transferred to Metrowater who will own and operate the system. Houses are designed to switch from drinking water to non-potable water for toilets and outside taps when the third pipe comes on-line in 2009. This is the first of its kind in the country and will potentially supply 8,000 people. This supply will be separately metered by Metrowater at a cheaper rate than potable, which should act as an incentive for households to switch to the third pipe.[110]

Metrowater is currently working through the issues of the third pipe supply, particularly regarding how to charge for wastewater. Metrowater recognises that charges for wastewater will need to be reasonable to promote use of the third pipe. These issues are being worked through with focus groups.

6.4.3.3 Water conservation programme

A Regional Water Management Plan (RWMP) was developed in 2004 by Watercare, Local Network Operators (LNO) and the Auckland Regional Council to address water demand management in Auckland. The document establishes a regional approach with a strategic goal

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107 ***http://www.aucklandcity.govt.nz/council/documents/rainwatertanks/docs/rainwatertanks.pdf***

108 ***Beacon PR 200 reference***

109 ***http://stonefields.com/ViewArticle.aspx?id=13***

110 ***http://stonefields.com/ViewArticle.aspx?id=13***

"to promote the sustainable, efficient and wise use of reticulated water resources in the Auckland region."[111]

A number of objectives are identified by the RWMP including water conservation and community education to ensure that the community understands the benefits of demand management and the changes required.

> *"Reduce gross per capita demand for reticulated water resources in the Auckland region. Improve water efficiency of commercial and industrial customers. Reduce leaks within the networks."*[112]

The RWMP established the Water Advisory Group to oversee water management in the region, and required LNOs to develop Water Management Action Plans by December 2004. The Water Advisory Group provides an important regional forum for information sharing between LNOs. In addition to the approved water demand management tools identified in Table 4 below, action plans are expected to encourage water conservation and it is anticipated that they would include other water sources such as rainwater tanks, greywater reuse and other drinking water substitution strategies.

111 ***From the Sky to the Sea, Watercare (2004)***

112 ***From the Sky to the Sea, Watercare (2004)***

Water metering	Sub-meter apartment buildings Promote sub-metering in large facilities for more accurate leak detection Improve meter calibration and maintenance practices
Water accounting and loss control	■ Annual audits of water networks ■ Develop proactive leak prevention programmes ■ Establish a leak reporting hotline
Water pricing	■ Based on quantities used ■ Investigate other conservation pricing initiatives ■ Apply a wastewater charge
Water-efficient landscaping and outdoor water use	■ Adopt the water-efficient landscaping model as promoted by the United States Environmental Protection Agency
Water use audits	■ Audit large volume users annually
Pressure management	■ Install pressure-reducing valves where water pressure is high
Wastewater and stormwater reuse	■ Investigate the demand for recycled wastewater and stormwater ■ For green field developments, require installation of water tanks and dual reticulation/stormwater systems ■ For development within built-up areas, require installation of water tanks and dual reticulation/stormwater systems
Information and education	■ Improve readability of water bills ■ Develop and promote water education programmes ■ Promote public awareness of water issues
Promotion of water-efficient technologies	■ Promote the use of water-efficient appliances ■ Consider promoting and/or subsidising certain technologies e.g. rain water tanks ■ Develop standards and regulations for the installation of water-efficient appliances in all new and redeveloped buildings ■ Consider appliance retrofitting schemes ■ Seek appropriate supporting legislation
Regulations and restrictions	■ Investigate the need to change legislation where it obstructs or prevents water management practices
Best practice	■ Set a target higher than 5% reduction in water use among the facilities of water authorities ■ Encourage the adoption of water management strategies within the water industry
Supply augmentation	■ Continue to cooperate in the development of demand modeling and information systems to more accurately predict future water demand

Source: From the Sky to the Sea

Table 5 Approved Water Demand Management Tools

Metrowater currently has no formal water conservation strategy in place; although a number of water demand management measures are in place. Prioritisation of the work required to develop

a Water Demand Management Plan is programmed for 2007/2008 and is currently underway.[113] Metrowater is firstly seeking to determine what the value of water conservation is in real terms to enable a focused strategy that effectively and efficiently achieves conservation. Therefore funds contributed to developing the strategy will be targeted to ensure that measures sought achieve real savings in terms of water use and cost. Options for a draft strategy are expected to be presented to the Metrowater Board before the end of 2007, with a Water Demand Management Plan finalised in June 2008.

It should also be noted that the Auckland City Consolidated Bylaw (1991) includes the following water conservation requirements:[114]

- All new and replacement toilet flushing cisterns to be dual flush.
- Automatic flushing urinals to be fitted with approved water conservation devices.
- Any equipment using water for cooling to include water conservation equipment.

It is also identified in Auckland City Council's Annual Plan (2007/08) that there is work planned to investigate guidelines for sustainable housing design to include energy and water conservation rules as part of the development of an environmental strategy. Nothing specific has been produced in this area to date.

6.4.3.4 Goals and targets

Goals and objectives for water conservation are currently set out by Metrowater's Statement of Intent and its Asset Management Plan. Of particular relevance is how the Asset Management Plan has defined water conservation:

> *"Water conservation is about efficient consumption of water resources in a sustainable manner so that in the long term we minimise the impacts on the environment by deferring the need to build new water sources and thereby achieve the best economic value for the community."*[115]

In terms of water supply Metrowater has a goal that recognises the need to improve water conservation, and reduce environmental impacts from wastewater. In terms of water conservation actions the focus for Metrowater currently is on reducing unaccounted for water and leakage.[116]

A regional target is established by the Regional Water Management Plan. This is a voluntary reduction of 5% per capita water demand from 2004–2024. This target is included as a key conservation objective within Metrowater's Statement of Intent.[117]

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113 ***Asset Management Plan, Metrowater (2007)***

114 ***Auckland City Consolidated Bylaw Chapter 26 – Water Supply, Auckland City Council (1991)***

115 ***Asset Management Plan, Metrowater (2007)***

116 ***Asset Management Plan, Metrowater (2007)***

117 ***Statement of Intent 2007–2010, Metrowater (2007)***

Other targets identified in the RWMP are:

- Maximum annual network loss (Watercare network) 2% or less.
- Watercare to maintain regional network efficiency.
- Establish domestic demand savings targets following further investigations and demand studies.
- Each water authority to develop their own targets and action plans.
- Investigate the potential for peak demand targets.

Specific water conservation targets identified by Metrowater include:

- A performance measure to maintain the percentage annual domestic water volume growth less than the percentage population growth of Auckland City.[118]
- A service target of 5,972,000m^3 leakage per annum by June 2009 to reduce the amount of water leaking from the network to an economic level.[119]
- To reduce unaccounted water from 17% to 14.7%.[120]

6.4.3.5 Pressure management

Reduced pressure would result in reduced consumption and reduced maintenance, in addition to reduced leakage. Average pressure is currently 623kPa and it has been identified that reducing it to 490kPa would reduce leakage by approximately 1.5 million m^3 per year.[121]

6.4.3.6 Leakage management

Leakage accounts for approximately 158 litres per property per day, resulting in an Infrastructure Leakage Index of 2.4. In September 2006 total annual leakage was 7,661,000m^3, with $2.9 million capital expenditure programmed over the next 20 years to achieve reductions. Reduction actions identified to respond to leakage have a cost of $7.5m (2007–2017).[122]

Leakage accounts for almost 84% of unaccounted for water, and as such leakage management accounts for 80% of Metrowater's water conservation programme. Leak management comprises a number of methods including:

- Leak detection—acoustic tests, minimum night flows at bulk meters, monthly monitoring bulk meters vs what water is sold (unaccounted for water). This programme is estimated at one to two full time equivalent jobs.
- Meter replacement—optimal programme testing of fleet, replace degraded meters, and identify what mileage can be obtained from different types, replacement at no cost to customers.
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118 ***Statement of Intent 2007–2010, Metrowater (2007)***
119 ***Asset Management Plan, Metrowater (2007)***
120 ***Asset Management Plan, Metrowater (2007)***
121 ***Asset Management Plan, Metrowater (2007)***
122 ***Asset Management Plan, Metrowater (2007)***

The leak remissions policy encourages residents to find and repair leaks, remit cost of wastewater charges as an incentive to fix leaks. Basis that if leaking then no wastewater into the system. However, this is at Metrowater's discretion and is only applied when a leak is repaired by a registered plumber within two weeks of one of the following notifications and applications must be received within four weeks of the leak being repaired:

a) you receive a high consumption letter from Metrowater advising you of a potential leak
b) you advise Metrowater of a possible leak
c) you receive a bill with an increase of 100% or more on your usual bill
d) you receive a high consumption card from a meter reader

If the Metrowater field crew repairs a leak at a property that has affected a bill then the account is automatically assessed for remission.

6.4.3.7 Conservation initiatives

Conservation tips are provided on Metrowater's website and are included within the quarterly newsletter *"Tapped In"* that accompanies household water bills. This information provides standard facts about water (water cycle, general water use) and outlines how households can reduce water use.

Although the Metrowater website comprises an education page there is no formal education programme. The education page includes basic water facts. A measure identified in Metrowater's Asset Management Plan is to produce educational material to support a community based marketing programme to foster sustainable water use as a way of reducing the nuisance impact of water quality problems.

The Metrowater Community Trust was established in 2001 and is an independent organisation funded by Metrowater, to assist Metrowater customers who have difficulty managing their water bills or who have unusually high water needs. One element of the Trust is to help people reduce their water use through conservation advice and by installing water efficient measures such as dual flush toilets, repairing leaking taps, and replacing old inefficient washing machines.

6.4.3.8 Segmentation of customer base

Metrowater has a "conservation and revenue project" to develop tools to facilitate the company's long term planning. As part of this work Metrowater is looking to the segmentation of its customer base to understand how to influence water demand.[123]

6.4.3.9 Metering

At the time of amalgamation (1989) the various borough councils had different methods of charging for water, and although most properties were metered some 60,000 were not. In addition, each borough charged differently for water from Uniform Annual Charges to inclusion within the Annual General Rate. In 1991 the Council moved towards a user pays system and

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123 ***Statement of Intent 2007/2010, Metrowater (2007)***

resolved to implement universal metering. This was prior to the Special Consultative Procedure requirements of the LGA 2002, and the decision simply required the Council's resolution.

The process of implementing universal metering began in 1990, with a recommendation from the Mt Roskill Community Board to the Council that it should be citywide. This was also in response to the fact that the Auckland Regional Council had identified metering as a way of reducing water demand, to defer a further water source and delay bulk water charge increases. At this stage it was determined that the cost of universal metering was $16 million. A working party was established of Auckland Regional Council and Auckland City Council officers to determine the costs and benefits of universal metering.[124]

In 1991 the Works and Services Committee recommended that the working group's principles and policies for water distribution—including a strategy for water charging be adopted by the Council. Supporting work included amendments to the Auckland Consolidated Bylaw to support universal metering.[125] The Community Boards were consulted about the proposals, and generally were supportive.

The Auckland City Consolidated Bylaw 1991 states that meters shall be installed and maintained by the Council, and that consumers shall pay charges for water. The bylaw requires that Council publicly notify resolutions identifying particular areas where all connections shall be metered, and the charges to be paid. A ten year programme was adopted to install meters to the remaining unmetered properties identifying the timing for the various areas, with all new water supply connections required to install meters.[126] By May 1992, the Council had resolved to accelerate the phasing to be completed within five years.

As part of the phased implementation programme, the Council undertook marketing and publicity including explanatory leaflets, display stands, explaining the effects and consequences of meters—emphasising that meters provide a fairer system of charging for water than was occurring at the time.[127]

The cost of installing water meters at each connection was subsidised by a grant from ARC up to a maximum of $4 million, as a result of the wider environmental benefits of water conservation. The Council paid for the installation of meters to existing sites; however, if landowners requested installation before the programmed date they were required to pay the full cost. All new developments pay the cost of the meter as part of its connection.

Water is charged at market rates and reflects the cost of bulk water purchased from Watercare. Watercare has guaranteed that water prices will remain 2% less than the rate of inflation for the next three years.[128]

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124 ***95 Works and Services Committee, 18 July 1990***
125 ***Works and Services Committee, 7 February 1991***
126 ***Works and Services Committee, 3 April 1991, Series 137, Volume 1-7***
127 ***Works and Services Committee, May 1992***
128 ***http://www.watercare.co.nz/default,68.sm***

Figure 19 Water meter

Water use is segregated into different uses, i.e. residential and commercial, and billing occurs at three monthly intervals on a rolling basis. Water use is monitored for all sites and this data enables water use to be understood by Metrowater. However, as billing is done on a rolling basis it is not possible to measure exactly what is happening on a month by month basis as some data will be three months behind.

Metrowater recognises that metering promotes behavioural change, and so changed the forecast model for water demand since the initial introduction of charges. Changes in behaviour have been most significant in response to the way that water is charged, which has changed over time—from an initial high fixed charge to the current high volumetric charge. Changing to high volumetric charges has according to Metrowater staff resulted in a more significant change to behaviour as water use is directly linked to the cost of water. This demonstrates a price elasticity effect.

Although Metrowater staff were unable to identify how much water use changed as a result of introducing meters, a reduction in average water demand was clearly seen after the 1994 water shortage and since the introduction of wastewater charges.

6.4.3.10 Wastewater charges

The establishment of a LATE to manage water and wastewater was identified. It was also signalled through Auckland City Council's 1997/98 Annual Plan that user pays for wastewater would be introduced. It appears that one of the reasons for establishing Metrowater, was to enable user charges for wastewater. Under the Rating Powers Act the Council was only allowed to recover sewage costs as a rate, a pan charge, or a uniform annual charge.

Therefore when Metrowater was established in 1997 it introduced wastewater charges. Although it is likely that submissions were made to the Annual Planning process opposing the introduction of wastewater charges, as a LATE Metrowater has greater powers to introduce charges without the need for consultation.

Metrowater indicate that charging for wastewater has had the most significant impact on reduced water usage, with per capita consumption steadily decreasing since 1997. In 1997 per capita consumption was approximately 132m³ per annum and was approximately 125m³ per annum in 2006.[129] This is attributed to the fact that the wastewater charges comprise the most significant proportion of the total water charges at two and a half times the cost of water.

129 ***Metrowater, Pers Comm. 2007***

Charges are based on the assumption that 75% of all water used is discharged to the wastewater network, with 25% consumed either through drinking, cooking or gardens.

In situations where water supply is provided by rainwater tanks with wastewater discharged to Metrowater's reticulation network/treatment plant, then the supply is metered to determine appropriate wastewater charges.

6.4.4 Drivers of water consumption

As part of the work to develop a comprehensive Demand Management Plan, Metrowater seeks to better understand the drivers of water consumption. There is a general awareness that households in higher socio-economic areas use more water, although it is unknown precisely why this is—whether it is because of swimming pools, number of showers/toilets, or gardens. It is also understood that water use in summer is greater.

Watercare is currently contracting research on "water end use", by undertaking a survey of 51 households throughout the region. Each household is being fitted with a logger that will survey water use over a year for a variety of devices to profile household water use. A total of 18 Auckland City households are taking part in this survey. This information is anticipated to demonstrate seasonal differences, household types and will enable a more targeted water demand management programme.

6.4.5 Regulations

Metrowater staff indicate that as far as business-as-usual goes there is little regulatory constraint, apart from Ministry of Health regulations and standards. However, when innovative measures are proposed the regulatory pathway is less clear. This process is managed by Auckland City and Metrowater has no input. There is political pressure around pricing of water, which was clear just prior to the recent 2007 local body elections with price increases for water charges and the extent of the charitable payment required by Auckland City Council from Metrowater highlighted as a big issue.

6.4.6 Central Government

Metrowater staff did not consider it necessary to have further guidance from central government on water demand management as there are too many variables throughout the country, such as per capita water use, or range of industrial activities with different water needs. Therefore targets and initiatives are better developed for specific areas. This is reflected in the Auckland Water Management Plan, which seeks some general targets but relies on Water Management Action Plans by each Local Network Operator to provide detailed actions.

6.5 Case Study—Nelson City Council

6.5.1 Key findings

- The installation of universal water metering and volumetric user charges has reduced peak water demand over summer by at least 37%.

- Nelson City Council (NCC) believes a transition to volumetric user charges is accomplished more easily if the existing charging regime is already a uniform annual charge rather than a rates based assessment.

Council is considering adopting demand management approaches to prevent having to invest in substantial new dam infrastructure.

Summary of demand management approaches

- Nelson City Council provides an example of a Council that has adopted water metering and volumetric user charges to good effect.
- The utilization of water metering has increased community awareness about the need to conserve water, while offering a clear incentive to reduce water use. Water savings of over 37% have been achieved.
- Water savings have meant that a significant decline in outdoor water uses over summer has been achieved, while reducing supply demands and increasing the sustainability of the overall system at the same time.
- Seeing the benefits of the water metering programme has encouraged the Council to continue to investigate other methods of reducing overall water demand from the mains water supply—which should ensure that the existing supply arrangements will be sufficient to meet the city's needs even while the population base continues to grow.
- At present there is supply capacity to provide for Nelson's residents for at least another 55 years. With the introduction of additional demand management approaches it is entirely conceivable that existing capacity could be sufficient to reach the end of the century and quite possibly beyond that time.
- Nelson has the benefit of time to model potential future use and demands against various demand management approaches, and to set appropriate policy directions and water reduction targets, to ensure the community has access to a high quality reticulated water system well into the future.

6.5.2 Background information

Nelson is known as one of the sunshine capitals of New Zealand, enjoying nearly 2,500 of sunshine hours per year. A small city surrounded by Mt Richmond Forest Park and Kahurangi and Tasman Bays, Nelson is geographically fortunate. The benign climate and stunning natural environment is a key factor driving Nelson's growing popularity. With a current population of 44,900 people, the city has enjoyed steady growth, with an increase of 10% between the 1996 and 2001 census years, and a further 8.8% between 2001 and 2006. Population growth is expected to continue, with projections estimating that the city will hit the 50,000 mark by 2021.[130]

An additional 6,000 people may not sound like a huge increase by contrast with the numbers of people moving into areas such as Auckland but Nelson is a geographically constrained area

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130 ***Nelson City Council (2004). "Nelson Urban Growth Strategy", Nelson City Council.***

which means growth must be carefully managed. On top of that, as a popular tourist destination, the area has a high-turnover of visitors throughout the summer who have to be accommodated. The district is also relatively limited in terms of its access to fresh water resources and therefore needs to carefully manage and monitor its water supply system with a high degree of forward planning. The majority of new growth will take place in the surrounding Stoke and Tahunanui areas rather than the existing city centre.

Nelson City presently manages its water supply operations in-house and per capita daily water usage figures are some of the lowest recorded figures in the country at 160l/pp/pd or roughly 400l/per household/pd. Historically Nelson's water quality was some of the worst in the country so an emphasis on improving this situation was paramount in terms of recent asset management decisions[131]. In 2004 the newly commissioned water treatment plant at Tantragee Saddle was made operational and significantly improving water quality in the district. Nelson's water quality is now rated as Ab and the plant can treat 42,000m^3 per day.

This year the Council also set up a Long Term Water Supply Working Group to review long term water supply options for the city and associated costs and risks of each option. A recommendation was made to Council that:

> *"Demand Management and water conservation measures be encouraged so that the construction of additional long term water sources may be deferred or used to counter the effects of climate change on the water supply"*[132]

6.5.3 Catchment characteristics

Nelson City Council abstracts from the Roding, Maitai South Branch, and Maitai North Branch Rivers for supply to the urban areas of the city. The water is coarse screened at the intakes and conveyed by raw water trunk mains to the Water Treatment Plant at Tantragee Saddle.[133] A population of approximately 45,000 is served by the Nelson City Council reticulated water supply. There are approximately 17,700 residential connections and 1,800 commercial/industrial connections. Several major fish processors are located in Nelson City and these are significant water users, utilizing roughly 15% of total supply.

Nelson's water service assets include: dams, intake structures and screens, control equipment, the Water Treatment Plant, tunnels, trunk mains, secondary mains, rider mains, services, valves, hydrants, non-return valves, pressure reducing valves, pumps, reservoirs, and water meters.[134]

The Maitai and Roding sources will provide sufficient water to meet the City's needs in a one in 60 year drought until beyond 2059. The installation of a new water treatment plant in 2004 has

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131 ***Plant, D. 2007. Personal Communication.***

132 ***Nelson City Council (2007). "Report Back From Long Term Water Supply Working Party", Nelson City Council, Report no 7312, August 2007.***

133 ***Nelson City Council (2006). "Water Supply Asset Management Plan 2006–2008", NCC, 2006.***

134 ***Ibid.***

also enabled the Council to obtain an A grading for source/treatment (completely satisfactory, very low level of risk). The Council feels that it has sufficient water of high quality to meet its reasonably foreseeable needs for the next 50–60 years.

Resident's surveys taken in 1998, 2000, 2004, and 2007 affirm that water supply and quality are important issues for Nelson residents. In 2004 and 2007 residents rated water supply as the most important of 14 significant activity areas contributing to the quality of life for Nelson residents. Having a good quality, permanent, continuous and reliable supply, at a fair and affordable cost were the issues that residents raised with respect to water supply.[135]

6.5.4 Water supply constraints

Nelson City Council's Regional Policy Statement contains the following policy and methods with regard to water conservation:

- Policy WA2.3.3: to continue to encourage urban water supply conservation.
- Method WA2.4.4: Council will continue to educate the public on the need for water conservation and will continue to monitor water use and assess the future needs of the community and ways of meeting these needs in an environmentally sustainable way.
- Method WA2.4.5: Council will continue to implement and extend water metering.

As a level of service in terms of security of supply, the council supply is able to provide adequate quantities of water to meet peak demand through a one in 60 year drought. The Council readopted a Water Supply Conservation Strategy in 2003.

The conditions of the Resource Consent for the Maitai abstraction require that a residual flow of 175l/sec be left in the Maitai River from 1 November to 30 April and 300l/sec be left in the river from 1 May to 31 October. The conditions of the Resource Consent for the Roding abstraction require that a residual flow of 51l/sec is to be left in the Roding River from October 2001. The residual flow to be left from October 2008 is 100l/sec. The loss of supply from the Roding River in 2008 however will be offset by an upgraded Maitai pipeline which will more than make up for the reduction in water take, by increasing the supply of stored water to the treatment plant.

6.5.5 Water conservation programmes

To date Nelson City Council hasn't run any significant water conservation programmes. However there is a growing awareness within Council, and enthusiasm for, greater use of water conservation and demand management programmes to reduce total water use.

While the city should have an adequate supply of drinking water out to 2060, the Council is currently considering an option to invest in an irrigation dam being proposed by the Waimea Water Augmentation Committee. The Committee is made up of members from Tasman District Council, Nelson City Council, various irrigator groups, DOC, local iwi, and Fish and Game.

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*135 **Nelson City Council (2006). "Water Supply Asset Management Plan 2006–2008", NCC, 2006.***

The proposal is to build a 20,000m^3 dam on the Lee River, behind Brightwater. By investing $2 million towards the cost of the dam NCC has an opportunity to procure a share of the total dam capacity to provide an additional water source in the future. Investing in the dam would provide the Council with access to roughly 14,000m^3 per day of additional supply at such a time as it is required, which is unlikely to be before 2050. This volume of water would be sufficient to supply 14,000 homes. The price of investment does not take into account the cost of supplying infrastructure to pipe the water from the dam into residential areas. A decision on whether or not to invest is pending and has to be made by 2010. However given the adequate supply out to 2060, the City is now considering whether or not a well managed demand management programme might not provide a means to render such a further investment unnecessary.

Although water metering has been successful in reducing summertime peak flows by over 37%, the Council still relies upon water restrictions during some summers to maintain adequate river flow in the source rivers.

6.5.6 Nelson's Water Conservation Strategy

Under the Regional Policy Statement, Nelson City has a requirement to prepare a Water Conservation Strategy to limit or restrict the "non-essential" portion of the urban water supply in times of drought. The strategy to date has focused on managing the water supply when lake water levels are getting low and predominantly relates to the use of water restrictions.

The strategy effectively provides a risk management approach to assist the council to manage supply when lake levels are low by imposing restrictions. The Council has three levels of restriction, the first stage allows for water sprinkling on alternate days. Second stage restrictions allow for hand held hoses only while the third stage requires a total ban on hosing and other outdoor water uses but these have never had to be used. The Council also notes that prior to universal metering, water restrictions were needed most summers (see below). Since then level 3 restrictions haven't been needed while level 2 restrictions have only been used once (in 2001), and level 1 restrictions twice.

When restrictions are in place the Council runs radio ads and water conservation messages which are published in the Council's own fortnightly newspaper. Enforcement is community initiated with people that break the restrictions usually being "dobbed in" by a neighbour.[136] Council will then send an officer to the house to discuss the reason for the restrictions with the household. Generally restrictions are not required for more than three or four weeks in a season unless lake levels are very low at the beginning of the summer period. In 2007 level 1 water restrictions were introduced early in the summer.

6.5.7 Metering

Nelson City Council adopted universal water metering in 1996 with a capital programme installing meters into every property. The metering has been in place since July 1999. The

136 NCC—pers comm. 2007

maximum two day average in 1997/98 was 42,000m^3/day, whereas the peak since universal metering has been in operation is presently less than 35,000m^3/day.[137]

Reducing the summer time peak demand was a key imperative for Nelson City Council and was the basis for the Council's decision to meter household water use. The decision to pursue metering had been made in 1993, and all new subdivisions and toby repairs had meter manifolds fitted from that time. Between 1998 and 1999 the programme was extended to include the retrofitting of all existing houses as well, but the Council believes the community was relatively well prepared because of the length of time between making the decision to meter and actual implementation.

Nelson had plenty of water capacity with its existing supply for the winter period when water use was at its lowest, but needed an intervention that would change water behaviours in the summer when demand for outdoor use of water becomes much higher. Because commercial usage in the city was stable over winter and summer, and yet typical water usage during the winter was half of that in the summer, NCC were able to determine that the additional water uses must be largely for outdoor sprinkler use and to cater for the high number of tourists coming into the town. It meant failure to implement a water reduction measure would mean that to meet uncontrolled garden watering demand the water supply system required 100% extra capacity which was being used approximately 10% of the time.[138]

The Council looked at Tauranga City Council and what had been done in Auckland before deciding that water metering and user pays charging would be an appropriate tool for reducing these peak flows. The Council was also aware that its consents for water take were soon to be renewed and that Nelson's population was steadily growing, so in order to gain resource consent it had to be able to demonstrate to the Regional Council that it was being proactive in managing its demands on local water resources.

Nelson City Council says that prior to the meters being installed there was some degree of community concern and a fairly vocal minority that openly opposed metering, however there was nothing like the level of opposition seen in Auckland with the setting up of Water Action Groups. There was enough opposition that the installation process had to be carefully managed at some sites.

The meters were installed across the city between 1998 and 1999. NCC produced regular publicity both prior to the metering and during the implementation phase that was sent to all households. The publicity explained how the metering would work and was coupled with a message that households could save money on water if they reduced their daily water use.

The frequency of billing is every six months, in May/June and again in November/December. Nelson Council has contracted out the meter reading and billing elements of the service; however complaints and enquiries are still managed in-house. Maintenance contractors are sent

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137 ***Nelson City Council 2006. "Water Supply Asset Management Plan 2006–2008"***
138 ***Ibid***

out if there is a problem, for example if there appears to be a leak on the property. However this service is performed by Council owned maintenance contractors.

Nelson has installed manifold meters that are located on each property. As the meters have a limited lifetime of between 10–15 years, they do require changing. However, the manifold meters are easily replaced as they can simply be unscrewed from the toby. Roughly 17,672 houses were metered and the Council estimates that the cost was approximately $200 per household. The total cost of metering the city at that time was therefore in the area of $3.5 million.

The Council also noted that it felt that a decision to move away from a "rates based charge" for water to a uniform annual charge in the early eighties had smoothed the way for the transition to a user pays charging regime. Councils that still set water prices according to the value of a property face more significant backlash to metering than those where there is already a level playing field for all water users, where each property pays a uniform annual change. This is because with rates based charging a single person in a high-valued property who uses little water at present is likely to be paying more relatively for their water than a family of six in a lower valued area. A transition to a user pays system will shift the burden of cost onto the larger family. Managing such a transition therefore becomes a significant equity issue and has the potential for a high-degree of political fallout.

6.5.8 Long Term Water Supply Working Party

In 2007 the Nelson City Council set up a working party to consider Long Term Water Supply for Nelson City. The working party considered a range of demand management interventions for adoption in the city. These included the promotion of private wells for irrigation, rainwater tanks, greywater reuse systems, permaculture xeriscaping, adopting different pricing structures, water restrictions, and reducing unaccounted for water through scaling up the leakage reduction programme.

The working party has made a recommendation that demand management and water conservation measures are to be encouraged and is continuing to investigate viable solutions to improve the sustainability and efficiency of their existing water supply.

7 International case studies

This study has considered four other developed countries with similar water supply technologies and delivery systems with the purpose of determining how effective policy approaches and/or legislation have been in reducing water demand and also the extent to which these approaches could be applied within the New Zealand context.

Of the four countries chosen for the study, the United Kingdom, the United States, Canada and Australia, it is clear that demand management, while on the political radar, is not given teeth until the existing water supply system comes under stress. That is not to imply that water supply managers do not plan ahead or assess future demands, it is simply that water demand policy is mainly concerned with public education and little else until other drivers such as cost or limited future supply options force it higher up the policy agenda.

Because of the similarities between the United Kingdom and New Zealand's planning systems, New Zealand can look to the United Kingdom's national approach to water management, its legislation and organisational structures which oversee all facets of the water supply business, despite water supply being privatised for the majority of the population. Of the four countries considered, only the United Kingdom has a lower per capita water use than New Zealand.

The drought in Australia has provided an enormous impetus in all aspects of demand management. Government at all levels has implemented regulations and policy and the industry has responded through providing a wide range of innovative solutions. Australian water use is coming down but is still higher than in New Zealand, probably due to the drier climate and hence higher outdoor use. The new Australian Labour Government has said it will invest an additional $1.5 billion in water reforms and will bring forward $400 million under the $10 billion National Plan for Water Security to fast-track improvements in water efficiency, significantly invest in key water infrastructure projects and address over-allocation.

Canada and the United States are big water users and their legislation does not deal well with water demand. There are still however many policy initiatives and financial instruments which have helped in many parts of those countries to apply demand management.

7.1 The United Kingdom

7.1.1 Key findings

- The United Kingdom context is similar in many ways to New Zealand in terms of their standard of living, culture, and lifestyle but it has a far higher population. The United Kingdom is becoming increasingly conscious of sustainability and its relevance to its current and future housing stock, approaching sustainability through policy to address climate change, energy and water efficiency. Carbon neutrality in particular is becoming a core focus of housing policy and performance.
- Water supply in England and Wales is privatised. Some results of privatisation are probably the reverse of many New Zealanders' expectations. Checks and balances have been set at a

national level, water companies are subject to centralised legislation and price regulation and monitoring of performance is stringent and public. This has led to prices which compare very favourably with New Zealand and a significantly lower water use per capita. There are also greater synergies across water companies who have an industry organisation working collectively on their behalf. This suggests that it isn't necessarily privatisation of water that is a problem but rather a lack of industry controls and legislation and transparent processes.

- In England and Wales where there is high population pressure the recognition of the role of metering in motivating water use efficiency is well understood and it is a policy mechanism that has received considerable attention. Current daily water use is 150l/pp/pd.
- While some of the imperatives and initiatives for water conservation are different in the United Kingdom they are probably on a similar path to New Zealand in terms of their adoption of water efficiency, although it appears that the imperative is both more obvious and more widely understood, especially in the South East.
- Some technologies such as dual flush toilets have previously had bad press but are now back in relative favour. It is certainly understood that water efficiency can be easily affected in the home through changing water fittings such as low flow showerheads at a reasonable cost. However there is as yet little emphasis on supplementing water supply on-site through rainwater tanks or wastewater reuse perhaps because the use of rainwater tanks has been less common in rural communities than it has in New Zealand.

Given their constant requirement to consider new supplies, the United Kingdom has developed sophisticated financial analysis to be able to balance the costs and benefits of a new supply against demand management approaches.

Summary of water demand management activities

- The Water Framework, the EU driven legislation which requires all inland and coastal waters to reach "good status" by 2015.
- The Water Act 2003 (in general for England and Wales only) which requires the sustainable use of water resources.
- Building regulation with a water use efficiency standard of 125l/pp/pd or less being introduced for new homes from early 2008.
- A strong emphasis on metering with charging, either for outdoor use or all water use. Currently seeking ways to accelerate the uptake of meters.
- Considerable promotional material issued by the Department for Environment, Food and Rural Affairs (DEFRA) and Waterwise.
- Some water utilities have had substantial water education programmes, especially in the South East of England where there is a considerable shortage of water. Retrofit programmes are less common.
- Development of a "Code for Sustainable Homes".
- Nationally regulated leak targets set by the Water Services Regulation Authority (Ofwat)
- DEFRA's proposed Water Products Information Scheme which is currently under development.
- A supporting market transformation programme which produces various papers on proposed product efficiency.
- Some regulation around water use fixtures, in particular toilets.
- Vulnerable Groups Regulations.

7.1.2 The United Kingdom context

The population of the United Kingdom is 60.3 million compared with New Zealand's population of 4.2 million. It has a slightly larger land mass and similar average rainfall. The job of maintaining high quality water services to such a dense population is a constant challenge and has led to a growing awareness of the need for demand management. Wastewater recycling with treated wastewater being returned to inland waterways as well as the coast has long been the norm in the United Kingdom and the technology is very advanced. The need to reuse biosolids is widely accepted with 62% of sludge being returned as biosolids to agriculture.

Climate change is considered a major threat to water supply in the United Kingdom as well as for future industry and overall environmental sustainability, with water company operations and assets considered vulnerable to a more volatile climate. Critical concerns are more frequent droughts as well as more intense rainfall and flooding, both of which will influence investment planning for all aspects of water services. The summer drought in 2006 strained resources and meant that severe outdoor water restrictions were in place, especially in the South East.

The United Kingdom Government has the overall responsibility for the legislative framework for the management of water services. The Environment Agency has a specific duty (set out in Section 6 of the Environment Act 1995) to secure the proper use of water resources. In practice

this means ensuring that there is a sustainable balance between the needs of consumers (domestic, industrial and agricultural) and the environmental impacts of abstraction. The Government expects water companies to adopt a twin approach to water supply. It is expected that these companies consider the full range of options for reducing water demand, including leakage programmes as well as helping customers to reduce water use. Robust assessment of the likely impacts of the implementation of demand management programmes is also undertaken. Customer affordability is a key issue for the Government which also banned the ability of companies to disconnect water services due to non-payment in 2000. There is also a stipulation that water charging needs to be fair and not disadvantage vulnerable groups.

The water industry in the United Kingdom is diverse with a range of ownership models. It is made up of 12 water and sewerage service providers and 13 water suppliers. In England and Wales, the companies are private with several companies being subsidiaries of international enterprises. Welsh Water, which as the name suggests supplies services in Wales, is a not-for-profit company. Scotland and Northern Ireland each have single water and sewage service providers (Scottish Water and Northern Ireland Water) that are in public ownership but rely upon private companies for delivery of many of their services.

The United Kingdom water industry collects, treats and supplies over 16 billion litres of water per day (equivalent to Waitakere City Council's water requirements for a year) and treats over 10 billion litres of the resulting wastewater in its 700,000 kilometres of mains and sewers. Domestic water consumption is currently at around150l/pp/pd with a proposed water efficiency standard of 125l/pp/pd being introduced for new homes from early 2008.[139] Householders pay about NZ$800 a year for water and wastewater services, a figure which is lower than in New Zealand if the relative costs of living are taken into account. The industry anticipates a collective £88 billion (approximately NZ$220 billion) spend on water management between 1980 and 2010. The industry notes its overall responsibilities as follows with investment falling into four categories:

- keeping the plant and infrastructure fit for purpose
- improving drinking water and environmental (wastewater service) quality
- ensuring a satisfactory balance between supply and demand
- improving specific customer services.

The water sector in the United Kingdom has several national policy and regulatory bodies. They are the Department for Environment, Food and Rural Affairs (DEFRA) in England, the Scottish Executive, the Welsh Assembly Government and the Department of the Environment Northern Ireland.

The industry group Water:UK[140] represents the collective water industry and responds to proposed policy initiatives while also supporting industry requirements, including new

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139 ***Water Efficiency in new buildings. A joint Defra and Communities and Local Government Policy statement. July 2007.***

140 ***www.water.org.uk/home***

innovations. There is also a "Water Services Regulation Authority" (Ofwat), which plays a water "watch dog" role focused on charging issues, ensuring good industry practice, and protecting customer interests.

7.1.3 Goals and targets

The water industry's operations are underpinned by strong regulation that covers most aspects of core business—drinking water quality, wastewater quality, environmental improvement and price control. Many regulations that directly affect the water industry are derived from EU directives—notably drinking water, urban wastewater treatment, the water framework, groundwater protection, sewage sludge, and health and safety at work. Others, for example economic regulation, are United Kingdom specific. Only more recently has "sustainability" oriented regulation become evident.

A major United Kingdom initiative is to accelerate the number of houses which are metered in recognition that both measuring and charging on a volume basis are critical components of increasing water use efficiency. More detail on metering is described in Section 7.1.6.

> **"Our water environment is in crisis. Providing enough clean, safe water is becoming ever more difficult and expensive, and climate change is increasing the challenge. Our rivers and lakes are under pressure from pollution and abstraction, while most of our wetlands have been lost to drainage". http://www.blueprintforwater.org.uk**

Following the creation of the Water Act 2003, Ofwat's role was extended to include a duty to *"exercise and perform powers and duties in the manner best calculated to contribute to the achievement of sustainable development"*.

Measures recommended by Ofwat include:

- Fitting houses with higher performing devices that require less water. A third of water supplied to households is flushed down the toilet; new, lower-flush toilets help to save water, while old toilets can easily be fitted with low-flush devices.
- Changing building regulations to require house builders to put water efficient devices, such as taps, toilets and showers, in new homes. (They are now focusing on the water efficiency standard.)
- Innovative solutions for new housing and commercial developments, such as water recycling and rainwater harvesting.
- Introducing a scheme to assess the performance of water using products and label the best performers accordingly. This will help installers and consumers understand how much water each fitting and appliance uses, enabling informed choices to be made.
- Widespread promotion to encourage people to be efficient in their use of water.

Overall, the pressure on water supplies is considerably greater in the United Kingdom than in New Zealand. Although England and Wales are often considered to be wet places, they are also very densely populated with the climate in the East of England being relatively dry and demand

for water being high. The combined effect is that there is actually less water available per person in the United Kingdom than in much drier neighbouring countries such as Spain or Portugal. Despite that, the emphasis on regulation for water efficiency has not been strong in the past. In addition, much of the existing wastewater systems are in need of major upgrades. The United Kingdom has many of the same approaches to water efficiency and demand management as New Zealand; in particular the issue of metering is widely discussed. There are some differences in the appliances used and there is little emphasis in on-site supplementation of water supply other than through capturing water in butts or barrels. As in New Zealand, greywater reuse on-site has to date found little favour.

Given the high impact that domestic water use has on the natural environment in the United Kingdom, there is a stronger link between the overall protection of water and domestic use there than there is in New Zealand where domestic water use has a lesser impact due to our considerably smaller population size. A coalition of nine key wildlife organizations has formed Waterwise which in turn has mounted a significant campaign to improve the United Kingdom's waterways and water ecology.[141] In England this action group sits on the Environment Minister's Water Saving Group alongside the water industry and regulators. They hold the only annual water efficiency conference in the United Kingdom and are prime movers and shakers for influencing policy with a ten point plan for water for 2015.[142]

7.1.4 Key UK legislation influencing water use efficiency

7.1.4.1 The Water Framework

One significant piece of legislation which is driving water management and getting companies to think more deeply about water conservation is "The Water Framework Directive" (WFD), reportedly the most substantial piece of European Community water legislation to date. It requires all inland and coastal waters to reach "good status" by 2015. It will do this by establishing a river basin district structure within which demanding environmental objectives will be set, including ecological targets for surface waters. For the United Kingdom with its population of 50 million people, domestic water demands on surface and groundwater are substantial, and therefore achieving the requirements of the WFD requires reductions in household water use. Predicted population increase is another key concern and driver of water conservation in the United Kingdom with 20,000 new inhabitants expected a year, as well as a reduction in overall household size which is predicted to decrease by nearly 10% from 2.42 to 2.20 persons between 2005 and 2021.[143]

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*141 **http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/about_us/about_waterwise.html***

*142 **http://www.blueprintforwater.org.uk/blueprint.html***

*143 **http://www.statistics.gov.uk/statbase/Product.asp?vink=13260&image.x=13&image.y=8hht://www.statistics.gov.uk/lib2002/default.asp***

7.1.4.2 The Water Industry Act 1999

For England and Wales, the Act provides new entitlements for water consumers, particularly household customers. It prohibits the disconnection of the water supply to homes for reasons of non-payment. It gives many water consumers new rights to choose the basis on which they are charged for water and sewerage services. It allows for rateable value to continue to be used as a basis of unmeasured charging after 31 March 2000. It also allows for the Secretary of State to make regulations concerning particular charges to be applied to particular groups.

For Scotland, the Act gives effect to the recommendations of the review of the water industry in Scotland carried out in 1997. It amends the Local Government (Scotland) Act 1994, dissolving the Scottish Water and Sewerage Customers Council and establishing the Water Industry Commissioner for Scotland to promote the interests of customers of the water and sewerage authorities. The Commissioner will assume most of the existing duties of the Council and will have new advisory functions in relation to the fixing of water and sewerage charges. The provisions also establish Water Industry Consultative Committees for each of the water and sewerage authorities. The Consultative Committees will advise the Commissioner on the promotion of the interests of customers of the authority in question.

7.1.4.3 The Water Act 2003 (in general for England and Wales only)

Part 1 and elements of **Part 3** of the Act provide the Environment Agency with additional tools for managing water resources and stronger powers to take action against abstractions causing environmental damage. They introduce provisions to increase the scope and public availability of information on water resources which are intended to enable abstractors to plan ahead in an environmentally responsible manner. They also make provision to increase the flexibility, accountability and administrative efficiency of the abstraction and impounding licensing system, with the intended result of increasing the ease of access to sustainable water resources.

Part 2 establishes a regulatory board to replace the existing individual Director General of Water Services along with a new independent Consumer Council for Water to replace the Customer Service Committees. It also introduces other provisions intended to improve the regulatory regime and to extend the opportunities for competition in the water industry, by allowing new entrants to supply non-household customers who use large volumes of water.

Part 3 introduces a range of miscellaneous provisions including a duty on the Secretary of State and the National Assembly for Wales to encourage water conservation. Part 3 also includes powers for the Secretary of State to require sewerage undertakers to adopt private sewers.

7.1.4.4 The Building Act 1984 and the Building Regulations

This legislation applies to England and Wales. The current edition of the regulations is “The Building Regulations 2000” (as amended) and the majority of building projects are required to comply with them. They aim to ensure the health and safety of people in and around all types of buildings (i.e. domestic, commercial and industrial). They also provide for energy conservation, and access to and use of buildings. The Building Code does not enforce people to buy water from a reticulated supply but does require them to have a supply available that meets required standards.

7.1.5 Key policy influencing domestic water efficiency

7.1.5.1 Homes for the Future—a green paper

In July 2007 the Government sought comments on its Housing Green Paper and the Government's proposals to increase the supply of housing, to provide well designed and greener homes that are supported by infrastructure and to provide more affordable homes to buy or rent. An integral part of this policy has been the development of the water efficiency standard for new homes to be introduced early in 2008 of 125l/pp/pd, the high end of the code for sustainable homes, see below.

7.1.5.2 Code for Sustainable Homes

A significant policy mechanism will be the Code for Sustainable Homes. On 13 December 2006, the Code for Sustainable Homes—a new national standard for sustainable design and construction of new homes was launched. Since April 2007 the developer of any new home in England can choose to be assessed against this voluntary Code. The Code measures the sustainability of a new home against categories of sustainable design, rating the "whole home" as a complete package by using a 1 to 6 star rating system to communicate the overall sustainability performance of a new home. The Code sets minimum standards for energy and water use at each level and, within England, replaces the EcoHomes scheme, developed by the Building Research Establishment (BRE).[144] The starting positions, levels 1 and 2 are less than the water efficiency standard being introduced early next year through the water efficiency standard of 125l/pp/pd.

7.1.5.3 The Market Transformation Programme (MTP)[145]

There is a drive towards sustainable products and sustainable procurement in the UK, starting with government agencies. MTP supports the United Kingdom Government's strategy on Sustainable Development.

7.1.5.4 Retrofit programmes and education

Water utilities, especially in the South East of the United Kingdom have educational and retrofit programmes underway.[146] There is also an abundance of websites which are set up to assist people save water and which are often associated with interesting imagery.[147]

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144 ***http://www.planningportal.gov.uk/england/professionals/en/1115314116927.html***
145 ***http://www.mtprog.com/***
146 ***http://www.eswater.co.uk/2807_ESW_Using_Water_Wisely(1).pdf***
147 ***http://www.waterwise.org.uk/***

Source: http://www.blueprintforwater.org.uk/about.html

Figure 20 From the blueprint for water strategy

7.1.5.5 Regulations around fitments and appliances

The main regulation relates to toilet water efficiency. There has been considerable controversy about the benefits of dual toilets which has since been overcome with about 60% of toilets in the United Kingdom now being dual-flush. The use of water in toilets in the United Kingdom is estimated to account for about 30% of all domestic water use. Bylaws exist which prevent the waste, misuse, undue consumption and contamination of water within premises. Water bylaws were introduced in 1981 which stated that every flushing toilet cistern in domestic premises should be dual flush replacing the previous requirement for a maximum single flush toilet of nine litres. Then in 1989 model bylaws were introduced which prohibited dual flush toilets from 1993 except as direct replacements for existing dual flush cisterns. Apparently this was due to technical problems with the dual flush toilets of that time. In 1999 the Water Supply (Water Fittings) Regulations were introduced which required that all new WC suites installed after 1 January 2001 should flush with no more than six litres. Dual-flush cisterns are permitted if the method of operation is clear and instructions are provided on the cistern or nearby. The lesser flush should be no greater than two-thirds of the full flush. The retrofitting of dual-flush devices to existing siphonic flush toilets is currently not permitted under the regulations.

7.1.6 Metering and its role in water supply policy

Metering has a major policy focus in the United Kingdom. Currently only one home in four has a water meter. Ofwat supports at least three-quarters of households to be metered by 2025, and in the South East they would like much of this to be achieved by 2015.

Ofwat has determined that having a water meter raises people's awareness of how much water they use at home, and encourages them to avoid wasting water. By saving water, there is also the potential to save money on water bills. Studies show that water meters lead to a 5–15% reduction in household water use. Metering in the United Kingdom is generally associated with charging on a per unit basis. In the longer term, metering may help change individuals' water use behaviour and influence the water fittings and appliances they buy. It is relatively normal in many other Western European countries for houses to be metered and for those customers to

pay for the water they use, which typically is less than the water used in England and Wales.[148] It is a highly debated policy instrument in the United Kingdom and in general there is wide support for all water companies to actively encourage all their customers to switch to water meters. Metering is already popular with households that use relatively low amounts of water, particularly where the unmeasured alternative is expensive. The most common alternative pricing arrangement is a rates based assessment method with charges for water services taken as a percentage of general rates. Conversely, water metering is not popular with homes with a higher number of occupants or people who water their gardens frequently.

In areas where water is particularly scarce it is recommended that water companies apply to the government for water scarcity status. Water companies whose supply areas are designated as water scarce are able to meter all their customers.

At the moment, water companies can only install water meters under particular circumstances. These are:

- when providing a supply to a newly constructed building
- when a customer requests a water meter
- where a customer uses a lot of water for non-essential uses, like filling a swimming pool or large pond, or using a garden sprinkler
- when people move home
- when an area has been designated “water scarce”.

To get water scarcity status, the water company must convince the government that there is a significant, long-term deficiency in water supplies in its area. The government considers the application for an environmental assessment. Folkestone and Dover Water are currently the only water companies which have water scarcity status. This piecemeal approach is considered a slow and expensive way to increase water metering.

DEFRA has investigated and consulted on water metering in areas of serious water stress. At current rates it is anticipated that there will be about 45% of households metered for water by 2015. The premise is that water metering must increase faster than at the current rate to meet rising demand and pressures on supply. DEFRA believes that water metering saves 10% of household water consumption,[149] a figure which is lower than some studies suggest but which is probably a good choice for considering alternative options to increased supply. They suggest that the need for water supply companies to be designated an area of scarce supply so as to be able to require metering is too restrictive and bureaucratic to achieve, having only been achieved by one company up to 2005.

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148 ***International comparison of water and sewage service. Ofwat, 2006.***

149 ***The effect of metering on peak and average demand—UKWIR, 2005.***

The Water Industry Act 1999 gave people the right to either:

- continue to pay for water on an unmeasured basis, if currently doing so; or
- choose to pay on a measured basis, with the meter fitted at no additional charge and with the option of reverting to unmeasured charging after 12 months.

In 1999, the Government also introduced the "The Water Industry (Charges) (Vulnerable Groups) Regulations".[150] The regulations cap bills at the average water and sewerage bill for a company's areas. Households are eligible for the vulnerable group tariff if:

- they are metered
- on certain income-related benefits; or
- suffer from medical conditions which cause a substantial increase in the use of water or have three or more dependent children under the age of 19.

DEFRA's paper sets out the issues and options to extend the ability to accelerate the installation of water meters, to assist in the efficient use of water, and to reduce demand and assist in long-term resource saving. It compares the option of a do nothing approach against amending current prescribed conditions and regulations. This would allow water companies in seriously stressed areas (as designated by the Secretary of State on the advice of the Environment Agency) to introduce compulsory metering where it forms part of their new Water Resource Management Plan (WRMPS). The WRMPS should set out least cost solutions to their supply demand balance. The plans will be finalized before the next periodic review of water prices in 2009. In this way the water scarcity status would be absorbed into the preparation of the WRMPS, making it easier to achieve that status.

7.1.7 Setting leak targets

OFWAT, the water regulator in the United Kingdom has used leakage targets to require water utilities to fix their leaks. Historically leaks were up at 36% of water produced.[151] By 2002–2003 leakages had fallen to 23% from their peak in 1994–1995.[152] Utilities used leakage detection modelling software to optimize their policies which included carrying out leak repairs within a couple of days of detection, replacement of mains with high burst frequencies.

Failure of meeting leakage targets meant that water companies might lose their licence to operate which tended to focus their efforts.

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150 ***http://www.opsi.gov.uk/si/si1999/19993441.htm***

151 ***Water conservation Programmes- A Planning Manual. AWWA Manual M52. 2006.***

152 ***Security of Supply, Leakage and Water Efficiency 2002–2003 Report, Office of Water Services UK Environment Agency, 2003.***

Their success appears to have come about because of the following:

- The drought of 1995 placed leakage in the media and public arena.
- There was high level political pressure.
- Water balance data was made public.
- There was a strong regulatory framework which resulted in a high level of scrutiny from the economic and environmental regulators.
- Water companies made expertise and other resource available to attend to the issue.

7.1.8 Demand management studies

Domestic water consumption in the United Kingdom has been extensively studied and various reports and working papers developed[153] which summarise and recommend options for reduction. Similarly there are a number of water demand prediction models available which consider the impacts of various water demand technologies. There are also social studies which focus on the consumer behaviour issues which will either help or hinder water conservation. A selection of demand management studies are included in Appendix 1.

7.2 The United States

7.2.1 Key findings

The two key findings of the United States research which are relevant to New Zealand are:

- The acceptance of water efficiency/conservation as one of the water supply options to be considered alongside, or even before, other options such as further dams and water extraction methods.
- State funding for water services may be used for water efficiency measures on the customer's side of the water meter, that is, to be owned and maintained by the private landowner as it is deemed to have longer-term public as well as private benefits.

In terms of regulatory and information agencies, the key findings are:

- The need for water efficiency practitioners to be more involved in the standards and codes setting process.
- Making most use of the synergies between the existing energy efficiency and the new water efficiency labeling schemes.
- The need to integrate the importance of water efficiency into green building rating tools.
- The need to tackle common barriers of consumer apathy, lack of understanding of the true cost of water and fragmentation and lack of uniformity in the industry.
- The possible benefits from the formation of a "National Water Efficiency Organisation".

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*153 **Sim, P. et al. Working Paper 05/03. The Options for UK Domestic Water Reduction: A Review, version 1, August 2005.***

The most frequent water resource priority was chronic "everyday" problems associated with maintaining and rehabilitating aging water and wastewater infrastructure.

Summary of demand management activities

The United States Conference on Mayors' Urban Water Council (UWC) survey of the nation's principal cities water resource priorities and trends in 2005 (National City Water Survey 2005) found that:

- The two most widely used system-wide methods effective in water conservation were automated meters because they accurately gauge use and billing and altering water rate structures as a demand-management tool.
- 73% of cities had traditional water meters while 70% said they would be interested in automatic metering if they could save water or money.
- Water rate structures were used by almost half of the larger cities, 40% of medium cities and 30% of smaller cities.
- Two thirds of cities have water conservation programmes (80% large cities and 60% smaller cities). Cities planning to make major capital investments in water supply infrastructure for the period 2005–2009 were nearly four times as likely to have an established water conservation programme.
- Mandatory measures produced savings of 13–63%, voluntary from 7–33% and retrofits reduced average household water use by 10% for low flow toilets and 8% for low flow showerheads.

7.2.2 Background information

The United States, with its very large geographic area, clearly has a wide range of water demand situations to contend with. Like most countries with large cities and populations, 301 million as of July 2007, it has recognised that water is not an unlimited supply; it comes at a cost and that managing demand will have to be a significant feature of delivering future supply. Indeed the United States has taken a significantly tougher line than many other countries in terms of setting standards and enforcing regulations.

A brief history of water efficiency in the United States is presented in the report to the U.S. Environmental Protection Agency by the California Urban Water Conservation Council titled "Developing a Framework for an Alliance for Water Efficiency Issues & Options", December 31, 2005[154]. The report was commissioned due to the central premise that "most communities across the country would benefit from higher levels of investment in water efficiency".

Over the last 50 years there has been severe recurring multi-year droughts in many states. In addition to utility appeals for consumer conservation the 1976–77 droughts in California encouraged the reconsideration of the water consumption of household plumbing products. At

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154 California Urban Water Conservation Council, December 31, 2005. Developing a Framework for an Alliance for Water Efficiency Issues & Options. Report to the U.S. Environmental Protection Agency.

the urging of water utilities, the American Society of Mechanical Engineers established a performance standard of 3.5 gallons (approximately 13 litres) per flush for a so called “water saver” toilet in 1978, to replace the earlier designs using 5–7 gallons (19–26 litres) per flush. At the same time, California set a flow rate standard for showerheads of 2.75 gallons (10 litres) per minute, in the interest of saving both energy and water. By the mid 1980s several United States plumbing manufacturers introduced new models of toilets designed to operate with 1.6 gallons (6 litres) per flush.

Energy efficiency also has co-benefits with water efficiency. A large portion of the energy use of clothes washers and dishwashers is derived from their use of hot water. For example, as new dishwashers became more water efficient, between 1993 and 2004, there was a proportionate reduction in energy consumption. However, in the case of clothes washers, early energy efficiency standards left many models on the market with little improvement in water efficiency.

The capacity of wastewater systems has also lead to water efficiency. For example, by 1990, five of New York City’s 14 wastewater treatment plants were exceeding the discharge volumes specified in state permits. This led to New York State insisting that proven water efficiency measures were written into permit extensions and consent decrees. For example, efficiency measures included:

- elimination of unmetered service connections
- adoption of plumbing efficiency standards
- increased programme for utility distribution leak detection and repair
- installation of 30,000 hydrant locks
- $300 million customer rebate programme responsible for replacing 1.3 million inefficient toilets.

Wastewater treatment issues also lead to early water conservation programmes in California, including San Jose, San Diego, and Los Angeles. River basin allocation schemes have also encouraged local water efficiency programs in Virginia, Georgia, Illinois, Nevada and Utah.

Another factor is the growing awareness of the cost of maintaining the current level of water consumption. The first national assessment of investment needs for drinking water infrastructure, along with an updated wastewater investment needs survey, were presented to Congress by the EPA (Environmental Protection Agency) in 1997. Taken together, they identified measures costing nearly US$280 billion that would be needed to accommodate growth over the next 20 years. Over US$200 billion of that amount was needed for facilities and equipment where the volume of water and wastewater flow affected the required size and cost of the infrastructure. In 2000, the Office of Water issued policy guidance clarifying that funds from the Clean Water State Revolving Funds may be used for water efficiency measures, including investments on the customer’s side of the water meter, as well as reasonable administrative costs. In 2003, this policy was reaffirmed and extended to the Drinking Water State Revolving Fund. Together, these two funds are the main source of ongoing capital assistance to the nation’s water and wastewater services.

7.2.3 Regulatory and information agencies

Regulatory and information agencies in the United States are summarised below under the following headings.[155]

- Plumbing Standards
- Plumbing Codes
- Product Labelling
- Green Building
- Waterwiser
- Proposed National Water Efficiency Organisation (Alliance for Water Efficiency)

7.2.3.1 Plumbing Standards

In the United States plumbing standards are the key avenue to advancing water efficiency in plumbing fixtures. The National Energy Policy Act sets maximum flow standards for showerheads, faucets, urinals, and toilets, but how those standards are manifested in fixtures is a function of standard setting.

The standards are developed and administered by a complex process. The American Society of Mechanical Engineers (ASME) and the International Association of Plumbing and Mechanical Officials (IAPMO) are both accredited by the American National Standards Institute (ANSI) to develop United States standards for plumbing fixtures and fittings. There are numerous committees involved in developing plumbing fixtures standards, but unfortunately, they are generally dominated by manufacturers and less by the water conservation community. Examples of further water efficient standards that could be implemented if there was more proactive involvement of water conservation interests include:

- Reducing the urinal flush volume maximum from 1.0 to 0.5 gallons (3.8 to 1.9 litres).
- Modifying the standard to enable the introduction of one litre flushing urinals.
- Refining the standard for pre-rinse spray valves.

7.2.3.2 Plumbing Code

In addition to Plumbing Standards, Plumbing and Building Codes play an important role in governing water efficient products. Whereas national standards approved by the American National Standards Institute are voluntary consensus-based standards, the Codes (which may or may not adopt the national standards by reference) are mandatory within the jurisdiction that adopts them.

Two areas of interest to water-efficiency practitioners are:

- Research into hot water distribution systems (piping) within residential dwellings to reduce the amount of energy (and water lost).
- The use of waterless urinals as these are effectively prohibited in many municipalities.
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155 California Urban Water Conservation Council, December 31, 2005.

Like the standards process, the codes process is complex. Being engaged in the code development process is a necessary first step to addressing some of the inherent inefficiencies in existing water delivery systems and the code language itself. There were once five different plumbing code development agencies in the United States but now, due to mergers, this has been reduced down to only two. The International Association of Plumbing and Mechanical Officials (IAPMO) produces the Uniform Plumbing Code (UPC) which is more prevalent in the west, and the International Code Council (ICC) which produces the International Plumbing Code (IPC), which is more prevalent in the eastern part of the United States.

The Plumbing Codes themselves have no legal status until adopted by jurisdictions such as cities, counties and states. Where adopted, the codes become as local ordinances and laws. Each jurisdiction can amend the code for their specific circumstances. The basis of the codes dates back to the early 1990s when water was relatively plentiful in high population areas, and sanitation and safety was the primary directive, not water efficiency.

7.2.3.3 Product labelling

The success of the "energy star" labelling programme has led numerous water efficiency stakeholders to yearn for a similar water efficiency labelling and market transformation programme. This became very evident during the national standard setting for clothes washers where it became clear that setting a modified energy factor standard did not guarantee a more water efficient appliance.

In 2002–2003, along with discussions among various water and environmental stakeholders, the EPA Office of Water investigated a product labelling system. This has now evolved into a system where both the "Modified Energy Factor" (MEF) and the "Water Factor" are given for products. For example most full-sized ENERGY STAR qualified clothes washers use 18–25 gallons (68–95 litres) of water per load, compared to the 40 gallons (151 litres) used by a standard machine. The Water Factor measures the gallons of water used per cycle per cubic foot (for example, a 3.0 cubic foot washer using 24 gallons (91 litres) per cycle has a water factor of 8.0). The lower the water factor, the less water the machine uses. All ENERGY STAR qualified clothes washers must have a water factor not greater than 8.0.

7.2.3.4 Green building

There is obvious potential to include water efficiency in the "green building movement" although most green building initiatives focus on energy efficiency and sustainable materials construction rather than water conservation. LEED (Leadership in Energy and Environmental Design) is the most prominent and well-known green building programme in the United States. The LEED scoring system uses 34 performance based credits worth up to 69 points, as well as seven prerequisite criteria divided into six categories:

- Sustainable Cities
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design Process

Although the second category, Water Efficiency, is specifically dedicated to water resources, it only represents eight of the possible 69 points. Other categories do include considerations for water usage, but not from a pure water efficiency perspective. The United States Green Building Council estimates that 30% indoor and 50% outdoor water savings are possible and commonly achieved. A workgroup was formed to recommend changes to the points awarded for water efficiency, and a new revised set of LEED criteria may have water efficiency changes in 2008.

7.2.3.5 WaterWiser

The *WaterWiser* water efficiency web site (www.waterwiser.org) has been in existence for more than 12 years. Created with a federal grant awarded in 1993, *WaterWiser* was designed as a national water efficiency clearing house, and has been housed since its inception in 1995 in the offices of the American Water Works Association (AWWA) as a resource for the AWWA Water Conservation Division.

The original vision for the *WaterWiser* was of a self-supporting clearing house to meet the needs of the rapidly growing water conservation profession. The founders hoped that *WaterWiser* would at least partially support itself through advertising, sales of reference documents, and membership dues. In reality, the website generated little revenue aside from the large establishment grants received. Were it not for the beneficence of AWWA, *WaterWiser* would have remained virtually static or disappeared after only a few years.

7.2.3.6 A National Water Efficiency Organisation

The report "Developing a Framework for an Alliance for Water Efficiency Issues & Options", December 31, 2005[156], examined the need for a national water efficiency organisation through a number of workshops and industry interviews across the United States.

The three most important issues were identified as:

- The need for better and more comprehensive efficiency standards.
- The lack of reliable information on efficient products and programmes.
- The lack of sufficient research of products and conservation savings.

The recommended mission statement and functions of the proposed "National Water Efficiency Organisation" (NWEO) were:

> *"Mission Statement—to promote, facilitate and achieve a market transformation to greater water efficiency and resource sustainability by raising awareness, creating a national dialogue, educating and consolidating efficiency efforts".*

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156 ***Developing a Framework for an Alliance for Water Efficiency, Issues & Options. California Urban Water Conservation Council, December 31, 2005.***

The functions of the NWEO include to:

- Create a national water efficiency clearinghouse and network for programme information and sharing.
- Advocate and research plumbing and code standard setting.
- Independently research and test new products and programs for reliable water savings.
- Coordinate with green building programmes.
- Train water conservation professionals.
- Develop consumer education programmes.
- Assist with market transformation for high efficiency products.
- Advocate strongly for water efficiency overall.

Further details from the Report are given in Appendix 2.

7.3 Canada

7.3.1 Key findings

Legislation in Canada does not provide strong support for water efficiency or water conservation. Water prices across Canada are generally low compared to other countries and the average Canadian uses 335 litres per capita per day, the second highest urban water users in the world.

A report summarising an extensive set of interviews with Canadian experts across Canada agreed on the following obstacles to demand management:

- Entrenched, supply-oriented engineering approaches.
- Fragmentation in management, both horizontally among various agencies and vertically between different levels of government.
- Lack of political leadership.

Summary of water demand policy and regulations

- Minimal national focus on domestic water supply, provinces have their own regulation and policy.
- Under The Constitution Act plumbing is the responsibility of the federal government.
- Strong focus on the “Soft Path”, education and public awareness but limited other policy in place.
- Estimation of value of water in relation to the provincial economy (Alberta).

7.3.2 Background information

Canada is water rich compared with many parts of the World with Canada’s rivers annually discharging 7% of the world's renewable water supply at about 105,000m^3 per second. Canada also has 563 lakes with a holding capacity greater than 100km^2. Across Canada, nearly all of the water used by municipal water systems comes from lakes and rivers, the remainder (12% of the

total) coming from groundwater. Canada only uses about 9% of its abstracted water for domestic use with agriculture taking the lion's share. Despite the abundance of water for Canada's 30 million people more than half of this water drains northward into the Arctic Ocean and Hudson Bay. As a result, it is unavailable to the 85% of the Canadian population who live along the country's southern border. That means the remaining supply, while still abundant, is heavily used and often overly stressed. Annual rainfall varies considerably across the country but is low in many areas.

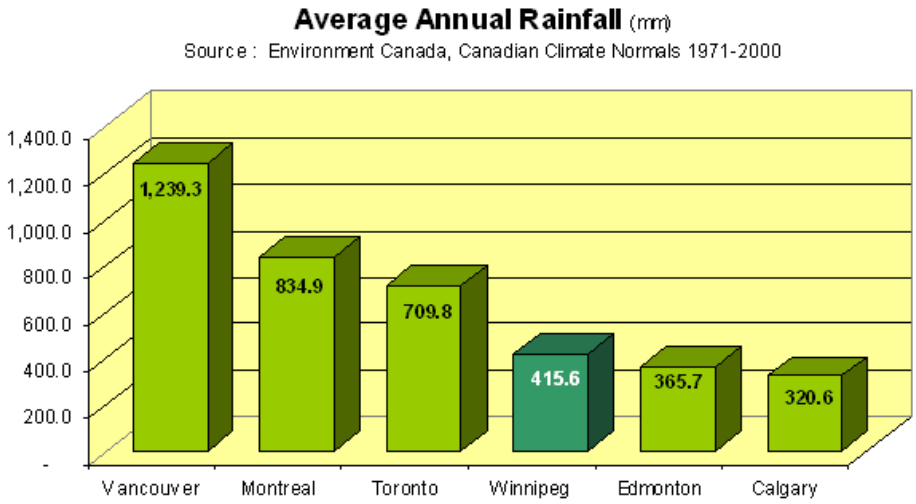


Figure 21 Average annual rainfall across main cities in Canada

Under the Constitution Act water is managed at a variety of governance levels[157] with the provinces having the main responsibility for domestic water. There are over 4,000 municipalities in Canada, most with the responsibility for delivery of water supply and wastewater treatment at the community level. Under Canada's Constitution Act, plumbing regulation is also the responsibility of provincial and territorial governments. The National Plumbing Code (NPC) of Canada 1995 and 2005 is in the form of a model code to permit adoption by the appropriate authority. Most provinces and territories adopt or adapt the model NPC and enforce its requirements and apply it to the design, construction, extension, alteration, renewal or repair of plumbing systems. It does not however focus specifically on water efficiency.

The NPC is referenced in Part 7 of the National Building Code of Canada. The plumbing system requirements were extracted from the National Building Code and first published as a separate Canadian plumbing code in 1970. The NPC is prepared under the auspices of the Canadian Commission on Building and Fire Codes and is published by the National Research Council of Canada. The 2005 NPC is in an objective-based code format.

157 ***http://www.ec.gc.ca/water/en/info/facts/e_jurisdic.htm***

All requirements in the 2005 NPC are linked to one or more of the following three top-level objectives:

- Safety
- Health
- Protection of Buildings and Facilities from Water and Sewage Damage

The federal government has direct responsibility for navigation and fisheries. Water on federal lands (e.g. National Parks) in the territories and on First Nation reserves falls under federal jurisdiction. The federal government also has responsibility for boundary and transboundary waters. Shared federal-provincial responsibilities include: agriculture, significant national water issues, and health.

Many rivers and some of the largest lakes in the world lie along, or flow across, the border between the United States and Canada. The International Joint Commission (IJC) assists governments in finding solutions to problems in these waters.

7.3.3 Water legislation approaches

Legislation in Canada does not provide strong support for water efficiency or water conservation although it is generally recognised that legislation could be better applied. There are laws that allow water authorities to deal with drought conditions such as the Conservation Authorities Act in Ontario. Provincial guidelines define low water and drought at three levels and the actions that must be taken under certain conditions. Ontario states that it has no specific provincial laws mandating water conservation but that the recent introduction of the Sustainable Water and Sewage Systems Act is likely to result in higher water rates and provide an incentive for conservation programmes. It means that municipalities will have to incorporate the true costs of supplying water into the rates. It also means that the costs of maintaining and building new water and sewage infrastructure (including source protection costs related to infrastructure) will have to be calculated and taken into account when rates are set. These costs can be mitigated by water conservation measures.

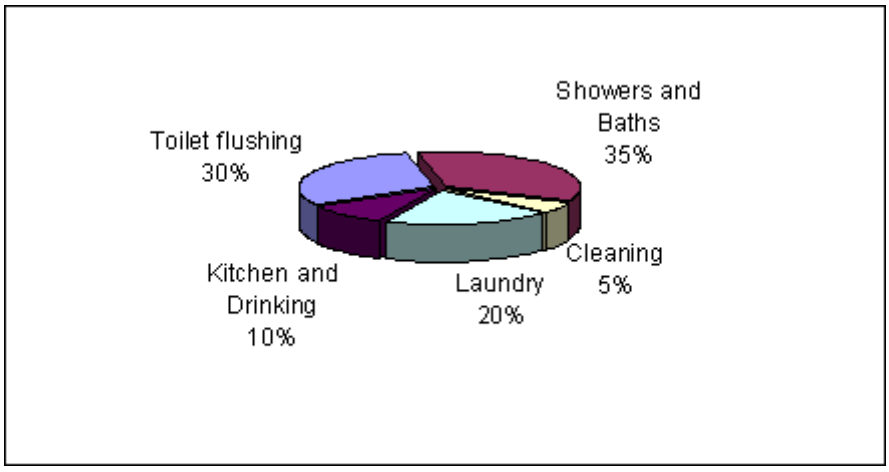
About 55% of Canadians served with municipal water pay in ways that do not promote conservation. A 2001 study of rate structures by Environment Canada showed that in 1999, 43% of the population was under a flat rate structure (where the charge or assessment is fixed, regardless of the amount of water used). Another 12% were under a *declining* block rate structure (where the consumer's bill rises at a slower rate as higher volumes of water are used); i.e. the more you use, the less you pay per unit.

Only about 45% of the population served was found to be under a rate structure that provided a definite incentive to conserve water: 36% were under a constant rate structure (where the bill to the consumer climbs uniformly with the volume used); and 9% were under an *increasing* block rate structure (where a successively higher price is charged as larger volumes of water are used).

Introducing conservation-oriented pricing or raising the price has reduced water use in some jurisdictions, but it has been emphasised that it must be accompanied by a well-articulated public education programme to inform the consumer what to expect.

Water prices across Canada are generally low compared to other countries. Monthly bills range between C$15 and C$90, the lowest being in Quebec, Newfoundland, and British Columbia, and the highest in the Prairie Provinces and northern Canada. Although water usage rates vary across Canada, the overall per capita use is very high compared to that of other industrialized countries. Only the United States has higher rates of municipal water usage.

Based on 2001 statistics, the average Canadian uses about 335l/pp/pd[158] (in summer, household water use can increase by 50%). The 335 litres is broken down as shown below in Figure 22:



Source: Canada. Environment Canada. Urban Water Indicators: Municipal Water use and Wastewater Treatment. National Environmental Indicator Series, SOE Bulletin No. 2001–1. Ottawa, 2001.

Figure 22 Pie chart of indoor residential end water use in Canada

One example of water conservation measures being undertaken at the provincial level is found in the province of Alberta. In Alberta the "Water Act" came into force on 1 January 1999, and this Act supports and promotes the conservation and management of water in Alberta.[159] The major water conservation initiative was a strategy entitled "Water for Life: Alberta's Strategy for Sustainability" which was implemented in 2004–05.[160] The strategy emphasises actions in three key areas:

- knowledge and research
- partnerships for watershed management and stewardship
- water conservation

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158 ***http://www.ec.gc.ca/water/en/info/facts/e_jurisdic.htm***

159 ***Report on implementation progress of 'Water for life: Alberta's strategy for sustainability', October 2005, Alberta Environment.***

The key water conservation programme initiatives included:

- electronic water use reporting system
- education programme on water conservation
- value of water in relation to the provincial economy
- analysis of economic instruments and water conservation measures
- water use practice and policy for various sectors

A water use efficiency and productivity measure is under development to assist in monitoring the effectiveness of the Water Strategy conservation initiatives. Targets will be determined relative to a 2015 target of a 30% improvement over 2005 levels. Despite the lack of strong water conservation legislation there is considerable policy under development. The most significant project is the Water Sustainability Project which grew from the POLIS project established in 2000 at the University of Victoria.

The project's overall objectives are to:

- develop innovative governance options that promote sustainable water management, including "watershed governance" as an alternative to centralized, hierarchical and sectoral governance approaches
- develop water policy decision-making tools that promote sustainable water management, long-term integrative planning, and regulatory mechanisms (including legal and institutional reform) to enable ecologically based water allocation
- create a national network of experts and others interested in the new paradigm of sustainable water management to contribute to and use these models as practical tools for policy and institutional change
- continue to examine urban and emerging water issues in Canada, including a survey of best practices in demand-side management (DSM) in Canada and abroad, and
- increase public awareness around the importance, and limits, of water in Canada, thereby ensuring that the above happens as part of a larger cultural change.

One of the POLIS research reports, "*What the Experts Think: Understanding Urban Water Demand Management in Canada"*, agreed on the following obstacles to demand management[161]:

- Entrenched, supply-oriented engineering approaches.
- Fragmentation in management, both horizontally among various agencies and vertically between different levels of government.
- Lack of political leadership.

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161 Maas, Tony; The POLIS Project on Ecological Governance, University of Victoria, Victoria BC. "What the Experts Think: Understanding Urban Water demand Management in Canada."

Finally, there is an organisation called “Sustainable Buildings Canada” and the use of “Green Globes” is encouraged. Green Globes is an online building and management audit that helps property owners and managers measure the environmental performance of their buildings against best practices in areas such as energy, water, hazardous materials, waste management and indoor environment.

7.4 Australia

7.4.1 Key findings

The key findings from Australia include:

- Prolonged drought conditions have driven widespread investment in demand management programmes with ambitious per capita reduction figures.
- Water conservation has become a key element of Australia’s overall water management approach.
- Place-specific water management solutions are emphasised.
- A National Water Initiative has been set up to provide a strategic plan and pathway for managing water security and encourage sharing of best practice water management across states.
- Water saving devices such as rainwater tanks in new build situations have been made mandatory in most states of Australia.
- Community consultation has been a strong feature of the overall programme.

Summary of water demand management activities

- Regulation such as compulsory water tanks in new houses in some states
- Education and a focus on how to engage with the community to have an informed debate and decision making process
- Incentivisation such as rebates for water tanks and retrofitting
- Technological improvements from integrated remote telemetry to the improvement in reverse osmosis for recycling and desalination
- Systems research to understand the stocks and flows of water in cities and its links to energy
- The use of pricing mechanisms and water trading
- Standards and labelling to inform customers
- Buy back over-allocated systems
- Regulate as required
- Be clear about resources available and where they are going (regional and catchment scale)
- Determine a demand standard for various communities
- Establish a national groundwater programme
- Determine the right pricing signals
- Develop a comprehensive plan
- Melbourne’s “Climate Neutral Water Savings Schemes”
- An online program that assesses a house or unit design, and compares it against energy and water reduction targets (BASIX)

7.4.2 Introduction

Australia has been slow to react to its climatic constraints, which include a drought which has lasted for several years virtually unabated in many populated parts of the country. Whether it is climate change or a geoclimatic blip in the normal climatic sequence, the lack of water has been a wake-up call for all of Australia. In the last three years water management has gone from being a low priority on the Australian political radar to perhaps the most pressing issue in the country. Driven by the drought which has reduced water reserves in most parts of the country and on-going and tightening water restrictions, Australia is now taking urban water management very seriously.

Australia's urban environments are not going to run out of water in the short to medium term, the longer term being too hard to predict. The challenge is being met head on through place-specific water management solutions. While Australia is water poor it is mineral rich. The country's thriving economy has enabled it to utilise expensive technical and energy intensive solutions such as reverse osmosis wastewater recycling and desalination for water supply in some areas, particularly around coastal cities where the majority of Australians live. The overall sustainability of the desalination option in particular is however still up for debate, with a number of water asset managers and industry specialists openly questioning whether demand management and other less expensive and technical solutions might not have been better.

Recently the National Water Initiative (NWI) was introduced in Australia to provide a strategic plan and pathway for managing Australia's water security and to encourage sharing of best practice in water management across regions. It also focuses on future water security and the health of rivers, with ecosystems being quite high on the agenda, despite the lack of water for human use. Critical to the project is understanding future needs and then considering supply options in a thorough and systematic way. The principles of the national water initiative are to:

- return over-allocated systems (in rural areas) to sustainable levels of extraction
- clarify water entitlements and allow trade, especially between rural and urban components
- encourage more efficient water use
- ensure good long-term planning and assessing options for supply

Because of the drought being obvious to Australians there was a strong emphasis on community consultation with the community wanting to be engaged and expecting fairness in the process and outcome. It was stated that often community engagement processes were immature and naive and that much better developed and informed processes were required.

Also underpinning the approach of the NWI is the philosophy that the low hanging fruit of water conservation had mainly been plucked and that the inclusion of mandatory measures were considered necessary to effect further change. In addition the NWI gives grants to local initiatives aimed at saving water use, preferably if their initiative was part of a larger plan.[162]

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162 ***http://www.dpmc.gov.au/water_reform/nwi.cfm#about***

New Zealand is not in the same position as Australia; we are not at crisis point in terms of water supply, but as our nearest neighbour, there is much we can learn from them in terms of what works, why and how. Collectively their measures are starting to have a significant impact on reducing demand and substantially increasing the efficiency of the available resource use to secure Australia's supply.

7.4.3 Water allocation issues

In Australia water has generally been allocated for farming on an ad hoc basis with little regard to its scarcity. As a result, many water systems are over-allocated, the Murray Darling River near Sydney being a prime example. The existing water use allocations from the river leave little water for either freshwater species or domestic supply.

Many water users have historically held licences providing for higher water extraction volumes than they have actually used. While the actual amount extracted was below the sustainable level of extraction, this was not a problem. However, as irrigators have increased production and used more of their licences, over-allocation has led to a level of use that exceeds the sustainable level of extraction. Now the government has to buy back those licences at significant cost.

With a population of nearly 21 million people and an extensive (albeit suffering) agriculture sector, Australia is fairly deep into a water crisis. The map below shows a thirty year rainfall average until 1990 which masks the situation of the last few years.

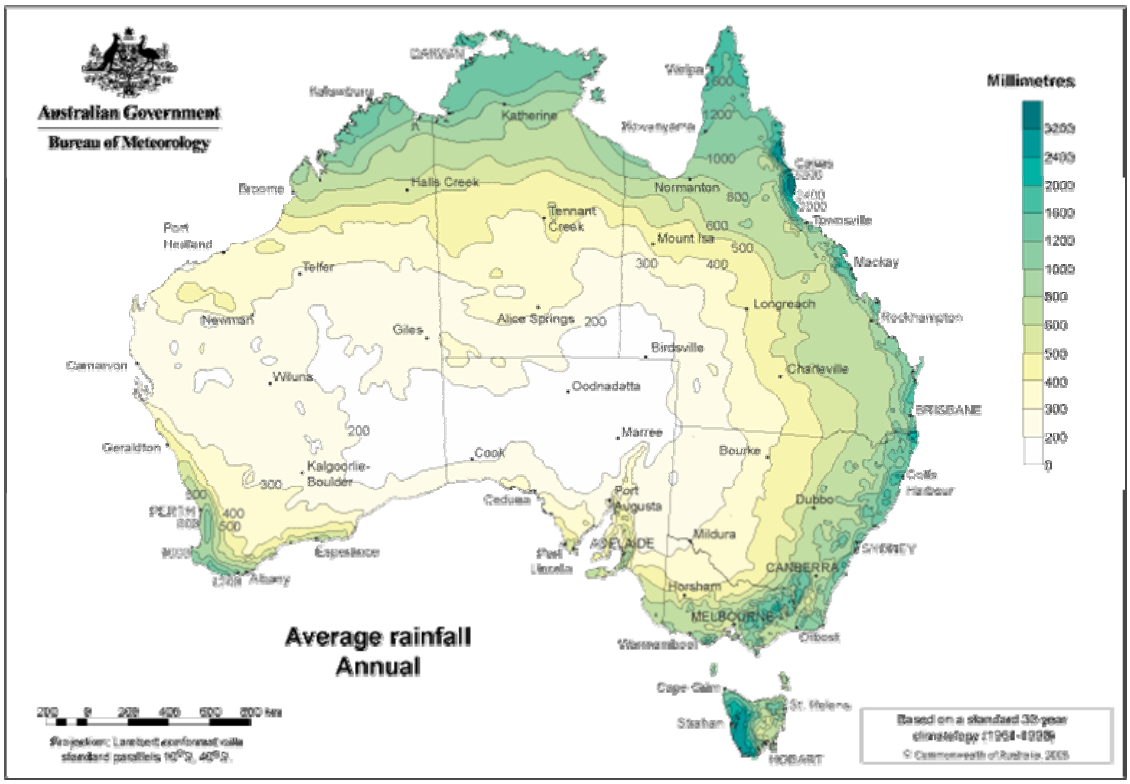

Figure 23 Average rainfall 1960–1990

In addition to Federal laws individual States and cities in Australia have their own legislation regarding water management. Some of these are now detailed.

7.4.4 State action across Australia

7.4.4.1 Queensland

In Queensland water levels within reservoirs have dropped dramatically in the last couple of years with level 4 water restrictions in place indefinitely with a result that the state is now "planning for the worst and hoping for the best".

The Queensland Water Commission is putting in place a water grid with a two way pipeline and has a framework in place that runs to 2056. The State Government is looking at every possibility to reduce demand and then provide supply at the right level. Key activities are to:

- manage the development of the Water Grid
- reduce water wastage
- identify alternative water sources; and
- efficiently manage existing water sources.

Given Queensland's projected population growth, water demand could double by 2050 if tough action isn't taken. To address this the measures being considered include:

- pressure reduction and fixing leaks
- 1,500 retrofits a year with 1,800 done to date (lack of sufficient plumbers to do more)
- a home wise water rebate which includes a $1,000 cash incentive for the installation of various water saving devices including water tanks and half the cost of a greywater recycling system.
- identifying other sources of water supply[163]

7.4.4.2 ACT Canberra

In ACT Canberra, as part of the World Environment Day Assembly Motion, the ACT Government passed a motion, which agreed that as far as possible "the building of further water supply dams in the ACT should be avoided".[164]

To assist in achieving this goal, targets (based on the base year of 2003) have been set by the ACT government as:

- by 2013 reduce per capita potable demand by 12%
- by 2023 reduce per capita potable demand by 25%
- by 2013 increase reuse from 5% to 20%

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163 ***http://www.qwc.qld.gov.au/***

164 ***Institute for Sustainable Futures, 'ACT Water Strategy, Preliminary Demand Management and Least Cost Planning Assessment Final Report' October, 2003. Report for ACTEW Corporation Ltd.***

7.4.4.3 Melbourne

Last summer Melbourne received only 40% of the average summer rainfall and stream flows into major catchments were well below average. This has lead to the implementation of "Stage 3a" water restrictions since the 1 April, 2007. Under these restrictions gardens can only be watered on specified days and only in the morning.

Melbourne's "Total Watermark 2004" strategy for managing water in the City set innovative policies and actions for managing the total water cycle, including water consumption, stormwater, wastewater and groundwater.[165] The city of Melbourne residents are encouraged to take action in residential and business water conservation programmes, water sensitive urban designs, waterwatch (residents, schools and community groups monitor their local waterways), sustainability streets (developing environmentally sustainable ideas and creating new community social links) and "savings in the city" (to help city hotels reduce waste, water and energy).[166]

An innovative approach taken by Melbourne City is their "Climate Neutral Water Saving Schemes"[167]. The discussion paper provides guidance for neutralising greenhouse gas emissions from medium to large water saving schemes with a compendium to guide smaller domestic water saving schemes.

7.4.4.4 Victoria

In Victoria water is a major issue in regional elections. Ballarat has virtually run out of water. It seems clear that a previous water strategy "Our Water, Our Future" got it wrong when it indicated that Victoria wouldn't have to worry about water supply. The State is now concentrating on an integrated management plan to cover 20 urban catchments and four rural authorities. At the moment the economics of an integrated system is not clear and needs much further work.

Victoria is also exploring a range of recycling options, including waste, storm, and backwater recycling as well as desalination. By establishing environmental water reserves for all rivers they will also undertake an annual review of water demand and supply. Water trading is also considered fundamental with allocations for consumption set at sustainable levels. Victoria wants to include externalities such as the value of water catchments in the pricing of water, and across all supply and demand options more efficient pricing is considered essential.

Victoria has made market mechanisms a key focus and is now looking at introducing trading water allocation rights to the top 200 users. As this system beds down this might extend to the top 1,000 users, with the goal that eventually all users with an allocation can trade. The benefit of this approach is that a water user who isn't using his or her full quota is able to trade their spare capacity to others, without requiring additional allocations to be made. There are also limitations to this market based approach which shouldn't be ignored, one of which is the

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165 ***http://www.melbourne.vic.gov.au/info.cfm?top=120&pg=1638***

166 ***www.melbourne.vic.gov.au/info***

167 ***City of Melbourne, "Climate Neutral Water saving Schemes, How to reuse water without increasing greenhouse gas emissions."***

potential to disrupt what could be long-established community practices with regard to use of a particular supply.

7.4.4.5 Western Australia

In Western Australia, 2001 and 2006 were two of the driest years on record. The State Government have produced a State Water Plan incorporating all aspects of the water cycle.[168]

The Government has also embarked on a very wide community consultation process involving roughly 1,200 people in "Futures" discussions using scenarios and planning tools. Like many other parts of the country they are using water rebates to encourage the uptake of water smart approaches.

"The Waterwise Rebate Programme" was introduced to help Western Australians to be more water efficient by offering rebates of up to 50% on a variety of water wise products, from swimming pool covers and irrigation systems to showerheads and washing machines. Already over 260,000 rebates have been processed with an annual saving of 4.6 billion litres of water, which will result in a saving of 52 billion litres of water over the life of the products rebated.

Key initiatives in Western Australia are:

- Wastewater recycling plant, mainly for industrial supply.
- State of the art High Efficiency Reverse Osmosis desalination plant powered by wind power.
- Recycling and a rural to urban trading system.
- Sustainable housing with a third pipe system to service gardens. This will be mandated in some new greenfields developments.

Economic measures and finding the right price for water was considered a major issue while trying to strike the balance between incorporating all the true costs, considering future impacts and not stifling the economy. The cost of desalinated water was comparable with other current water supply options such as reservoirs.

7.4.4.6 South Australia

In Adelaide water conservation efforts have mostly been focused on:

- changing horticultural industry behaviours away from over extracting water to safeguarding existing resources
- responsible water use
- utilising additional water supplies.
- fostering innovation.
- using a water balance model to try and maximise water use in medium density urban areas.

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168 ***http://portal.water.wa.gov.au/portal/page/portal/PlanningWaterFuture/StateWaterPlan***

Adelaide is starting to get water management under control. They now have the compulsory use of rainwater tanks for new houses (controversial because of rainfall pattern) and rebates for re-plumbing existing systems to make them more efficient. There is also a smart watermark labelling system for appliances in place.[169]

Adelaide had an "Urban Stormwater Initiative" running for a number of years but this is now discontinued. The initiative was a programme run under the Australian Government's "Living Cities" programme and was used to fund projects that tackled enhancing water quality in the waterways of major coastal cities by improving stormwater management. Projects that were targeted turned a problem into a resource through capture, treatment and reuse of urban stormwater. Stronger industry source control, community education and water sensitive urban design were also focuses of the programme.

7.4.4.7 New South Wales

Sydney Water has implemented demand management activities since the early 1990s. The first demand management strategy was developed in 1995 to meet a target of 329l/pp/pd by 2011, a reduction of 35% from the 1990–91 baseline. The current average water use figure is around 340l/pp/pd.[170]

An innovative approach to mandating water use is the NSW Government BASIX online programme that assesses a house or unit design, and compares it against energy and water reduction targets.[171] The design must meet these targets before a BASIX Certificate can be printed. For water the reduction target ranges from 40 to 0% across NSW reflecting the differences in rainfall and evaporation rates at different locations. A typical single dwelling design will meet the target for water conservation if it includes:

- Showerheads, tap fittings and toilets with at least a 3A rating;
- Rainwater tank or alternative water supply for outdoor water use and toilet flushing and/or laundry (in very dry areas of NSW, a typical single dwelling may not require a rainwater tank).

On the Gold Coast they have maintained a steady water demand despite 40% growth in population. They are planning for desalination coupled with a tidal energy generation system to be introduced in 2030 when all other supply and demand options have been maximized for efficiency. There is a concern raised about investing too early and/or about having stranded assets if there is a sudden, increasingly unexpected reversal in drought conditions.

Until then they expected to get gains from water conservation, reducing water pressure and fixing leaks and subsidizing the retrofit of water tanks. It's mandatory for new houses to have water tanks and the State Government is prepared to mandate for further water conservation

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169 ***http://www.wsaa.asn.au/smartwatermark/smartabout.htm#***

170 ***www.sydneywater.com.au.***

171 ***http://www.basix.nsw.gov.au/information/about.jsp***

measures. A Summary of Demand Management Practices and selected city practices are also included in Appendix 5.

7.4.5 CSIRO

The Australian Commonwealth Scientific and Research Organisation (CSIRO) has been working on a systems view of Australia's urban water situation and has been creating metabolic systems for cities, linking energy and water use. To date there is relatively little understanding of the feedback loops in such systems. CSIRO is also trying to understand the total greenhouse gas emissions of the system and how much water use contributes to the emissions profile as well as how different supply and demand options contribute.

CSIRO stress that understanding the local environment is imperative before adopting any particular water savings approach. For example rainwater tanks might provide a sensible on-site solution in Brisbane where there is good summer rainfall but may not prove as effective in Adelaide where it is substantially drier.

A water resources observation network has also been established to keep track of Australia's water at a range of scales with digital sensors and remote telemetry playing a major role (http://www.csiro.au/news/newsletters/0604_water/story1.htm).

8 Overall summary and discussion

It is clear from this research that the perceived and real diminishing water supplies, both here and abroad, are the main drivers for water demand management. For example, prolonged drought in Australia has driven significant water conservation measures while the United Kingdom must maintain a substantial level of effort to reduce water use given its high population density and changing climate. In New Zealand water restrictions are also a necessity in many parts of the country during the dry summer months and there is widespread recognition that there is scope to be considerably more efficient with the available resources. The over-allocation of some water sources is a growing and a very real concern for a number of areas such as Canterbury and the Waikato.

What this study clearly shows is that the technologies required to reduce water use are mostly readily available. Generally speaking, it is the quantity and quality of our water conservation policy and regulations that are lagging behind and that need further development if they are to better support the adoption of such technologies. The role of having active water champions promoting a demand management approach within organizations should also not be underestimated.

Based on these findings and other experiences from New Zealand and overseas, some general principles emerge in relation as to how to influence water use efficiency and promote demand management:

- Fixing leaks is a given and unless the leakage rate is of an acceptable level, there can be little credibility in asking consumers to moderate their water use habits.
- Regulation can be used to gain uptake of technologies which provide for water efficiency. For example it can be used to mandate for low-flow shower heads, dual flush toilets, urban rainwater tanks and the use of meters to measure and monitor water use. Mandating also gives certainty to the market producing that equipment.
- Policy alone cannot achieve the same level of uptake without being accompanied by strong financial incentives.
- Regulation alone can result in perverse behaviour, with homeowners being more profligate with water, taking longer showers, using the toilets to dispose of tissues and similar household waste.
- Policy is an essential companion to regulation. Consumer education coupled with financial incentives and correct pricing signals appears to provide the strongest likelihood of success.
- A well defined target in terms of a proposed reduction in overall water use is likely to drive innovation across all areas of water use intervention—especially if the target is a stretch target.
- Cities that have clearly defined and coordinated programmes of demand management interventions running over a substantial time enjoy far greater returns on their investment than those employing programmes run on an ad hoc basis.

The policy and regulatory pathways, with their likely outcomes, can be summarised diagrammatically (see Figure 24 below). These outcomes are generalised as there are likely to be variations within each pathway depending on the types of policy and regulation applied.

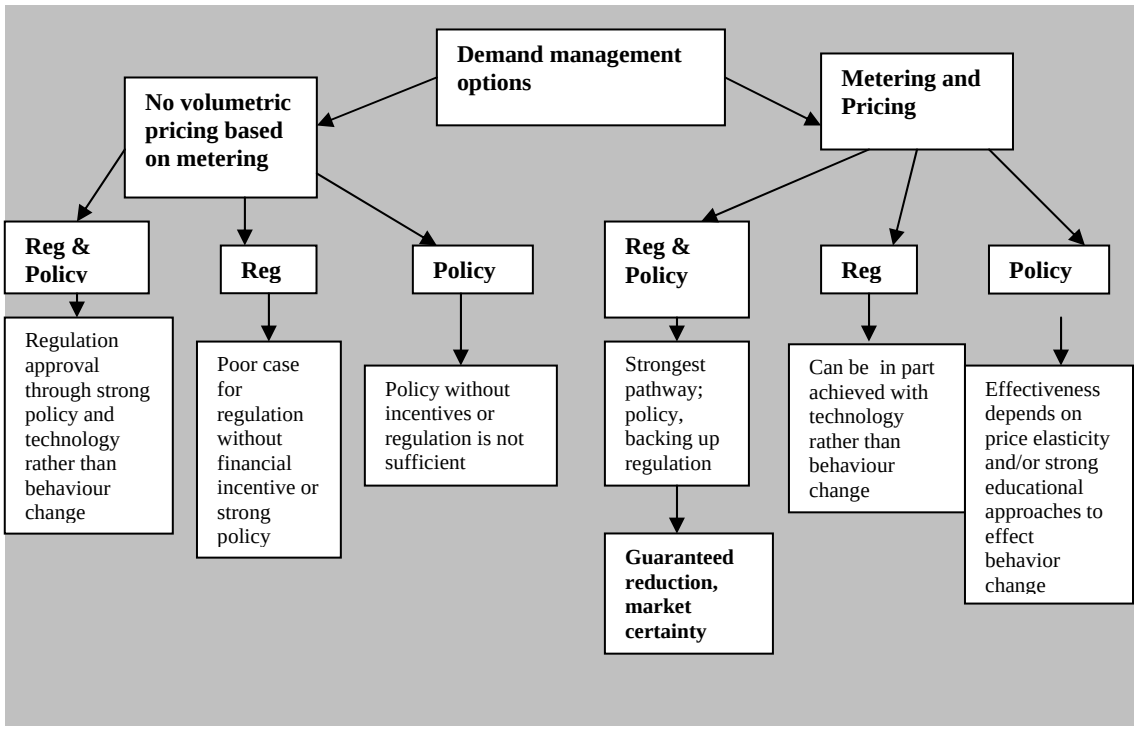

Figure 24 Policy and Regulatory Options

This study also finds that the take-up of interventions used to reduce water use as well as consumer acceptance of such measures is likely to depend on a range of factors including:

- **Perceptions about the degree of necessity or as it is commonly put, whether there is a "crisis".** A common comment regarding the need for water use efficiency is that "this isn't Australia", we don't have a water crisis; the implication being that we don't really need to worry about domestic water supply. To counter that argument Section 2.3 lists the numerous reasons why domestic water use efficiency does matter.
- **The understanding of "water as a necessity" which is undoubtedly more pronounced in those areas of the country that have experienced periods of drought in more recent years.** Drought affected areas are obviously more likely to offer support for mandatory water conservation approaches and volumetric pricing, based on consumption. The degree of necessity relates substantially to water access and climate. In New Zealand some parts of the country have low rainfall but still enjoy a relatively plentiful supply, for example the Queenstown Lakes District. Other parts are more obviously short of water with most of the available supply already allocated to hydroelectricity generation, agriculture, industry or domestic uses. Climate change and the increasing likelihood of greater weather variability is unlikely to improve this situation.

- **Consumer acceptance and politics will play a major role in how far and how fast water managers and politicians are prepared to promote certain water use efficiency measures**. Water metering and volumetric pricing remains a contentious issue in many parts of the country. The primary issues focus on a perception that water should be a "free" good and that metering and charging is the first step towards privatisation of supply. While education may partially resolve these issues for consumers it is unlikely to ever convince every member of the community. In New Zealand a number of cities use water metering and volumetric pricing and yet only one supply operation in the country is privately managed, whereas the United Kingdom experience suggests that while the water supply is largely privately managed still only 25% of homes have a water meter. These findings contradict the above consumer beliefs and suggest that water metering and privatisation are not necessarily that closely related. What is known however is that metering allows water supply managers to determine accurately what households are using and what amount of water is being lost in the system allowing for improved efficiency right across the system.
- **Access to technologies is relevant but a secondary issue**. Low flow showerheads, highly efficient dual flush toilets and low water use appliances are all readily available. However they are not necessarily promoted in retail outlets and shop assistants may also lack knowledge about the differences and benefits between conventional and more water efficient products.[172] This situation may improve once water efficiency labelling (WELS) has been made mandatory. Further regulation would also assist, for example a Building Code requirement for toilets with a reduced maximum flush volume or a shower-head with a reduced maximum flow. Even better, a water efficiency target for new homes could be introduced on a par with the United Kingdom. Other technologies such as greywater recycling systems are available which include the necessary health safeguards. The market for urban rainwater tanks is not fully developed in New Zealand and requires more certainty before it becomes well established. That could be achieved through the mandatory requirement to provide for on-site water supply for new homes.
- **The degree to which current policy and regulation is enabling will impact on the route of uptake of water use efficiency**. Without strong national legislation promoting water use efficiency, it is left to councils or water supply organisations to individually determine the policy or regulation required to promote water efficiency. Conflict between Acts, in particular Section 18 of the Building Code and the RMA leads to uncertainty in using regulatory mechanisms. There is also significant replication of effort at a local scale, much of which could be avoided by stronger national level guidance.
- **The lack of a national structure to oversee and promote water use efficiency initiatives in New Zealand means that progress is piecemeal.** New Zealand has acknowledged the benefits of an organisation focussed on energy efficiency, the Energy Efficiency Conservation Authority (EECA). Water is arguably an even more essential resource than power due to its life-supporting properties and a body dedicated to promoting water efficiency should be set up as an immediate priority. Australia has introduced the National Water Initiative that could provide a potential model for New Zealand.

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*172 **A personal survey undertaken by one of the authors in Auckland***

8.1 Reiterating the case for a National Water Act

The Parliamentary Commission for the Environment's report (2000), "Ageing Pipes and Murky Waters" notes the wide number of roles local authorities must play in managing urban water systems. These include: infrastructure owner, customer representative, service provider, and regulator. The report notes there has been concern about "the multiple and potentially conflicting roles of local authorities with unclear responsibilities, blurred accountabilities, lack of customer choice, and lack of commercial focus". The PCE suggests that there is a lack of an appropriate framework that applies to all service providers and proposes that a consolidated Water Services Act might go some way to clarifying some of these issues.

The lack of a dedicated Water Act may well be an impediment to the uptake of improved water conservation measures. For example, there is little standardised data demonstrating per capita water use, and there appears to be considerable water use differences between populations. A National Policy Statement under the RMA could also be used for promoting demand management approaches by advising councils to be actively pursuing water saving measures and possibly recommending suitable water reduction targets. This could be promulgated through a Regional Policy Statement to lend more weight to the inclusion of demand management rules in a District Plan.

As this report demonstrates, universal water metering and user charges also have the potential to significantly reduce water use. However councils have to manage political tensions about the adoption of metering. A Water Services Act that requires a transition to universal metering and user charges would give councils the mandate they need to implement such an approach. Such an Act would however have to consider and provide for the equity issues surrounding user charges and ensure that there is adequate protection for the most vulnerable members of society and who are therefore potentially most susceptible to a user pays regime for water.

The Ministry for the Environment's Water Programme of Action until recently has had minimal focus on domestic water supply concentrating primarily on rural allocation and water quality issues. There is no overarching organisation which considers the spectrum of water supply issues across the country. For a small country like New Zealand that would be possible and in many ways desirable.

9 Conclusions and recommendations

This report indicates the breadth of the current programmes and interventions being employed both nationally and internationally to achieve more sustainable management of our cities' water resources. In such a fast moving field and in such a wide range of geographical, political, social and environmental spheres, within which decisions about water management are made, it is difficult to generalise about what is "best practice" for any particular locality. That said, the research suggests there is a strong case to make for the efficacy of well managed demand management approaches, and that in New Zealand there is an imperative which is driven by an impending shortage of supply and associated over-allocation issues. In particular, picking up on the findings internationally, it is possible to see how good governance and appropriate policy and regulation can drive substantive progress in reducing excessive and unsustainable levels of water consumption.

In turn, the conclusions and recommendations for consideration for national level interventions are:

- Develop a national agency along the lines of EECA which develops and overviews water strategy and influences legislation and implements national policy such as the National Water Initiative in Australia.
- Clarify and amend if required, any potential conflicts between Acts which inhibit an appropriate level of resource use efficiency, and/or,
- Create a Water Services Act which recognises the value of water to New Zealanders' wellbeing and assists local government to easily adopt the water conservation methods appropriate for their particular context.
- Ensure that appropriate demand management interventions are advocated for and feature strongly in the National Policy Statement for water that is currently under development.
- Mandate to consider how a domestic water supply might be configured to minimise water and energy use and plan for its roll-out over a suitable period, perhaps 10–20 years.
- Enable Councils to step charge for water use regardless of whether the system is managed in-house or as a CCO.
- Set national targets for leak reductions and ensure pricing structures are fair and equitable.
- Require water metering through the Building Code or a Water Services Act.
- Set a water use efficiency standard through the Building Code (or a Water Services Act) similar to that in the United Kingdom of 125l/pp/pd for all new homes
- Set water efficiency performance levels for shower heads and toilets and mandate the installation of these technologies in newly built houses, or,
- Set whole house water efficiency figures for new dwellings akin to those proposed for the United Kingdom.
- Clarify and address health issues relating to greywater recycling to enable it to be promoted and utilised in new or existing homes

- Remove the legislative requirement for urban homes to be connected to a municipal water supply and instead require them to show that they can meet the standards for water management requirements—allowing innovation to thrive within safe parameters.

At the local scale:

- Introduce water metering if not mandated for at the national scale.
- Introduce on-site rainwater collection and consider greywater recycling as rules under the District Plan.
- Set pricing policies that send signals for water efficiency and use volumetric pricing for water supply and wastewater.
- Ensure that demand management is considered as an alternative against any decision to increase capacity or supply from existing or additional water sources and that a full comparative cost/benefits analysis is carried out.
- Have well targeted educational and incentive schemes for water efficiency and remove any barriers for water efficiency in current policies and procedures.
- Set regulatory requirements for new homes and encourage retrofit activities through other policy initiatives. With new homes that are more water efficient and consumers paying on a volumetric basis, eventually the market will favour increased water use efficiency.

In conclusion, this report acknowledges that domestic water use efficiency is still not high on either the New Zealand policy or regulatory agenda or for the end users, the wider New Zealand public. It does, however, argue that being a key natural resource for virtually all of New Zealand's activities, be they at a commercial, industrial, agricultural, household or recreational level, its proper and efficient management is a critical component of any strategy for sustainable development. This research also suggests that at a residential scale New Zealand could be far more efficient in its water use habits without taking anything away from our quality of life.

The waste in our water use system not only impacts upon the health of the country's water sources but extends to many other factors, such as our energy supply and quality of environment. As New Zealanders' wellbeing and quality of life (and that of the visitors who come here) is so inextricably linked to the quality of our environment, more sustainable water management with its greatly improved environmental outcomes offers a clear win-win situation. This symbiotic relationship has recently been better acknowledged and understood by decision makers and local and central government officers but there is still significant scope for improvement.

At present our water supply and wastewater infrastructure is based on systems developed well over a century ago. Modern technology and knowledge provide the means to be far more water efficient. However, the inherited system and associated investments in infrastructure often means there is a disincentive to consider new ways of doing things. Sustainable water management implies a system that is more in tune with natural water cycles, is more localised, uses the cleanest most energy efficient approaches, while minimising the use of treated water as a medium for removing waste. As with energy, there can be high and low quality water sources,

and ensuring that the water used is fit for purpose rather than the present one size fits all approach should be a key part of future strategic decision making. Greater use of on-site water storage also greatly improves the resilience of the system especially during times of water stress or natural disaster.

While a number of New Zealand councils are becoming more proactive in their attempts to implement demand management policy, education and a low level of financial incentives has had only a minimal impact (though in the case of education admittedly difficult to quantify). While it is unlikely we will face the crisis situation that exists in Australia in the immediate future at least, there will continue to be increasing demands and climate shifts which will make water use efficiency more relevant and important to New Zealand. There is no doubt that a range of policy and regulations will need to be applied. A clear finding from this research is that there is no one silver bullet, but rather a range of options that can be developed to form policy packages designed to meet the requirements and context of the variety of situations throughout New Zealand.

Finally while the challenges inherent in moving toward a paradigm of more sustainable urban water management are significant, New Zealand is fortunate that by international standards at least it has a small population with reasonably good access to abundant freshwater resources. As such, opportunities to innovate and change existing patterns of use and consumption abound. In some parts of the country the journey has very definitely begun, though it is acknowledged that there is still a considerable way to go. This research would argue that for those serious about heading towards a more sustainable urban water system there are many good lessons to be learnt from simply looking at what other countries and councils in New Zealand are achieving through taking a demand management approach. This will in turn almost certainly offer encouragement to organisations and other councils to do more, especially as the savings and benefits to those more proactive councils are harvested. And perhaps most importantly of all, collectively these efforts combined will almost certainly begin to make a substantial difference to the wellbeing of New Zealand’s very precious and ultimately finite life-giving water resources.

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