

WATER DEMAND MANAGEMENT – MANUKAU WATER LIMITED CASE STUDY

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ABSTRACT

Manukau Water Limited is responsible for the provision of high quality and cost effective water and wastewater services to the people of Manukau. Manukau Water Limited serves approximately 347,000 people living in an area covering 552 square kilometers from Mangere, Pakuranga and Howick in the north to Manurewa in the south.

Water demand management was included as a strategic initiative by Manukau Water Limited in 2008. A water demand management strategy was formulated in October 2008, with the aim of “providing cost effective water services to meet the needs of residents and businesses of Manukau City in a sustainable manner” (Manukau Water Limited 2008).

The strategy defines the measurement of successful demand management and sets specific targets, including yearly city-wide water consumption targets for the subsequent four years; non-revenue water targets as a percentage of water purchased from the bulk water supplier; and a gross per capita water demand target to be within the 4.5 percent reduction from 2004 to 2024, set by the Auckland regional water management plan “From the Sky to the Sea” (Auckland Water Industry 2004).

The strategy also outlined a map of linked core business processes and an implementation programme to achieve the specified targets. The ten core business processes identified were:

- Manage bulk water demand – Water mass balance;
- Water leak reduction programme;
- Pressure management;
- Operations water reduction;
- Customer communications and education;
- Key accounts demand management;
- Improved meter management;
- Smart metering;
- Hydrant policy implementation, and;
- Drought management plan.

This paper discusses the on-going implementation of this water demand management strategy. The performance against the targets set in the first year since implementation is reported. Analysis of water demand trends is discussed in relationship to the effectiveness of the measures implemented.

Manukau Water is demonstrating its commitment to provide leadership in delivering reliable water and wastewater services, respecting and caring for the environment while meeting the needs and expectations of a culturally diverse community.

KEYWORDS

Water, Demand Management, Manukau, New Zealand, Efficiency, Transparency, Customer, Consumption.

1 INTRODUCTION

Demand management is an integral part of water services planning at Manukau Water Limited (Manukau Water). It was identified as a strategic initiative of Manukau Water in 2008. As a water retailer, Manukau Water adopted a customer focused and environmentally friendly approach to demand management, promoting efficient use of water resources.

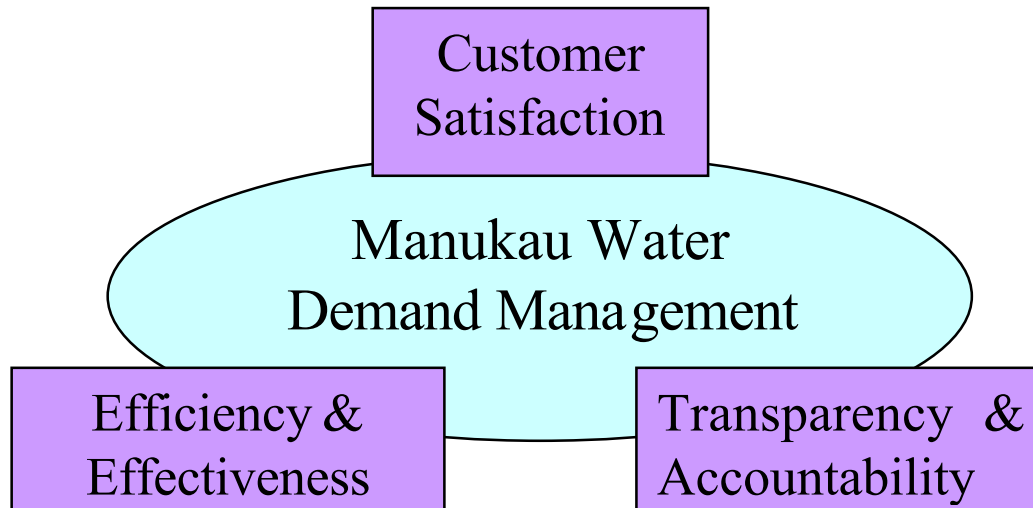


Figure 1: Manukau Water Demand Management Vision

A water demand management strategy was formulated in October 2008, with the aim of “providing cost effective water services to meet the needs of residents and businesses of Manukau City in a sustainable manner” (Manukau Water Limited 2008). The strategy defined the measurement of successful demand management and set specific targets. The strategy also identified ten core business processes and an implementation programme to achieve the specified targets.

This paper discusses the on-going implementation of this water demand management strategy. The performance against the targets set in the first year since implementation is reported. Analysis of water demand trends is discussed in relationship to the effectiveness of the measures implemented.

When considering the applicability of the lessons learnt from Manukau Water’s example, it should be noted that Manukau Water is a water retail company purchasing water from bulk supplier Watercare Services Limited (Watercare), and selling water directly to customers. All customer connections are metered and are charged 100% on volume consumed.

2 MANUKAU WATER DEMAND MANAGEMENT TARGETS

Three demand management targets were set in the demand management strategy. The demand management project execution is considered successful when these targets are met or exceeded. The performance targets were considered realistic considering a balance between capital investment and improvement in water savings during formation of the demand management strategy. All these targets were met or exceeded for the financial year 2008/09. These targets will be reviewed annually, to align with actual progress of the programme.

2.1 TARGET 1 – BULK WATER DEMAND

The first target specified water usage, as measured by the volume of water purchased from the bulk water supplier Watercare, will not exceed the first tier values in the bulk water supply contract. This is to keep the unit rate of purchasing water from Watercare at the price incentive rate for water demand management. The first tier limits set for 2009 to 2012 are summarised in Table 1.

Table 1: First tier volume limits specified by the Bulk Water Supply Contract

Year	Financial year	Volume (m ³)
1	2009	36,417,278
2	2010	37,269,985 *
3	2011	37,830,791
4	2012	38,249,857

The actual bulk water consumption for financial year ending 2009 was 35,028,009 cubic meters, within the first tier volume limit. This demand management target has been achieved for the first year of the strategy.

2.2 TARGET 2 – NON REVENUE WATER

The second target specified non revenue water, as a percentage of the total volume of bulk water purchased, should be maintained at the 2007/08 financial year level of 10.6% (indicated by red target line in Figure 2) or reduced over time. A reduction down to 10.3% was achieved in financial year 2008/09. The newly revised target is to reduce further to 10.2% in financial year 2009/10, and then maintain at 10.2% level in the future.

It should be noted that the current non revenue water percentage is relatively low compared to other network operators in the Auckland region. It is also in line with other well performing developed countries.

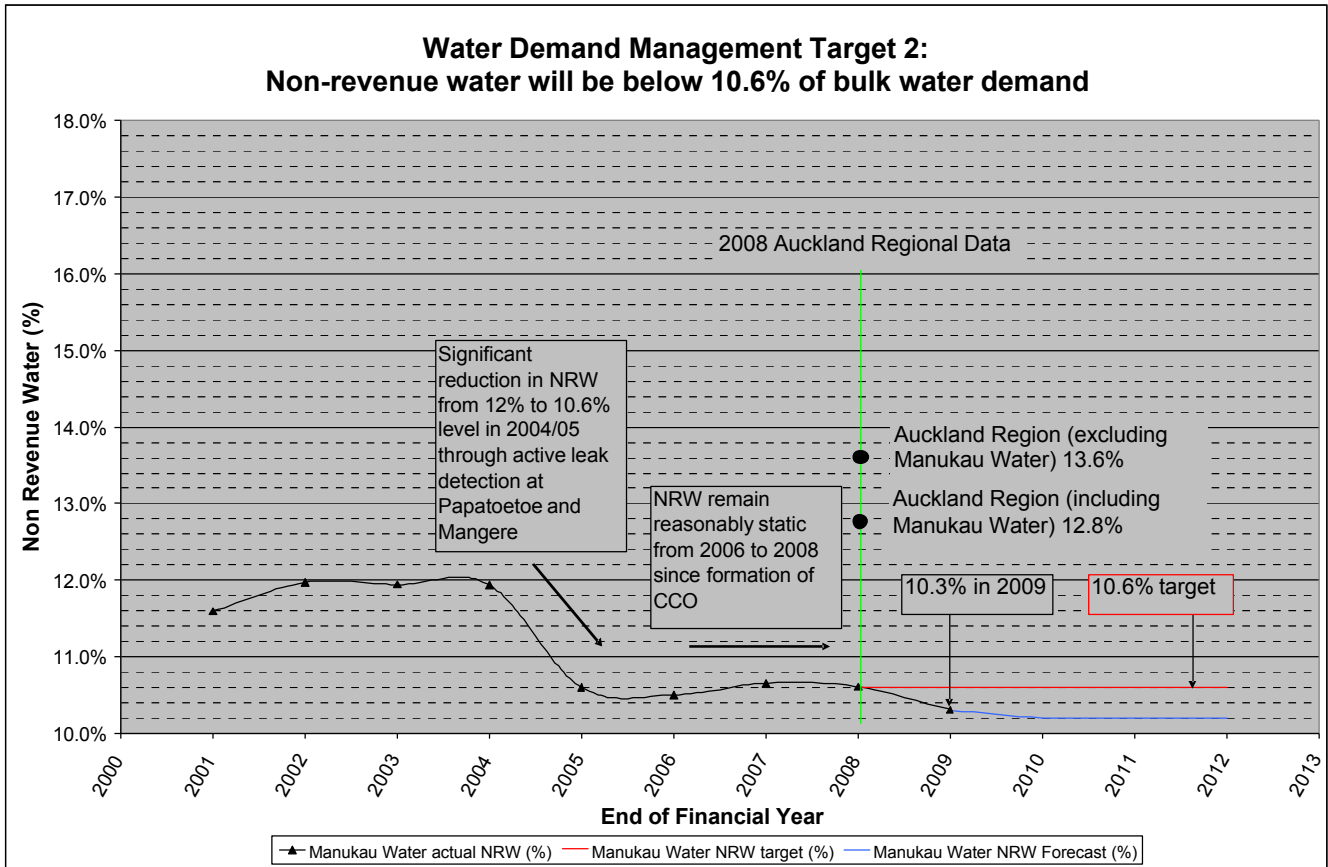


Figure 2: Non Revenue Water as Percentage of Bulk Water Purchased

2.3 TARGET 3 – “FROM THE SKY TO THE SEA” DEMAND REDUCTION TARGET

The third target specified the gross per capita water demand to be reduced by at least 4.5% between 2004 and 2024 as set by the Auckland regional water management plan “From the Sky to the Sea” (Auckland Water Industry 2004). This equates to a gross per capita demand of 284 litres/day/capita by 2024.

The black line in Figure 3 below shows the actual gross per capita demand between 2000 and 2009. In 2008/09 financial year, a gross per capita demand of 270 litres/day/capita has been achieved, already exceeding the target to be achieved by 2024. If Manukau Water continues to keep the gross per capita demand at current level, the regional target can be achieved by 2024.

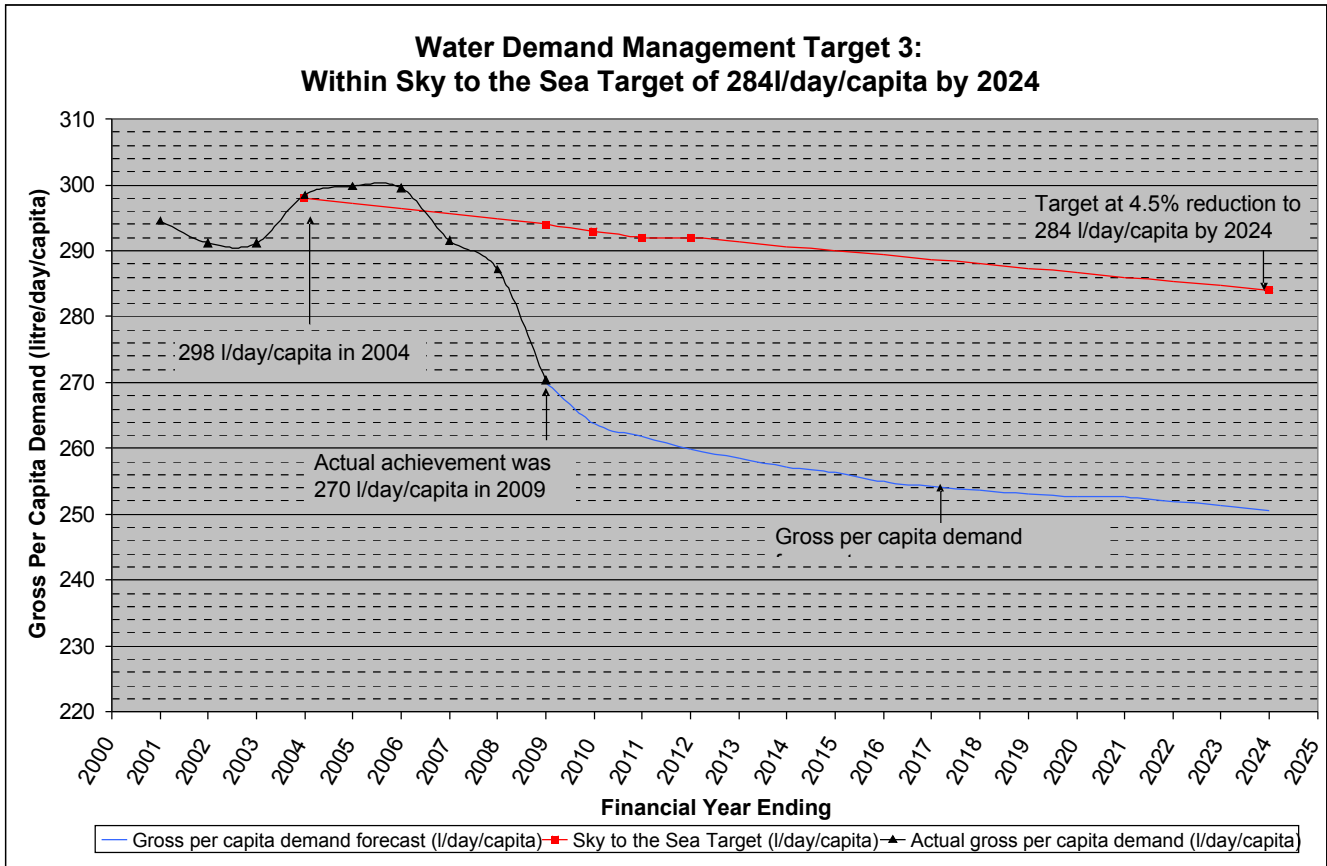


Figure 3: Gross Per Capita Demand Compared to the From the Sky to the Sea Target

3 DEMAND MANAGEMENT THROUGH TEN CORE BUSINESS PROCESSES

The demand management strategy is summarised as a strategy map depicted in Figure 4. The strategy identified demand management initiatives in ten core business processes. An implementation programme was setup to push water demand down to the specified targets considering dependency of the processes, spread of funding investments, resources and time commitments, and cost versus benefit return. A demand management committee was formed to execute the strategy, consisting of executive members, a demand management champion appointed to manage the implementation of the overall strategy, and task managers appointed to manage individual core business processes. The core businesses and associated projects are outlined below.

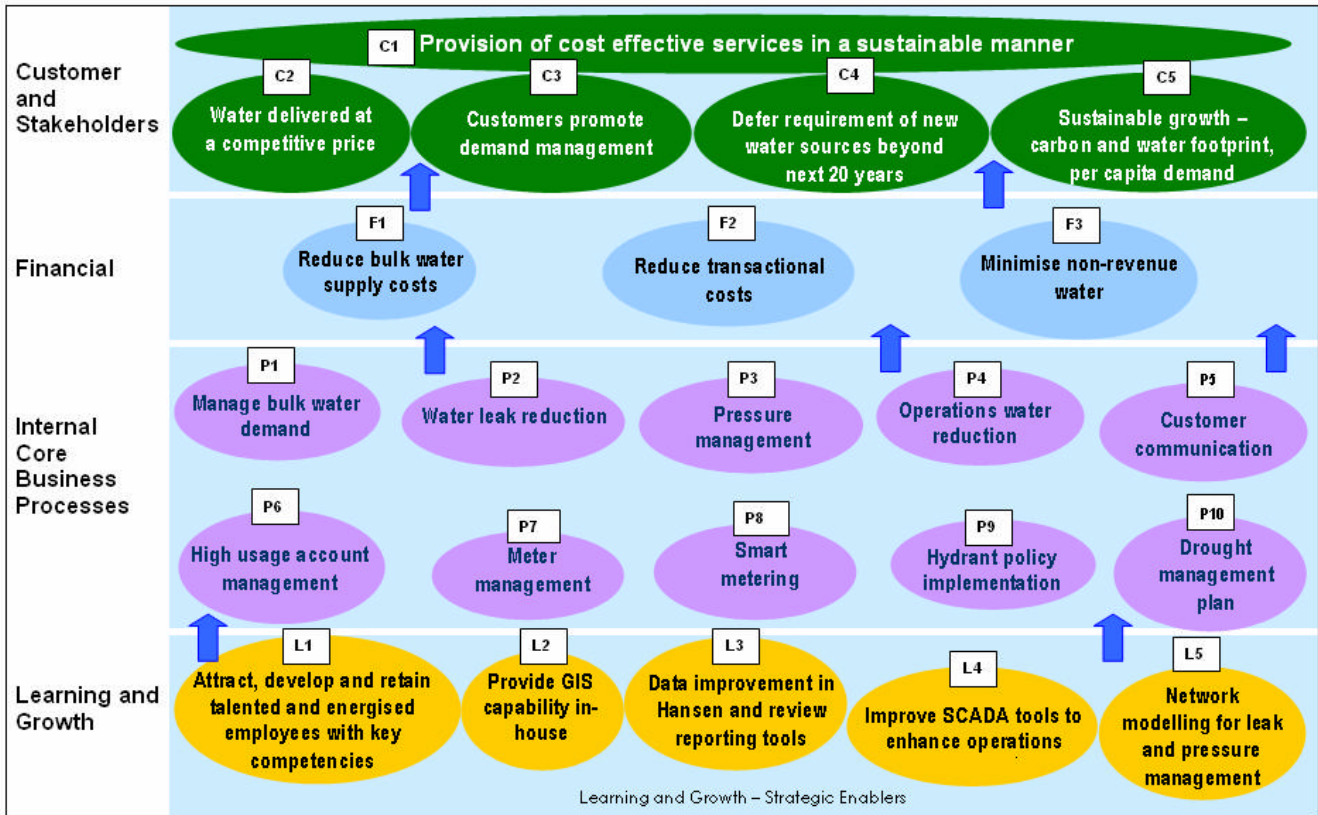


Figure 4: Manukau Water Demand Management Strategic Map

3.1 MANAGE BULK WATER DEMAND - WATER MASS BALANCE

Currently, the water mass balance is calculated at a city wide level annually. To be able to locate critical areas with high non-revenue water to target demand management programmes, an accurate water mass balance is required. Water demand and non-revenue water should be analysed per water supply district at monthly and quarterly intervals. The projects identified as essential to allow the accurate water mass balance calculation per water supply district are discussed below.

3.1.1 REVIEW METER READING PROGRAMME

Non-residential water meters are read monthly and residential water meters are read quarterly to meet the current billing cycle. To be able to allow mass balance calculation per water supply district, the meter reading programme needs to be reviewed such that water meters in the same water supply district will be read in the same timeframe. A project is underway to map all the water meters against water supply districts. An instruction is being drafted for meter reading staff to follow, so that water meter reading cycles will be aligned with water supply districts.

3.1.2 COMPLETE WATER SUPPLY DISTRICT METERING

43 district meters were installed at most boundaries of the water supply districts. Those meters monitor inter district flow at 15 minute time intervals utilizing the supervisory control and data acquisition (SCADA) system. The city wide water supply master plan model calibration report identified 11 locations where inter district flows were not metered (GHD 2009). With these gaps in district metering, the water supply districts can only be grouped into four larger discrete zones, utilising 11 out of the 43 existing district meters (25%) for mass balance calculations. This limitation can be resolved by the installation of new district meters and telemetry at the 11 unmetered boundaries. A capital expenditure report is currently being drafted, with the aim of completing the district meter installations in the 2009/10 financial year.

3.1.3 WATER MASS BALANCE ANALYSIS AND REPORTING

The current water consumption data reporting is limited to a monthly report of bulk supply water volume through Watercare's bulk supply meters, for billing purposes. Although flow information is captured at all of the 25 bulk supply meters, and the 43 district meters through the SCADA system at 15 minutes intervals, the data is not extracted and analysed on a regular basis.

Once the meter reading programme is revised and inter district metering is completed, an automated decision making support system will be developed to extract and analyse;

- bulk supply water data;
- inter-district flow data, and;
- customer consumption data.

Water mass balances and non revenue water per water supply district will be reported on monthly and quarterly basis.

3.2 WATER LEAK REDUCTION PROGRAMME

3.2.1 DETECTING POTENTIAL LEAK IN PRIVATE PLUMBING AND CUSTOMER NOTIFICATION THROUGH ANALYSING BILLING RECORDS

Since 2008 a routine has been implemented to the Hansen asset management database to check all customers' water bills to highlight bills showing a sudden significant increase or decrease in consumption. Figure 5 shows the screen in Hansen with default settings to highlight a customer's bill record in red or orange if their usage is twice to three times more than the last bill. Notification letters were sent to these customers and their water usage in subsequent bills was checked to follow up on the outcome of leak notification. This programme has resulted in a 2% drop in Housing New Zealand Corporation water demand from 2008 to 2009.

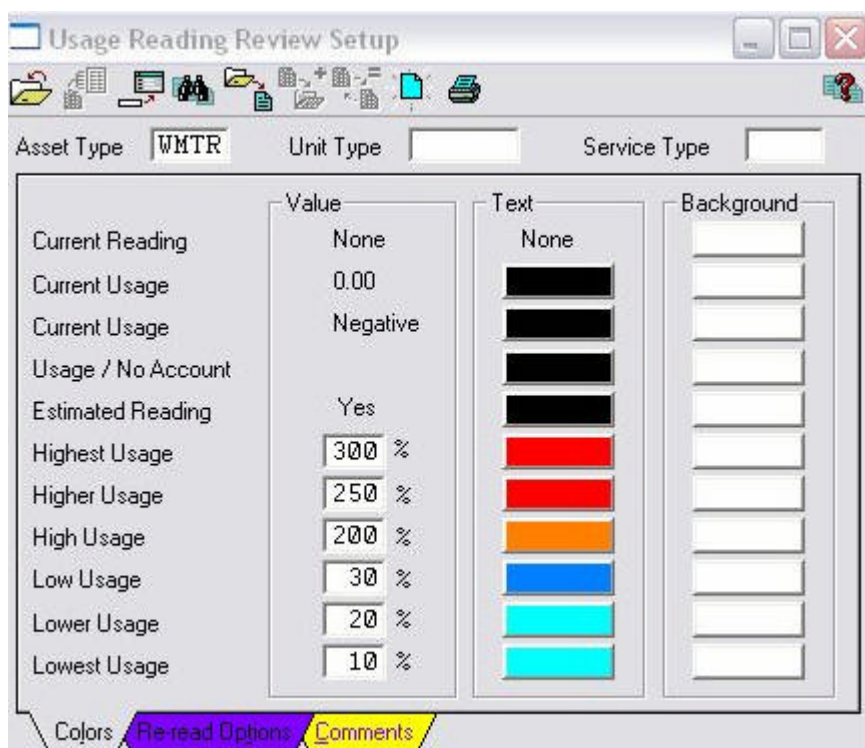


Figure 5: Water usage reading review in asset management database - Hansen

3.2.2 LEAKAGE ALARMS THROUGH SCADA SYSTEM

Each of the 20 water supply districts has a leakage alarm system in place to monitor night flows. The flow limits are set according to historical network knowledge. A leakage alarm is triggered if the night flow recorded by the

SCADA system rises above the set point. This system can pick up large events like pipe bursts, but not smaller continuous events such as water leakage through cracked pipes and joints. The joint water supply master plan modelling study, to be finished in October 2009, will confirm the need to revise the alarm set points for each of the water supply districts.

3.2.3 ACTIVE LEAK DETECTION AND REDUCTION IN SUPPLY SYSTEM

The results of the water mass balance detailed in 3.1.3 and the water supply master plan modelling study to be completed in October 2009 will be used to highlight areas with unusually high leakage. This will enable a leakage detection programme to be implemented. Previously targeted active leak detection programmes have proven to be effective. Significant reduction in non revenue water from 12% to 10.6% was achieved in 2004/05 through active leak detection in the Papatoetoe and Mangere supply districts (Refer to Figure 2).

3.3 PRESSURE MANAGEMENT

Manukau Water provides water supply at high average pressures between 700kPa and 900kPa, taking advantage of its reasonably new assets and its close proximity to the Watercare Redoubt Road Reservoir Complex water source. Five of the 20 water supply districts have reduced supply pressure using a number of pressure reducing valves, but the reduced pressure supply area is relatively small and the settings of the pressure reducing valves are not optimised.

Following the completion of the city-wide water master model in October 2009, the existing pressure zones will be reviewed and potential new pressure reduction zones identified and analysed. Pressure management will be investigated aiming to reduce non-revenue water by reducing water main breaks particularly in older parts of the city and to reduce per capita demand.

3.4 OPERATIONS WATER REDUCTION

Operations and maintenance of the water network requires water mains to be flushed following water quality problems, connection cut-ins, and maintenance tasks. The operation and maintenance procedures have been reviewed and amended to use medium flow for flushing to minimise the loss of water during operations and maintenance tasks. The general intention to reduce water wastage has been communicated to contractors in the new operations and maintenance contract.

3.5 HYDRANT POLICY IMPLEMENTATION

With the implementation of the Hydrant Policy in 2009, all the standard standpipes excluding those used for fire fighting are metered (Refer to Figure 6). The metered water usage readings are captured in Hansen. Manukau Water is working on monthly reporting of the metered water use from standpipes, as well as reporting the number of incidents where flushing is required.



Figure 6: Standard Standpipe for Hydrant Flushing

3.6 CUSTOMER COMMUNICATIONS AND EDUCATION

One of Manukau Water’s strategic goals is that “Customers are our advocate”. As a water retailer, Manukau Water has adopted a customer focused approach to demand management and to promote efficient use of water resources. The message communicated to customers was “The less you use, the more you save”, rather than simply “conserve water”.

Customer communications have been focused on two main points, to educate customers on good water wise habits and to communicate achievements to date.

The World Water Day communication programme has been successfully rolled out in 2009. A detailed customer communication programme was also drafted for discussion with regional stakeholders to collate a regional communication programme.

3.7 KEY ACCOUNTS DEMAND MANAGEMENT

3.7.1 TOP 30 WATER CUSTOMERS

The key accounts manager is liaising with the top 30 water customers regularly to promote water efficiency in their business processes. Water auditing services are provided to customers free of charge. A web based water consumption monitoring tools are provided to the top 5 water customers.

3.7.2 HOUSING NEW ZEALAND CORPORATION

Following the Housing New Zealand Corporation Study in 2007 that confirmed Housing New Zealand Corporation tenants use more water on average than non Housing New Zealand Corporation households, a water demand management programme aimed at Housing New Zealand tenants has been developed and is under review. The leak notification programme was implemented in 2008 and has proven to be successful and beneficial to Housing New Zealand Corporation as discussed in section 3.2.1.

3.8 IMPROVED METER MANAGEMENT

3.8.1 MISSING WATER METER PROGRAMME

A programme is underway to identify properties without a water meter. Water meters will be located with global positioning system (GPS) technology and entered into the geographical information system (GIS). This will also enable water meters to be linked to water mains, and provide operational information on the number of properties affected by a water main break or shutdown. Automatic notification to customers, such as text messages, of water outage will then be possible.

3.8.2 METER REPLACEMENT PROGRAMME

Prior to June 2006, water meters were replaced based on age of the meter. Testing of the removed meters, however, revealed that the majority of the water meters were still operating within their 2% tolerance range. A risk based meter replacement programme will be developed to target the water meters of large water use customers as well as an improved process for the replacement of faulty meters. Meters displaying no consumption will be investigated to check for meters that have failed.

3.9 SMART METERING

3.9.1 WEB BASED DEMAND TRACKING TOOL

In 2008, Manukau Water trialled a web based demand tracking tool with its two largest consumption customers. Water usage at the meter is recorded every five minutes and is downloaded to the web based system each night via a cell phone link. Customers can login to the secure website to view demand data. With the success in the trial, the programme will be extended to five more customers in late 2009.

3.9.2 DAILY WATER CONSUMPTION DISPLAY UNIT

Five Manukau Water employees are currently trialling a daily water consumption display unit within their homes. The unit interrogates an electronic counter attached to the water meter providing daily and weekly water consumption data. If the trial is successful, there are opportunities to distribute these display units to residential customers or schools for educational purposes.

3.10 DROUGHT MANAGEMENT PLAN

Manukau Water has adopted the regional drought management plan and is working with other stakeholders in the region to monitor and review drought management needs.

4 WATER DEMAND TRENDS IN RELATIONSHIP TO THE EFFECTIVENESS OF DEMAND MANAGEMENT MEASURES IMPLEMENTED

To observe the effectiveness of the demand management measures implemented so far, historical demand data has been analysed for trends in consumption behavior. Figure 7 below shows the historical trend of bulk water demand. It is evident that water demand in the Manukau City rose steadily from July 2000 to June 2006. When Manukau Water became a Council Controlled Organisation (CCO) in 2006, water demand stabilised at approximately 36.5 million cubic meters level for the three years to 2008. In the 2008/09 financial year, there has been a 4% (1.5 million cubic meters) drop in water usage compared to consumption in the previous year.

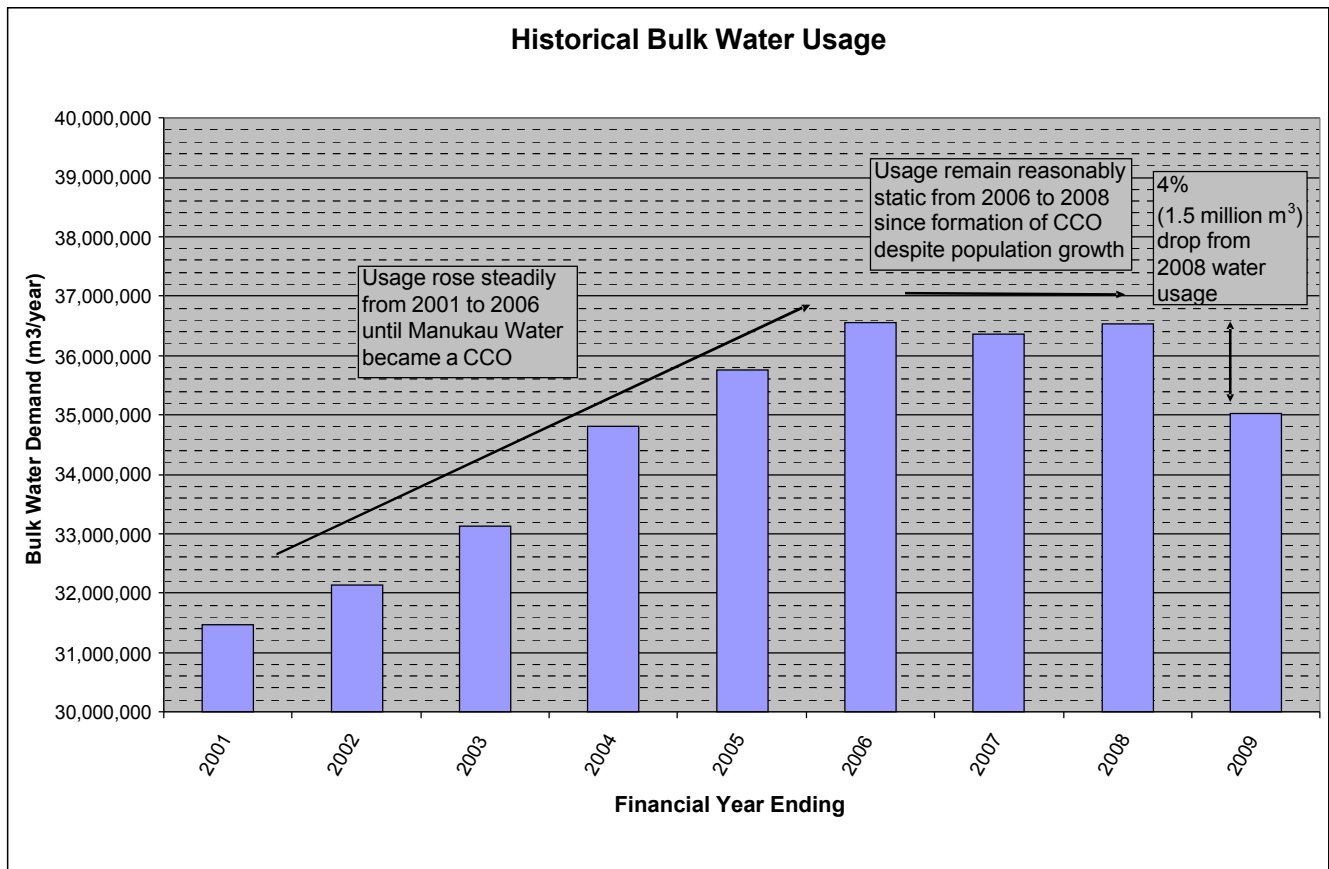


Figure 7: Manukau Water Historical Bulk Water Demand 2000 - 2009

The water consumption data has been further analysed based on the type of use. Figure 8 shows the historical trends for residential water demand excluding non revenue water from July 2008 to June 2009. The bar chart shows that residential demand rose steadily from 18.6 million cubic meters/year in 2000 to 22.3 million cubic meters/year in 2006, then stabilised ranging between 22 million cubic meters/year and 22.5 million cubic meters/year from 2006, when Manukau Water became a CCO. This is consistent with the overall trend observed in the bulk water usage in Figure 7.

The scattered plot in the secondary axis on the graph shows that residential consumption rose from around 180 litres/day/capita between 2000 and 2003, to round 190 litres/day/capita in late 2003 to 2006. This confirms the steady increase in total residential demand in that period was not purely caused by population increase, but rather an increase in usage per person. Since 2006, the per capita residential consumption dropped steadily to reach 171 litres/day/capita. This explains the stabilisation in total residential demand despite rapid population growth. The drop in per capita residential demand since Manukau Water became a CCO in 2006 is believed to be a response to the change in water bills, showing both water and wastewater charges on one bill. Historically, the wastewater charge was billed as part of property rates without a breakdown amount in the bill. The effect of customers perceiving the costs of water and wastewater services, and associating that with volume of water used had an impact in per capita usage behavior.

Of the 512,170 cubic meters reduction in residential demand from the 2007/08 financial year to 2008/09 financial year, 63,000 cubic meters (12.3%) was from water savings by Housing New Zealand Corporation properties as shown in Figure 10. This demonstrates that the leakage detection and notification project implemented last year (discussed in section 3.2.1) has been effective in reducing leakage and overall consumption for this customer.

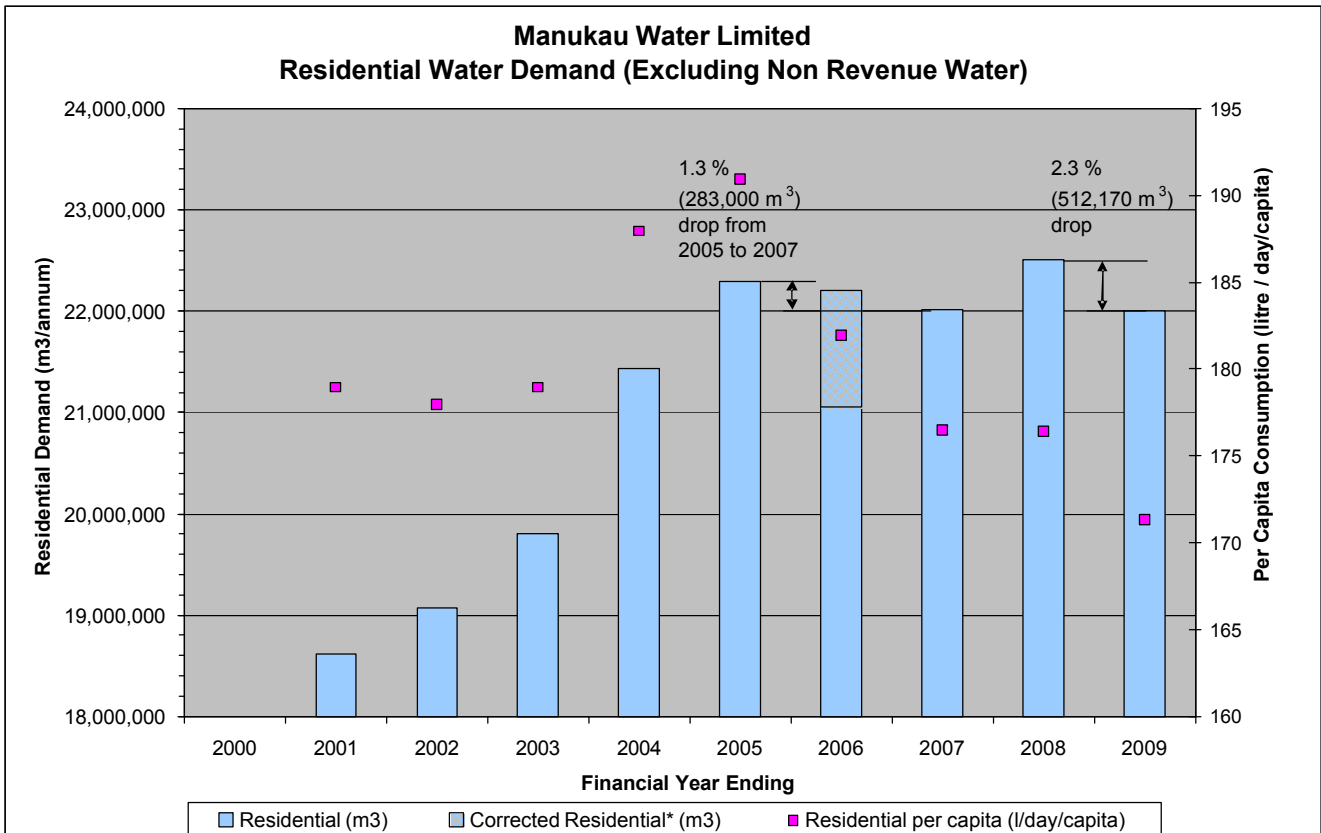


Figure 8: Manukau Water Historical Residential Demand July 2000 - June 2009

* The 2006 water consumption figure were adjusted to correct discrepancies caused by misallocation of demand type during database transition. The database transition were completed and audited in 2007.

Figure 9 shows the historical trends for non residential water demand, excluding non revenue water from July 2008 to June 2009. The water usage for the top 40 water use customers in 2009 was extracted from non residential demand for the five year period; and the water usage for Housing New Zealand Corporation has been extracted from residential demand over the same period and plotted in Figure 10.

An 8.4% growth in non residential demand was evident between 2005 and 2007. This increase was largely due to economic growth but also resulted from the data clean up project initiated for the Manukau Water customer database, following the introduction of volumetric wastewater charging in 2006.

The significant demand drop of 324,285 cubic meters observed between the 2006/07 and 2007/08 financial years was mainly in response to a tariff structure change for wastewater charges. Before the tariff structure change, a 400 cubic meters equivalent volumetric wastewater charge, equating to \$1,072, was waived. Comparing the demand of the top 40 usage customers between 2006/07 and 2007/08, the effect was more noticeable to lower usage non residential customers, as the percentage increase in their water bills was higher.

Non residential water demand dropped by 730,862 cubic meters (7.2%) between the 2007/08 and 2008/09 financial years. As observed in Figure 10, the water consumption reduction contributed by the top 40 high usage customers was 763,000 cubic meters, higher than that observed in the overall non residential sector. This suggests that the demand of other non residential customers increased slightly. The Manukau Water key accounts manager has been in close liaison with the top 40 water use customers, and has confirmed that the 15% drop in demand is mainly due to the economic downturn as well as implementation of water efficient technology.

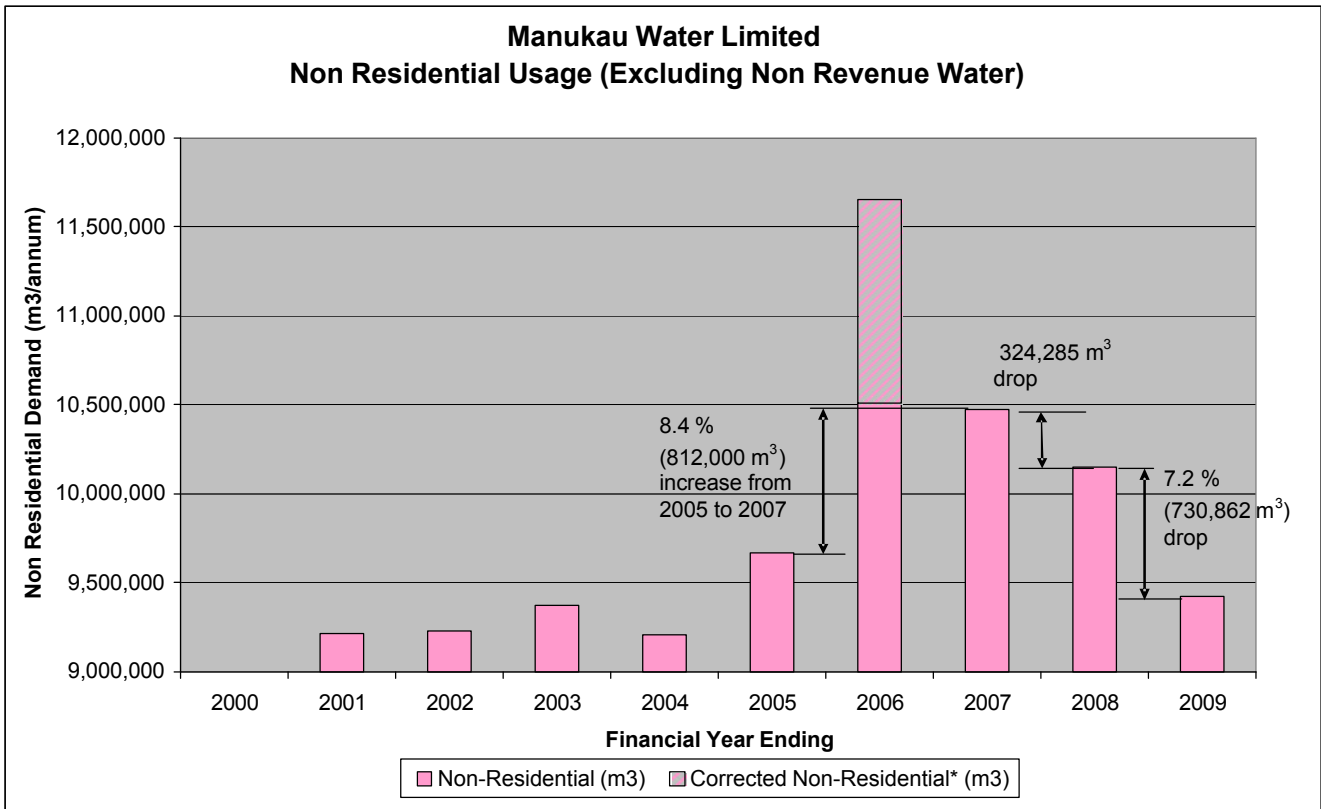


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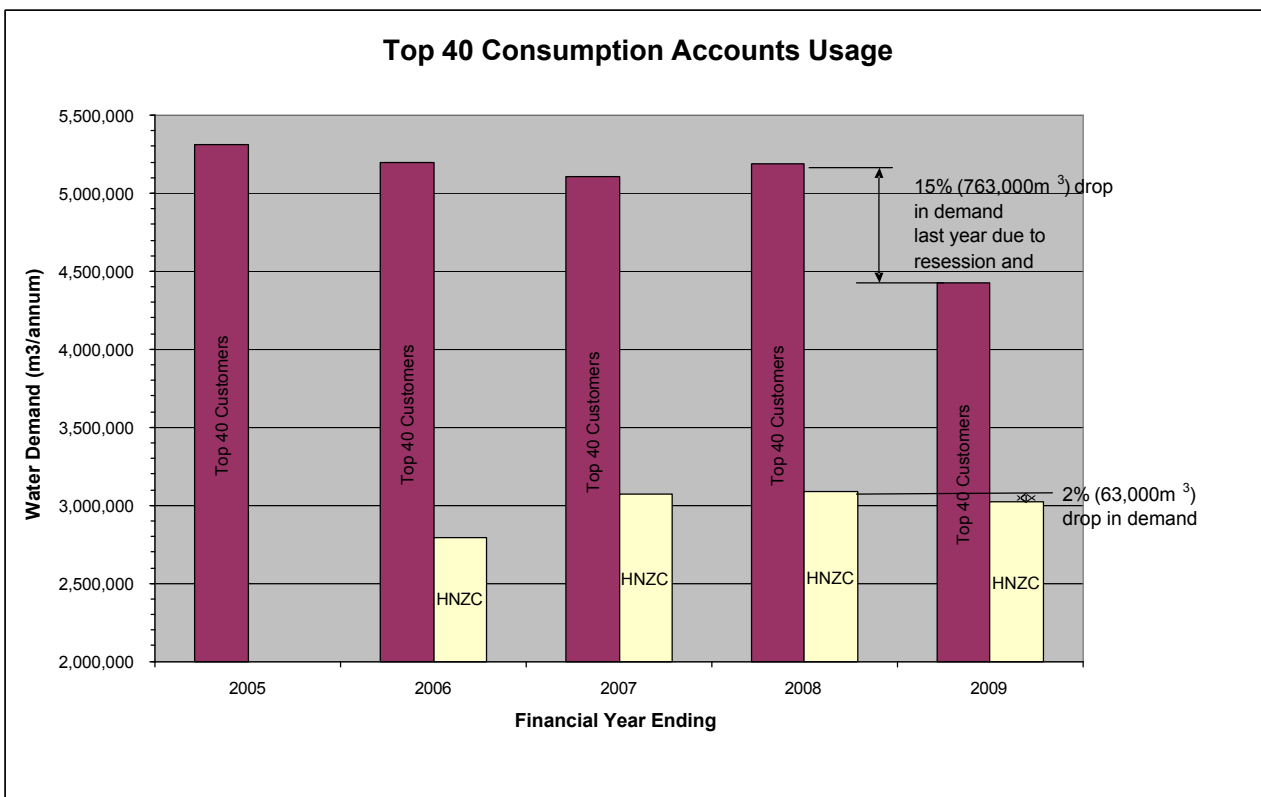


Figure 10: Manukau Water Historical Top40 Customers Demand July 2004 - June 2009

*Housing New Zealand Corporation (HNZC) demand data was unavailable before July 2005

** The top 40 customers from 2009 have had their historical usage collated for comparison in the graph

5 CONCLUSIONS

Manukau Water is experiencing success with its strategic initiative, Water Demand Management in its first year of implementation. A recently formulated water demand management strategy has been implemented starting in the 2008/09 financial year, with the aim of “providing cost effective water services to meet the needs of residents and businesses of Manukau City in a sustainable manner”. Since then demand management became an integral part of water services planning in Manukau, with a customer focused and environmentally friendly approach, promoting efficient use of water resources.

The three targets set in the demand strategy prepared in October 2008 were met and exceeded. These were:

- Bulk water consumption for the financial year ending 2009 was 35,028,009 cubic meters, within the first tier volume of 36,417,278 cubic meters;
- Non revenue water has been reduced to 10.3%, better than the target of 10.6%; and
- Gross per capita demand of 270l/day/capita has been achieved, exceeding the 284l/day/capita target to be achieved by 2024.

The strategy also identified ten core business processes and an implementation programme to achieve the specified targets, including:

- Manage Bulk Water Demand – Water Mass Balance;
- Water Leak Reduction Programme;
- Pressure Management;
- Operations Water Reduction;
- Customer Communications and Education;
- Key Accounts Demand Management ;
- Improved Meter Management;
- Smart Metering;
- Hydrant Policy Implementation; and
- Drought Management Plan.

Historical water demand trends have been analysed, and this confirms the significant achievement in demand management since 2006, when Manukau Water became a Council Controlled Organisation. The measures proven to be effective are customer communications and education, price control through changing tariff structure, key accounts demand management and water leak reduction programme through checking water bills and customer notification.

Manukau Water is demonstrating its commitment to provide leadership in delivering reliable water and wastewater services, respecting and caring for the environment while meeting the needs and expectations of a culturally diverse community.

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