Target Sustainability

TARGET WATER BUSINESS GUIDE

www.targetsustainability.co.nz

CHRISTCHURCH
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1. Introduction

The Target Sustainability Programme has been developed to help your business improve the efficiency of resource use and improve profitability.

The Target Water Business Guide is one of a series of Target Sustainability Business Guides written to help your business use both natural and manufactured resources more efficiently. Other Business Guides in the series include Target Waste, Target Energy and Target Paper and an implementation guide called The Path to Sustainability Business Guide.

This Guide focuses on the efficient use of the water resource and provides suggestions to help improve efficiency in both the office and manufacturing environments.

This Guide will be more effective for your business if read in conjunction with The Path to Sustainability Business Guide which outlines the basics of how to go about implementing the kinds of changes necessary to make significant and lasting resource efficiency improvements.

2. Water - An Overview

2.1. International issues

“About one-third of the world's population live in countries with moderate to high water stress.”[1,2] The problems are most acute in Africa and West Asia but lack of water is already a major constraint to industrial and socio-economic growth in many other areas, including China, India and Indonesia. “If present consumption patterns continue, two out of every three persons on Earth will live in water-stressed conditions by the year 2025.”[3] The declining state of the world's freshwater resources, in terms of quantity and quality, may prove to be the dominant issue on the environment and development agenda of the coming century.

2.2. Canterbury and Christchurch issues

Canterbury’s water is a natural resource that needs protecting. While many New Zealand towns get their water from rivers, Christchurch is different because its water supply is drawn from the artesian basin under the City.

Christchurch water is naturally filtered through the gravel beds and sand laid down by glaciers and rivers during the formation of the Canterbury Plains. This means that the water doesn’t need to be filtered to remove bacteria or other matter, because it comes from the ground clear, refreshing and ready-to-drink.

Over time the underground artesian basin is recharged predominantly from the Waimakariri River, and also from rainfall that has seeped from the surface down into pores in the sand and shingle.

“Fresh water is vital to the Canterbury region which has 70% of the country’s irrigated land and generates 24% of the nation’s power through hydroelectricity.”[4]

The total volume used per capita in Christchurch is 427 litres/day (averaged between 2000 to 2005 and including all users).[5]

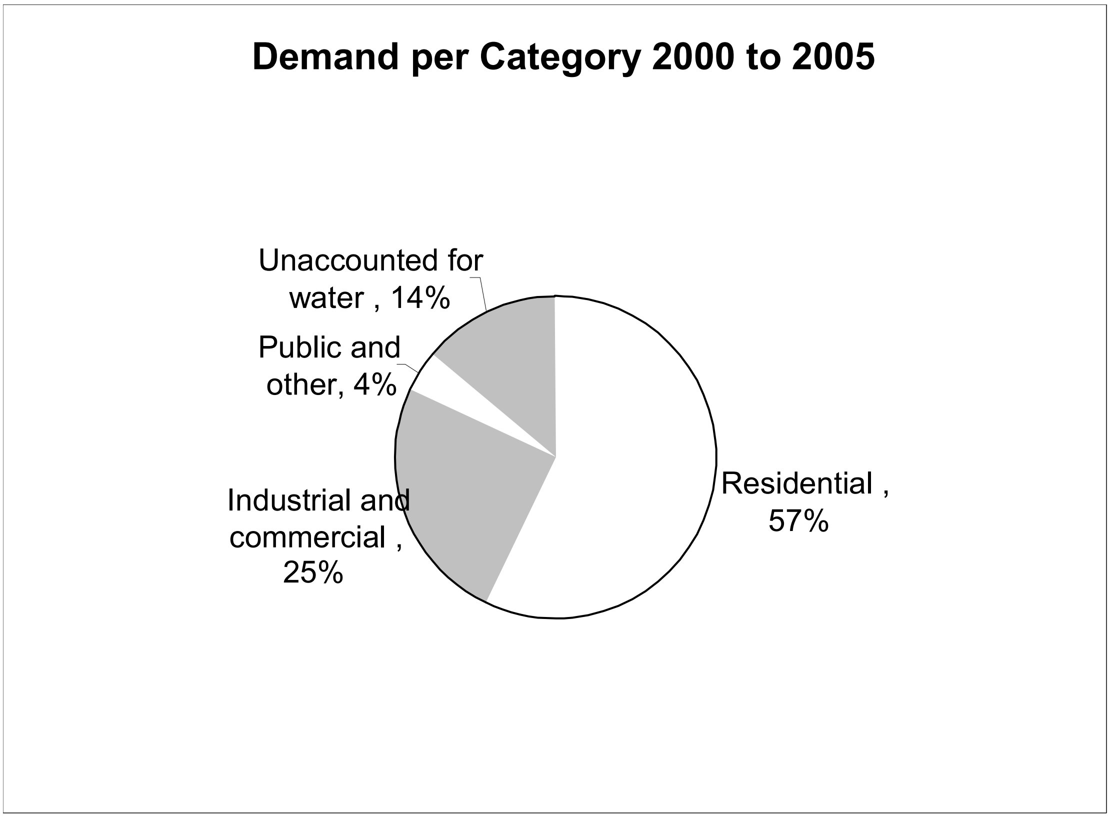
2.3. At work

Water is a necessary input to many production processes in Christchurch. Industrial water use accounts for approximately 14.0 million cubic metres (m^3)/year (1 m^3 = 1000 litres).

[1] www.unep.org/geo2000
[2] Water stress occurs when the demand for water exceeds supply or when poor quality restricts its use.
[3] http://freshwater.unep.net/
[4] Source http://www.ecan.govt.nz/Our+Environment/Water/.

The main users in the local industrial sector involve the processing of leather and wool, meat and poultry, fruit and vegetables, seafood, soft drinks, beer, cereal food, milk, fertilizers, organic chemicals and the rubber tyre industry.

The pie graph below shows that the industrial use of water accounts for 25% of Christchurch water use between 2000 and 2005[5].



2.4. Water quality

It is not just about the quality of water we are using, it is also about retaining water quality. Christchurch is rare in that its water complies with the requirements of the New Zealand Drinking Water Standards without filtration or other treatment.

Unlike chlorinated water supply systems, in Christchurch there is no disinfection of the water supply to treat small numbers of bacteria that may enter the system. However, water from the system is sampled frequently and special precautions are taken to ensure that our high grade, public water supply does not become polluted. These precautions include being extremely careful as to who works on the pipe work and how the work is carried out.

Where a business uses water in its manufacturing processes it must ensure such usage does not adversely impact the drinking water supply.

Care is also needed to ensure that water cannot siphon back from a business premises into the water supply. This is prevented by the use of a backflow preventer, which will protect staff on the premises as well as the public water supply.

2.4.1. How good is Christchurch water?

Around 1800 samples per year are taken from the water supply and tested for E. Coli (bacteria found in the intestines of humans and animals). The Community Public Health (Ministry of Health), Environment Canterbury, and the Christchurch City Council work together to ensure the quality of our water supply is protected.

[5] Christchurch City Council data

The Christchurch City Council carries out chemical testing, looking for any variations in the chemical composition of water. Chemical composition may differ from one well to another. A typical chemical composition analysis chart is available on the Christchurch City Council website.[6]

2.5. *Why do we need to reduce water use?*

At least 25% of the total water consumed in Christchurch is due to commercial and industrial activities. Unnecessary water use (i.e. waste) has significant business impacts in addition to the environmental and quality impacts discussed above.

Using the water resource responsibly is clearly important for the on-going health and sustainability of the Canterbury water supply, economy and community. It can also yield financial benefits to your business through:

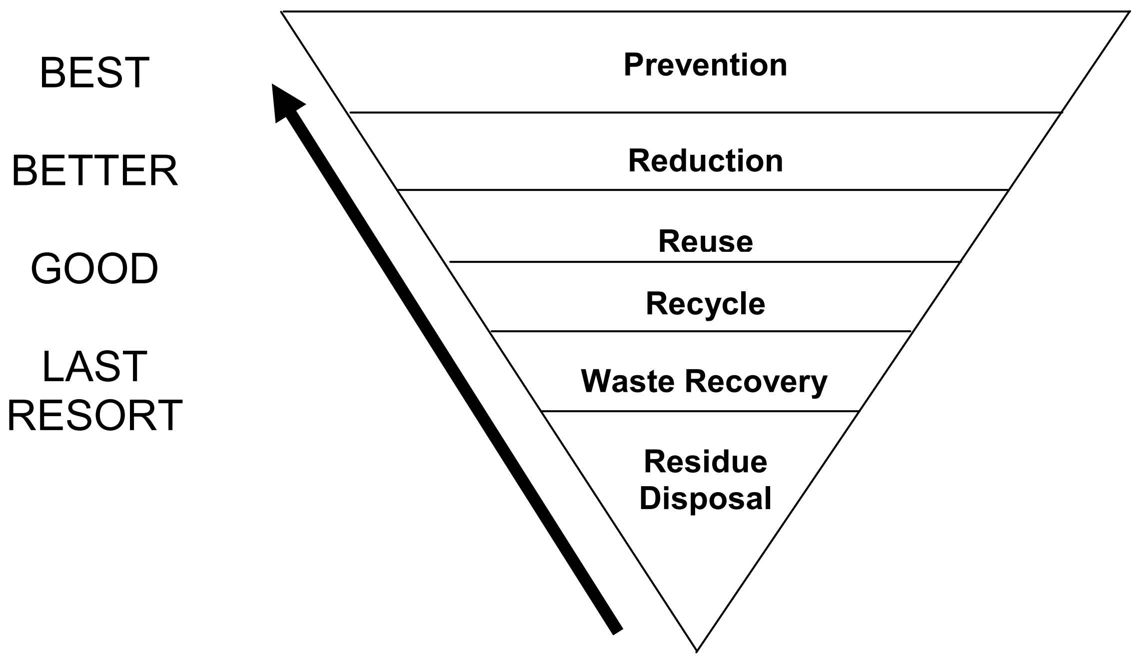
- a reduction in the amount of material (raw material or products) sent to waste in wastewater,
- a reduction in trade waste costs, and
- a reduction in energy costs.

2.6. *The waste hierarchy*

The importance of preventing waste is a common theme of the Target Sustainability Programme, whether we are looking at water, energy or solid material resources. The waste hierarchy illustrated below clearly shows where we should start – can this waste be prevented from occurring at all.

It is important to keep this hierarchy in mind as you look at ways of improving the efficiency of how resources are used in your business.

The waste management hierarchy



[6] http://www.ccc.govt.nz/Water/HowWeGetOurWater/ChemicalAnalysis.asp

3. Water Use - Office

Water consumption in an office occurs in four principal areas: kitchens, amenities (i.e. toilets and showers), heating and cooling systems (i.e. cooling towers) and landscaping. In some cases leaks can also account for a large proportion of the apparent 'consumption'.

This section provides ideas on how to measure the water you are consuming, where opportunities for using water more efficiently might be found and some options for improvement.

You should approach water reduction systematically, following the approach outlined in The Path to Sustainability Business Guide. The following table illustrates the link between the main sections of the office related portion of this Guide and The Path to Sustainability Business Guide.

Office water use sections	The Path to Sustainability Business Guide
3.1 Measuring water use 3.2 Opportunities for improvement 3.3 Developing key performance indicators	Step 3: Measure the baseline Step 4: Identify opportunities… Step 6: Monitor, review and report…

As you work through this section, please also incorporate the other Steps in the The Path to Sustainability Business Guide not explicitly mentioned, especially Step 1, Commitment and Step 2, Planning and organisation.

3.1. Measuring water use

Understanding your water use is an important step.

It is useful in the first instance to gain an understanding of the office's total consumption, as this can be used as an indicator of progress in your water efficiency efforts, as well as a means of comparing your performance with other offices.

At a more detailed level, understanding what contribution individual water end users are making to the total can help identify where to start making improvements.

3.1.1. Total office consumption – the big picture

3.1.1.1. Single tenancy

Where a business is using the Council water supply it is possible to monitor water use by simply reading the Council water meter on a regular basis. If you have a bore water supply read your meter on a regular basis.

Some companies do this at the same time each day or week. Consistently recording water use will provide a good indication of your water use.

3.1.1.2. Multi tenanted building sharing a water meter

Where a business is a tenant in an office block or another type of building that shares a water meter, calculating business water consumption requires some additional information.

One way to determine water consumption is to approach the landlord and request the total volume of water consumed by all tenants in the building. By also finding out the total number of people using the building (as full-time equivalent staff, or FTE) you can calculate the average volume of water consumed per FTE. This figure can be used to estimate the water consumed for each business in the building, based on a business's number of FTE staff.

If total water use and FTE data are not available, water usage can be estimated for a particular business based on the occupied floor area (m^2). Often a business will pay its landlord a portion of the water bill based on the average water consumption (per m^2) for the whole building. Although this is not based on the actual quantity of water consumed by an individual business, it is based on the building average and is a useful starting point.

3.1.2. Estimating individual water use - the detailed picture

Estimating the water use by individual applications is a useful way of identifying the major water use areas and can be a check (if done for each of the main water consumption areas in your business) that the total consumption matches the individual end users. A significant mis-match indicates some usage areas are not accounted for, including for example, potential leaks.

In the first instance, use what information is already available. For example, appliance manufacturers (e.g. dishwasher manufacturers) generally supply water use data (see below).

Where data is not available, individual flow rate tests may be necessary (measuring the amount of time taken to fill a known volume with water).

Whatever method you use, make sure you record your findings. Use Worksheet 2 (see Section 9) to keep a record of the data you are collecting.

3.1.2.1. Appliances

The best way to find out the actual water used by an appliance is by contacting its supplier.

While the table below provides some indicative water use data, we recommend you check individual appliances or equipment for actual water use information. If you cannot locate this information, contact your supplier and ask about the specific water use characteristics of your equipment.

Appliance or Equipment	Water Used (litres)	Units
Garden sprinkler	1000	litres per hour
Shower	10 - 30	litres per minute
Standard dishwasher	20 - 40	litres per wash
4 star rated dishwasher	12[7]	litres per wash
Toilet flush	11	litres per flush

3.1.2.2. Flow measurement

The following are examples to help you estimate water use (and in many cases water waste!) in different areas of the office.

Kitchen tap

To find out the flow rate of a kitchen tap, measure the time taken to fill say a 10 litre bucket of water. If this takes 1 minute to fill, then the flow rate is 600 litres per hour (10 litres per 1 minute = 600 litres per hour). If this tap is used for 30 minutes per day, 5 days per week and 50 weeks per year, then the estimated water consumption can be calculated as follows:

- Flow rate = 600 litres per hour or 10 litres per minute
- Actual amount of water consumed in a year
    - 10 litres per minute x 30 minutes per day x 5 days per week
      x 50 weeks per year = 75,000 litres per year

[7] Corresponds to a 12 place setting capacity dishwasher.

Dripping tap

You can calculate the volume of a dripping tap using a jug of known volume and a stop watch to record how long it takes to fill the jug. A simple calculation of volume filled multiplied by the time taken will give you a volume over time. For a basic calculation use the following table.

Amount	Volume
1 drip	0.1 ml
10 drips	1.0 ml
1 drip per second	3.15 m^3 per year
3 mm stream	336 m^3 per year

Leaks from water pipes

You can calculate the volume of water leaks from pipe work by estimating the hole size where the leak is coming from.

Note: 450 kPa (65 psi) pressure is just being used as an example in the following table. You should contact Christchurch City Council for the specific water pressure in your area.

Water loss at 450 kPa pressure		
Hole size (mm)	**Water loss (m^3/day)**	**Water loss (m^3/year)**
0.5	0.4	140
1	1.2	430
2	3.7	1300
4	18	6400
6	47	17,000

Garden tap

You can calculate the volume of water being used by a garden tap by knowing the diameter of your hose and the amount of time the tap is running. Refer to the following table as an example.

Note: This is also an example that uses 450 kPa, (or 65 psi) pressure. You should contact Christchurch City Council for the specific water pressure in your area.

Losses at the tap				
Hose (mm)	**Loss litres per minute**	**Loss litres per day**	**Loss litres per month**	**Loss litres per year**
15	18	25,920	788,400	9,460,800
20	58	83,520	2,540,400	30,484,800

3.2. Opportunities for improvement

The process of measuring your water use has established a base line usage against which to measure your progress and has probably also highlighted to you some areas where you think you could do better. This section provides some ideas about changes you could make that could help reduce your water use.

The section is divided into the three main water use areas that are generally within the office occupier's direct control; the kitchen, the amenities and the garden. An additional section describing the water efficiency labelling scheme scheduled to be introduced into New Zealand from 1 July 2008 is also included.

Water use in the heating and cooling system is a specialist area and is not covered in this Guide.

Further reading:

- For general guidelines on equipment and opportunities to save water see http://www.sydneywater.com.au/SavingWater/WaterWiseProducts.cfm
- For more technical aspects and specific sector based guides on water savings see http://www.envirowise.gov.uk/page.aspx?o=watertools

3.2.1. Kitchen

3.2.1.1. Dishwashers

- Dishwashers can use up to 40 litres of water per wash
- Consult your appliance manual or supplier to determine the volume used
- Ensure that you fill the unit before washing dishes
- If you are replacing the unit then choose a WELS 4 star water rated appliance

Using a dishwasher with a WELS four star rating or better will reduce water usage to less than 1 litre per place setting. For example, a four star, 12 place setting capacity dishwasher would have a water use less than 12 litres per wash.

For more information on the WELS Water Efficiency Labelling Scheme, see Section 3.2.4 and http://www.waterrating.gov.au/index.html.

3.2.1.2. Taps

- Use flow regulators and taps that are rated for water efficiency (see http://search.waterrating.com.au/tap_srch.asp)
- Aeration units are more efficient by using less water than conventional taps
- Use a jug and stop watch to measure the actual flow
- When rinsing items, fill the sink first and then rinse. Rinsing under a flowing tap wastes water

3.2.2. Amenities (toilets and showers)

3.2.2.1. Shower heads

- A standard showerhead uses about 15 to 25 litres of water per minute
- A (WELS) three star water efficient showerhead uses a maximum of 9 litres per minute (see http://search.waterrating.com.au/showers_srch.asp)

3.2.2.2. Taps

- A dripping tap can waste up to 2,000 litres per month
- Typical taps discharge 15 to 18 litres per minute
- Low-flow and aerating models can use as little as 2 litres per minute
- WELS 6 star taps use less than 5 litres per minute (see http://search.waterrating.com.au/tap_srch.asp)

3.2.2.3. Toilets

- A leaking toilet can waste up to 16,000 litres per year
- A standard flush unit uses 11 litres per flush
- Water efficient dual flush units can use as little as 4 litres per flush (see http://search.waterrating.com.au/lavatory_srch.asp)
- An average urinal uses about 2.2 litres per flush
- The most efficient urinals reduce flush volumes to 1.5 litres per flush (see http://search.waterrating.com.au/urinal_srch.asp)
- Water less urinals use no water

3.2.3. Gardens

3.2.3.1. Hoses
Hoses left running are a significant source of water wastage

Hose size	litres per minute	litres per day
15 mm	18	26,160
20 mm	58	83,040

3.2.3.2. Automatic watering devices
These are often programmed to run at a certain time of the day. Ensure that they are switched off when it is raining. Soil moisture meters can also be used to ensure that you only water plants when it is needed

3.2.3.3. Time of day
Schedule garden watering to occur in the cool of the evening or early morning. This will minimise the water loss caused by evaporation.

3.2.3.4. Plant selection
Native species generally require less watering than exotics, especially if the native plants are a naturally occurring species from the local area.

3.2.3.5. Water crystals
Water absorbing crystals are another way to save watering for pot plants. They capture water that would normally run through the soil media and allow it to be utilised by the plant over a longer time period. The crystals are made from a polyacrylamide cross linked polymer and can absorb up to 300 times their weight in water.

3.2.3.6. Spray / trigger nozzle
Putting a trigger nozzle on the end of the pipe is another useful water saving action. Not only will the hose shut off when it's dropped or put down during gardening jobs but it is also beneficial in that it regulates the flow to a lower volume and allows the focusing of the water jet, which is more efficient. Spray nozzles that use a twisting action to regulate the flow also facilitate higher water pressure while using less water.

3.2.3.7. Rain water tanks
These are used to collect rain water which can be re-used to either water the garden or some other suitable activity i.e. washing cars and flushing toilets.

3.2.4. Water efficiency labelling
The Water Efficiency Labelling Scheme (WELS) gives consumers information about a product's water consumption and efficiency. A label attached to the product will provide relevant water use information. This will enable a consumer to make a more informed decision when purchasing a new appliance.

The WELS label replaces the previous Australian AAAAA label scheme (only seen on some products in New Zealand) and is being phased in to the New Zealand market as a mandatory requirement from 1 July 2008.

The products proposed under the scheme include:

- Taps
- Dishwashers
- Washing machines
- Showerheads
- Toilets, urinals
- Flow controllers (voluntary)

In addition to the labelling requirement, toilets will also have to meet a performance standard. If a toilet is tested and found to exceed the indicated level of water consumption per flush (as specified in the relevant standard), it will be prohibited from sale.

The scheme is enabled by the joint New Zealand/Australia standard ASNZ/6400 which makes labelling of all WELS products mandatory. The labels for the different WELS products also differ slightly, however all share two key pieces of information:

- The star rating
- Water consumption figure

For more information and to compare the WELS rating for available appliances, see http://www.waterrating.gov.au/index.html.

3.3. *Developing key performance indicators*

It is important to develop a systematic method of recording water use that provides you with a means of evaluating your progress over time. Use Worksheet 1 (see Section 9) to record site water use.

Consider also incorporating a simple key performance indicator (KPI) as a part of your record keeping. Performance indicators are a useful tool for reporting changes in the office water use to management and staff and should be developed so that they can account for changes in office size and staffing levels. Performance indicators are also useful for making comparisons with other offices. Options included on Worksheet 3 are:

- Water use per full time equivalent e.g. litres/FTE/month
- Water use per m^2 e.g. litres/m^2/month

It is important that measurements are made regularly and that performance indicators are only compared for equivalent time periods.

Monitoring water use performance indicators will help you:

- Identify water use trends
- Indicate high usage
- Indicate the need for further investigation i.e. looking for leaks
- Develop 'stories' to tell management and staff.

NABERS (the National Australian Built Environment Rating System) is an Australian initiative that provides an on-line rating tool to enable comparisons to be made between different commercial buildings. For more information see http://www.nabers.com.au/.

3.4. *Top tips - Office*

3.4.1. Red flags (common waste areas)

- Water on the floor
- Hoses left running
- Taps dripping
- Unexplained changes in your water use
- Uncontrolled water flows (e.g. no timer, manual controls or stopcocks)

What can a business do to minimise water use?

3.4.2. Basics

- Know how much water you are using - measure your use
- Educate staff on water conservation methods
- Install signs and reminders for staff
- Install water efficient appliances
- Install water saving nozzles on taps, showers, and hoses
- Install backflow prevention devices (see Section 5)

3.4.3. Quick fixes

- Encourage staff to report leaking taps and toilet cisterns - fix promptly
- Limit dishwashing until you have a full load and avoid unnecessary rinsing
- Install a toilet dam to reduce water consumption (e.g. fill a 1.5 litre plastic bottle with water and place inside the cistern if the toilet isn't a dual flush)
- Turn off automatic garden irrigation systems and only water when necessary
- Purchase appliances with a high WELS water use rating as these are the most water efficient

3.4.4. Medium and long-term

- Install efficient taps or insert flow control devices into existing ones
- Install dual-flush toilets if possible
- Install waterless urinals if possible or urinals that use water only when necessary
- Install water efficient dishwashers
- Insulate hot water pipes so heat loss is minimised
- Review water use by cleaners to check if water use can be reduced
- Minimise the distance between the hot water cylinders and taps
- Water gardens in the evenings or early morning when there is less loss by evaporation
- Choose native plants which generally require less watering

4. Water Use - Manufacturing

In the manufacturing sector water is frequently used as a means of transferring material and energy around a processing facility.

Water is in fact the most common solvent that we use and while this characteristic is extremely valuable to industrial processes, it also means that while clean water may come onto a site, it is generally dirty, material laden water that leaves a site as trade waste. The more water that is used, the less concentrated the waste stream becomes and the more difficult and expensive it becomes to extract potentially valuable raw materials or products on-site from the water.

Water is also a common heat transfer fluid, as hot or chilled water and steam. While the recovery of heat is covered elsewhere (see The Target Energy Business Guide), the loss of energy down the drain can be a significant cost to a business.

Water use in manufacturing is clearly more complex than in an office environment with the range of water uses as diverse as the industries themselves. The principals outlined in The Path to Sustainability Business Guide are however applicable to both office and manufacturing activities and it is important to begin implementing a water efficiency programme systematically, as outlined in The Path to Sustainability Business Guide.

The following table illustrates the link between the main sections of the manufacturing portion of this Guide and the The Path to Sustainability Business Guide.

Office water use sections	The Path to Sustainability Business Guide
4.1 Measuring water use 4.2 Opportunities for improvement 4.3 Developing key performance indicators	Step 3: Measure the baseline Step 4: Identify opportunities… Step 6: Monitor, review and report…

As you work through this section, please be mindful of the other Steps in The Path to Sustainability Business Guide not explicitly mentioned, especially Step 1, Commitment and Step 2, Planning and organisation.

4.1. Measuring water use

Understanding water use on a manufacturing site before implementing a water efficiency programme is a critical step.

It is useful in the first instance to gain an understanding of the site's total consumption, as this data, if recorded regularly, can be used as an indicator of progress in your water efficiency efforts.

At a more detailed level, understanding what contribution individual water end users are making to the total can help identify where to start making improvements. It is particularly important to determine how much water an individual operation is using before making any improvements, as this will allow you to quantify the benefit of any improvement in terms of both cost and resource savings.

4.1.1. Total site consumption – the big picture

One of the ways to understand the dynamics of where water is being used on large sites is to perform a water balance.

Water balances are based on the premise that all water coming into a business must go somewhere i.e. inputs must equal outputs.

The following table is an example of the beginnings of a high level water balance, represented by the major inputs and outputs of water for the manufacturing site.

Inputs	Outputs
Mains water	Waste water
Bore water or river water	Discharges to the atmosphere
Components of raw materials	Water contained in the product
Rainwater	Water contained in solid waste

Measuring total site water consumption helps identify leaks or unexpected water use. For example, if water is used during times when the plant is closed down, then water is being wasted either through leaks or because a tap or appliance has been left running.

It is also useful to log water use against a production figure. This helps to identify changes that aren't easily explained by an increase in production and which may therefore indicate wastage.

It is useful to measure water use by department or process to ensure that the overall site water balance is understood.

4.1.1.1. Bore water

All bores require consent from Environment Canterbury for installation and many for on-going abstraction. Future consents will require the user to record the amount of water abstracted. If the bore is not metered, the amount of water abstracted from it can be calculated by multiplying the capacity of the pump by the number of hours the pump operates.

4.1.1.2. Water meters

Where a business uses Council water supply, there is likely to be a water meter at the roadside edge of the property.

Read this meter regularly to monitor water use - some businesses read their meter at the same time each day or week.

(See http://www.ccc.govt.nz/Waterwise/HowToReadYourWaterMeter/ for more information)

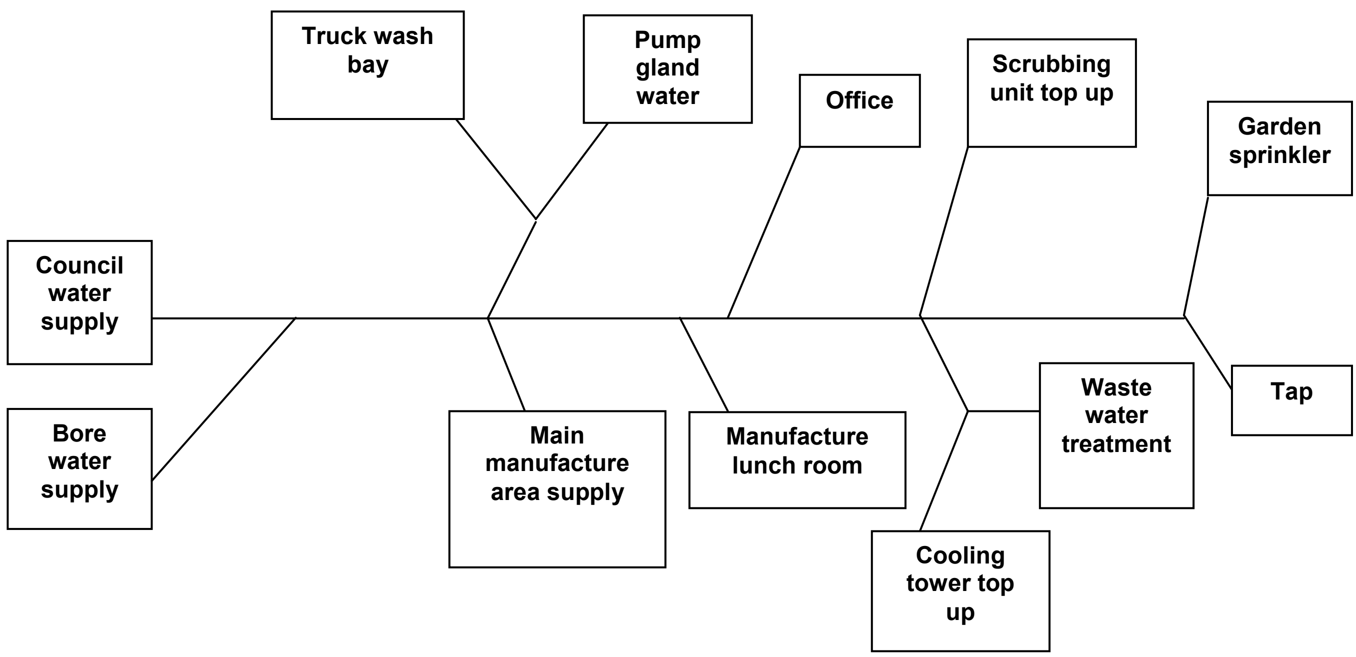
Most roadside Council water meters in Christchurch are now Kent PSM Series metric meters but there are still some older gallon meters around. Most show whole cubic metres in black on white and fractions in colour.

- 1 cubic metre = 1m^3 = 1000 litres = 220 gallons
- 1000 gallons = 4.545 m^3 = 4,545 litres

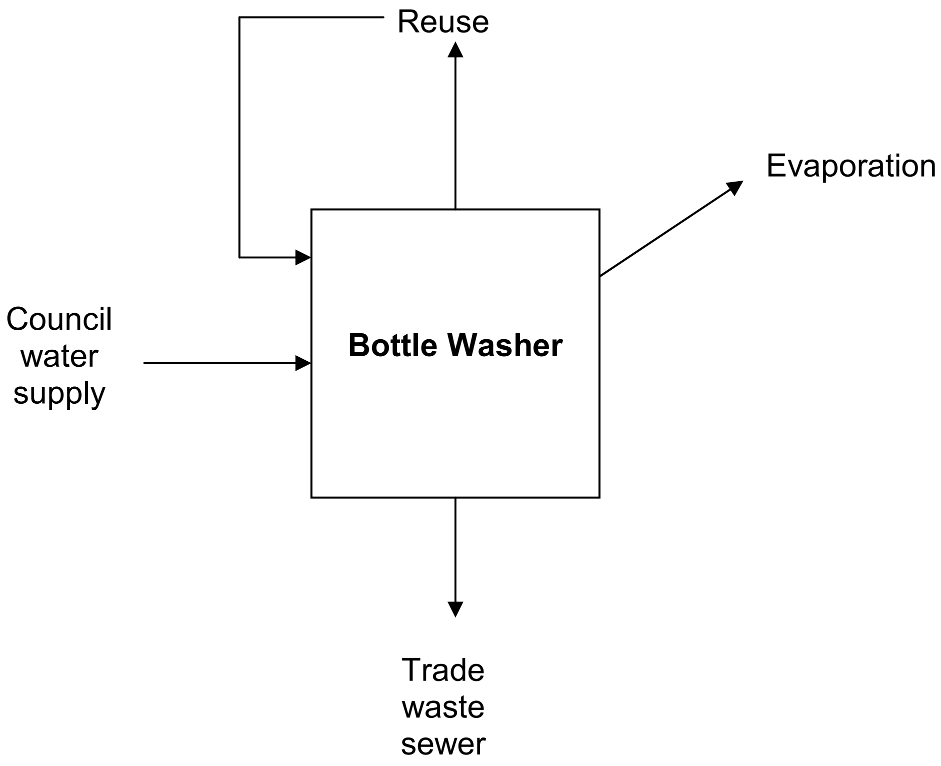
4.1.2. Understanding water use on complex sites – the detail

The high level input – output diagram is unlikely to provide sufficient information for you to decide where you should begin trying to make improvements. If water represents a key focus resource for your site (see The Path to Sustainability Business Guide) developing a more detailed understanding of where water is used within the site will be a very useful exercise.

One tool that can help you develop a more detailed picture of how the water system works is a “fish bone” diagram. This simple map indicates where water goes on site; it is not designed to be to scale but just to outline how everything is connected. Gather information on water volumes and add to the map in each area to ensure that you have measured all sources. You can then use this information to assess which areas use the most water and establish the priority areas for your improvement team to focus upon.



Another useful tool is the "process flow" diagram. The engineering versions of these are called Process Flow and Information Diagrams or PFID. These diagrams are useful to show the water flows within a specific process or series of processes. For example:



The fishbone diagram and the process flow diagram are just tools – do not be constrained by them. The key result that you should be striving for from this exercise is systematically developing a clear understanding of where water is used in the manufacturing process. These tools will help you be systematic in your discovery and recording of data and establishing priorities for further action.

Where you have completed both a high level summary and a detailed breakdown of water use, a comparison can indicate whether you have accounted for the major water users. If you achieve better than 90% agreement between the high level inputs and the total of the detailed breakdown, you should be well satisfied with your efforts!

4.1.3. Flow measurement

Measuring the flows in the areas identified on your fishbone or process flow diagram may require equipment as simple as a bucket and stopwatch, or in some form of mechanical or electronic meter.

4.1.3.1. Bucket and a stop watch

Steady water flows can be measured by putting a container of known volume under the flow and timing how long it takes to fill the container. For example, if the flow fills a 10 litre bucket in 1 minute, and the flow is continuous, then the flow rate is 600 litres/hour x 24 hours x 7 days x 52 weeks = 5,241,600 litres or 5,241.6 m^3/year.

4.1.3.2. Meters

Meters can be classified as invasive or non-invasive.

- Non-invasive meters are useful where you only want to meter for a short period and in a number of different locations. This is often the case when you are completing a more detailed audit (such as filling in the gaps on your fishbone diagram) and do not want to break into a pipeline to install a meter. Ultra-sonic meters are a widely available non-invasive meter to measure clean and dirty water (check first, as not all ultrasonic meters have a dual dirty water/clean water capability). An ultra-sonic meter can be used to help decide where best to install permanent metering.

- Invasive meters require a section of pipe to be cut for the meter to be installed. Invasive metering is installed where permanent metering is required.
    - A mechanical meter suitable for measuring cold (<50ºC) water flow through a ½"/12 mm pipe are not very expensive. Meters for hot water are more expensive.
    - Electromagnetic meters have no moving parts and, although more expensive, provide a more durable and accurate metering solution.

4.2. Opportunities for improvement

The process of measuring your water use has established a baseline usage against which to measure your progress and has probably also highlighted to you some areas where you think you could do better.

Remembering the waste hierarchy illustrated in Section 2.6, this Section is divided into a description of some prevention and reduction focused options and some reuse and recycle options.

When you have generated some potential improvement options, remember to accurately reflect the cost and other benefits within your analysis (see The Path to Sustainability Business Guide). For example, ensure that water use calculations include:

- Pumping costs
- Maintenance costs
- Treatment costs
- Whether the waste is hot water or cold water, and the costs of heating or cooling
- Costs of disposal of resultant waste water (i.e. trade waste charges)

4.2.1. Prevention and reduction - stemming the flow

There will be areas within a business where water use is required but where the amount of water used can be decreased without the necessity of staff manually controlling this. Examples include:

- Leakage control e.g. maintenance programmes that identify leaks early on and thus minimise the time that leaks occur
- Use of flow control e.g. valves and restrictors
- Overflow elimination e.g. alarms and level indicators
- Tamper prevention e.g. locks and position indicators which ensure that if controls are altered, that this is evident
- Undesirable heat loss or gain e.g. lagging of pipes
- Valves e.g. restrictor valves minimise flow
- Sensors e.g. position indicators on valves or flow indicators on plc (programmable logic controller) controlled systems
- Counter current rinsing e.g. topping up highly concentrated baths with less concentrated material to minimise water use, or topping up tanks with final rinse water
- Flow restriction/pressure control e.g. pressure monitoring on pipelines to indicate leaks as they occur
- Scrapers/squeegees/brushes e.g. cleaning with these will minimise the amount of water used
- Sprays and jets e.g. these can be used to restrict the water flow and minimise the time a flow operates
- Cleaning-in-place (CIP) technology e.g. washing manufacturing units in place by putting in spray jets so that a specific amount of water is used, which is directed to the areas that most need cleaning. This eliminates any necessity to have hoses running during cleaning

4.2.2. Reuse/recycling options

To develop water reuse options within a manufacturing process, it will be necessary to incorporate the expertise of an engineer and someone else who is familiar with the processes being investigated. There are some processes where water reuse may not be an option (i.e. food manufacturing etc).

The most common form of water reuse is the wash bath and rinsing processes.

The following options are worth considering:

- Can flushing water (e.g. water used to clean a process after batches) be reused again later in the process as a source of key ingredients/final product, instead of being dumped after the first flush?
- Is waste water sufficiently hot or cold enough to be used as cooling water or as a heating agent in other processes?
- Can wash water be filtered/strained easily to remove large particles and then used again in the earlier stages of the washing process?
- Can recycled water or rainwater be used instead of freshwater?

4.3. *Developing key performance indicators*

It is important to develop a systematic method of recording water use that provides you with a means of evaluating your progress over time. Use Worksheet 1 (see Section 9) to record site water use.

Consider also incorporating a simple key performance indicator (KPI) as a part of your record keeping. Key performance indicators are a useful tool for reporting changes in water use to management and staff, via reports, newsletters and notice boards for example.

Key performance indicators should be time based (i.e. m^3 per week, litres per day etc) and should also be expressed in terms of some key business characteristic (e.g. m^3 per widget).

In a manufacturing business KPIs should be developed that can account for how water use changes with changes in production. For example, dividing the weekly water consumption by the total number of widgets produced in the same week could give a KPI expressed litres of water per widget. Similarly, the water use could be related to the weight of product produced over the same time period, giving a KPI expressed as litres of water per kg of product.

Worksheet 4 (see Section 9) includes an option for expressing water use in absolute terms and per widget. The choice of production unit will depend on the type of industry, as production could be measured according to volume, weight, number, area or dollar value.

It is important that measurements are made regularly and that performance indicators are only compared for equivalent time periods.

Monitoring water use performance indicators will help you:

- Identify water use trends
- Indicate high usage
- Indicate the need for further investigation i.e. looking for leaks.

4.4. *Top tips - Manufacturing*

4.4.1. Red flags (common waste areas)

- Water on the floor
- Hoses left running
- Taps dripping
- Unexplained changes in your water use
- Uncontrolled water flows (e.g. no timer, manual controls or stopcocks)

What can a business do to minimise water use?

4.4.2. Basics

- Know how much water you are using - measure your use
- Check for leaks
- Educate employees on water conservation methods
- Install signs and reminders for employees
- Clean areas with brooms rather than using water
- Wash items in water baths or with water from other processes
- Monitor water use as part of your production
- Undertake a site wide water audit
- Ensure back-flow prevention devices are installed appropriately.

4.4.3. Quick fixes

- Encourage staff to turn off the taps when water is not required
- Encourage staff to report leaking taps - fix promptly
- Limit the use of water for cleaning
- Use water efficient spray jets
- Adjust flow rates to the minimum required for the operation
- Use trigger operated guns for hoses
- Use flow control pedals and timers to limit the time that water flows
- Use ping-pong balls on heated baths to contain heat

4.4.4. Medium and long-term

- Ensure the site has completed a water balance (water inputs should equal water outputs)
- Log water use against production to look for inefficient water use
- Install water efficient taps or insert flow control devices into existing ones
- Reuse cooling water or boiler blow-down for site processes
- Insulate hot water pipes so heat loss is minimised
- Use air cooling rather than water based systems
- Ensure that cooling water is recycled rather than being used once through the system
- Recirculation of cooling water in liquid ring vacuum pumps
- Collect rainwater for appropriate cleaning, irrigation, cooling system top up and for flushing toilets
- Ensure steam traps and condensate is returned for reuse
- Use counter current rinses for multi stage cleaning i.e. this uses the most dilute tanks to top up the more concentrated to save fresh water

5. Backflow prevention

One of the biggest risks to our water supply is from backflow caused when water pressure drops in the water distribution system. When backflow occurs, water can flow in the opposite direction from residential or commercial premises back into the public water supply network. Contaminants could be back-siphoned or injected by back-pressure into the public water supply.

It is critical to the integrity of our water supply that this risk is eliminated.

For more information on back-flow prevention contact Christchurch City Council.

6. Glossary

- AS/NZ6400 = Joint Australia and New Zealand Standard for water efficiency labelling of products
- PLC = Programmable Logic Controller: These are used on automated systems to help control equipment and log information
- WELS = Water Efficiency Labelling Scheme
- kPa = kilopascals, a metric unit of pressure
- psi = pounds per square inch, imperial unit of pressure

7. Target Sustainability Business Guide series

The following Guides will be useful to help you undertake your sustainability programme:

- Target Sustainability - The Path to Sustainability Business Guide
- Target Waste Business Guide
- Target Energy Business Guide

8. On-line worksheets

Electronic worksheets are available at www.targetsustainability.co.nz. These can be modified to suit your requirements and used for data entry.

9. Attachments

The following worksheets are attached to show you what is available to download from www.targetsustainability.co.nz to record your information.

- Worksheet 1: Record of Site Water Use
- Worksheet 2: Record of Individual Water Use Areas
- Worksheet 3: Water Use Key Performance Indicators - Office
- Worksheet 4: Water Use Key Performance Indicators - Manufacturing

Target Sustainability

Worksheet 1: Record of Site Water Use

Physical address of the site:

Year:

Water meter location:

Month	Date	Meter reading	Water used	Name of recorder	Comments
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

Target Sustainability

Worksheet 2: Record of Individual Water Use Areas

Date:

Physical address of the site:

Name of recorder:

Appliance / Facility	Number of times used per day	Volume each use (litres)	Volume (litres) per day (Number of times used x volume = volume per day)	Method of measurement
Example: Dishwasher	*2*	*30*	*60*	*Suppliers information*
Example: Toilet	*36*	*11*	*396*	*Suppliers information*
Example: Hose	*1*	*1090*	*1090*	*Bucket and stop watch and time run*
Total			**1546**	

Worksheet 3: Water Use Key Performance Indicators - Office				
Physical address of the site:				
Year:				
Month	Date	Water used, litres/month	Average number of FTE[1]	KPI litres/FTE/month
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

Note 1: Floor area, expressed as m^2, can be used as an alternate to FTE.

Target Sustainability

Worksheet 4: Water Use Key Performance Indicators - Manufacturing				
Physical address of the site:				
Year:				
Month	**Date**	**Water used, litres/month**	**Production, Widgets[1]/month**	**KPI litres/widget**
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

Note 1: Alternative, or multiple, measures of production can be used. Examples include $ value, kg, m, m^3, with the production unit selected appropriate to the type of production