Water Efficiency

- Hospitals (Small to Medium)
- Extended Care Homes
- Laundries

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Introduction to Water Efficiency

Rising costs, limited high quality drinking water supplies and environmental concerns are all important reasons for water efficiency.

Benefits of Water Efficiency

- Lower water costs due to lower use and fewer leaks.
- Lower energy costs for hot water.
- Delay the need for a municipality to build new treatment facilities, helping to control utility costs.

Water Costs Money

Increasing expenses are associated with a growing demand for municipal water. Costs include the construction and maintenance of infrastructure, pumping costs, treatment, and monitoring for both water and wastewater. All of these expenses will eventually be borne by taxpayers and/or water customers.

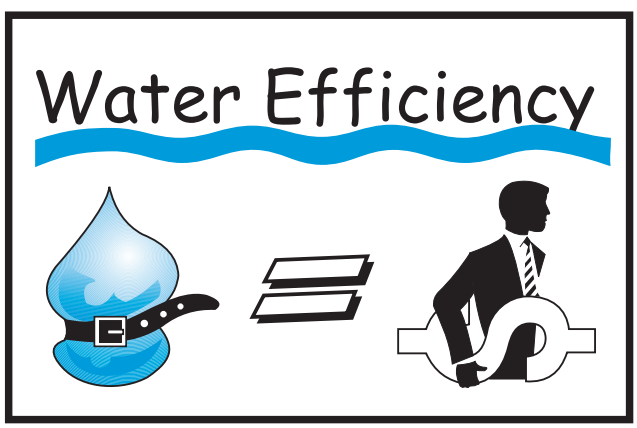
Environmental Impact of Water Use

The amount of water available for municipal use in Manitoba is diminishing, and available water sources have sometimes become contaminated as a result of natural or human activities. More efficient use of water will protect existing supplies for later years.

Water consumption puts pressure on the water body receiving treated wastewater. The effect of wastewater discharge depends on the amount and quality of the wastewater and the nature of the treatment. If a sewage treatment plant is overloaded, it will not adequately treat the wastewater.

Water Audit

A water audit will determine where water is used in your facility, and how much water use and leaks cost. Gathering this information is the first step toward implementing cost-effective solutions.



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General water conservation priorities are:

1. Fix leaks and drips
2. Reduce waste/optimize processes
3. As old fixtures need replacement, install fixtures that are both cost effective and water (and energy) efficient
4. Retrofit existing fixtures using new water saving technologies
5. Replace existing fixtures/appliances in high use areas

1. LEAKS

- Fix leaks. Schedule regular leak detection of all toilets and other water using devices. Scheduled maintenance of fixtures is usually the most cost effective method of reducing water bills, as well as saving water heating costs. As an added benefit, having scheduled maintenance checks may result in other potential problems being recognized, reducing the chance of emergency maintenance incidents or disruptions.

- A slow leak can waste about 50,000 litres of water per year. If hot water is leaking, repairing the leak will also reduce energy costs. Leaking faucets can result in stained wash basins, resulting in the cost of increased cleaning. Even if it only takes an additional 30 seconds per day to remove the stain, it will take at least an extra three hours per year to clean that sink. Hence, the yearly cost of each faucet leak (assuming a combined water and sewer rate of $2.25 for 1,000 gallons) is $24.57 for the water and about $20 for the extra labour to remove the stain; this does not include hydro costs for a hot water leak, or extra wear and tear. Therefore, it will be cost effective, in most cases, to fix the leak.

  A toilet that continues to run after flushing can waste up to 200,000 litres of water in a single year. At $2.25 for 1,000 gallons, the yearly water cost of a single toilet leak could reach approximately $100 per year.

- Fix ice machine leaks; ensure screw in back is set properly (water should only flow when machine is turned on). Ensure water flows for ice machines are set for optimal efficiency.

- Post a sign or sticker by all water using fixtures and appliances with name and phone number to call if water leaks or other maintenance problems are noticed.

2. REDUCE WASTE/OPTIMIZE PROCESSES

Correcting obvious waste, such as allowing water to run when the water is not being used, is an inexpensive and effective water saving option. Look for these options whenever water is used in your facility. The best ideas for savings often come from your employees. Be sure to encourage suggestions.

Heating, Ventilation, Air Conditioning

- Use alternate chemical treatment for cooling towers that allows higher concentrations of hardness (i.e., calcium, magnesium, etc.) to remain in solution, thereby reducing bleed off requirements by up to 90%.

- Replace water-cooled equipment with air-cooled equipment.

- Run chilled water loop through water-cooled equipment.
- Replace once-through cooling system with a closed-loop system.

- Recirculate cooling water from water-cooled equipment using a heat exchanger.

- Install solenoid valves to water-cooled pumps to shut off water when not operating.

- Clean humidifier air washers properly in order to reduce frequency of cleaning water consumption, as well as increase the effectiveness against corrosion, deposits, and microbiological contaminants.

- Caulk and seal around windows and other openings to increase indoor humidity and hence the efficiency of the humidification system.

Laundry

- Purchase the most water and energy efficient machines available. Current research indicates these are normally front loading machines.

- Launder full loads only. Ensure maximum effective and efficient use of water, energy and detergents. Follow the manufacturer's recommendations, matching the material being laundered to the correct cycle. If the manufacturer of your appliance(s) did not supply information to use the equipment in the most efficient manner, write or call your sales person, repair person or manufacturer for that information. Match the type of laundry, detergent and water temperature to maximize energy and detergent savings.

Dishwasher

- Higher efficiency can be achieved by washing full loads, and limiting water flow rates and operating the equipment as suggested by the manufacturer. Final rinse water may be able to be used for a garbage disposal. Try reducing the flow rate by about 10 percent. If no problems result, continue to operate at the reduced flow rate. This will result in both water and hot water energy savings.

Garburator

- Scrape plates, bowls and pots into the garbage before pre-rinsing. Scraping will reduce the water needed to properly pre-rinse the items. Using a garbage can will reduce the water needed to wash waste down the garburator. Some facilities place a screen at the bottom of the sink to catch large pieces of material, periodically emptying the screen into the garbage.

Thawing Foods

- Thaw foods by thawing in a refrigerator. If quick thawing is necessary, a running stream of cold water should be used (for health reasons), but use a slow flow.

X-Ray Processing

- Be certain X-ray processors are equipped with shut-off valves that stop the flow of water when processing is not taking place.

- Reduce flow rate through the x-ray processors to the minimum consistent with quality performance. Many hospitals use a higher flow rate than necessary - often 7.6 litres (2 US gallons) per minute or less is sufficient.

Lab

- Eliminate single-pass water-cooling of instrumentation or analyzers; supply this cooling water from the plant's chilled water system.

- Consider replacing water aspiration (faucet) medical air or vacuum pumps with pressure/vacuum pumps.

- Replace sterilizers with water efficient models.

Hot Water Supply

- To reduce pooling in the pipes, optimize energy use, and reduce time (and water) needed to obtain hot water, point of delivery hot water systems may be a viable option when planning a building, or replacing a water heater. They are relatively expensive; therefore, they may be best for situations where only one or two areas in the building use hot water. The shorter piping distance will result in lower initial costs for piping and lower hot water energy costs.

Ice Making Machines

- Ice making machines use water for two processes: making the ice, and cooling the refrigerant condenser of water-cooled models. Softened water may reduce the bleed off needed to wash minerals from forming ice. Reduce cooling water by linking cooling water to an existing water cooling recycling system. Consider purchasing air-cooled units as machine replacement is required. Air-cooled units may require slightly more electricity, so an overall life cycle cost comparison (capital, operating and maintenance expenses) is warranted.

Landscaping

- Reduce or eliminate lawns that are not used. Substitute junipers or other ground cover plants that require minimal water and maintenance once established. Use a three to four inch layer of

mulch to cover bare soil; this will reduce weeds and evaporation. Common mulch materials are wood chips, straw, plastic, peat moss, dried grass clippings and bark. Rain barrels with childproof lids can provide water for landscaping needs.

3. FIXTURES

Toilets and Urinals

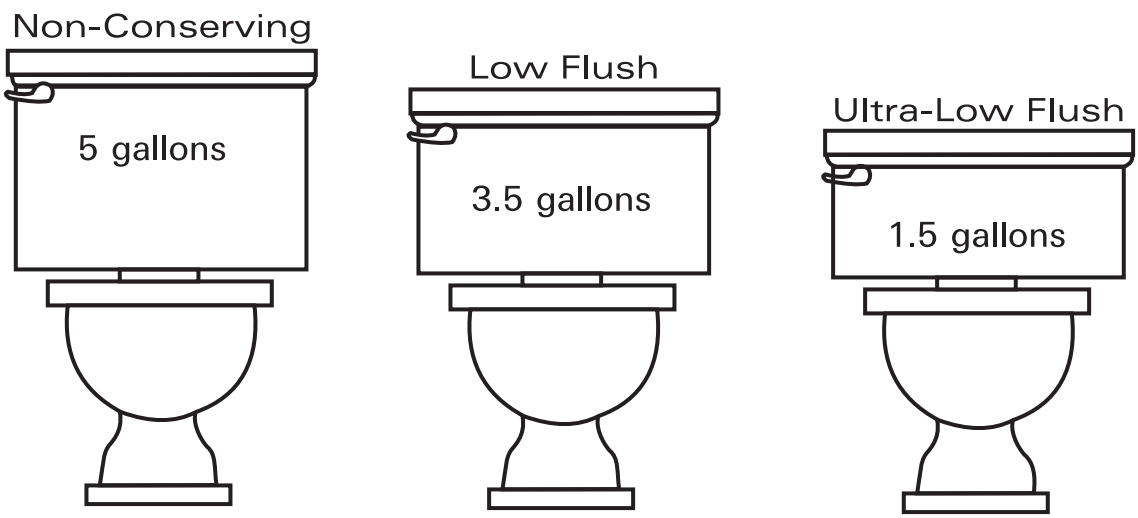
- Reduce water use of toilets by installing toilet retrofit devices. Although retrofitting toilets, for example, may not have as long term an effect as replacement with more efficient fixtures, there are often significant short term cost savings. Facilities may wish to experiment with various retrofit devices, such as early closure devices for flappers, using identical toilets, to determine which will result in the most reasonable investment. Consider: water saved, ease of installation, incidence of multiple flushing, cost, and water saved per flush. Various retrofit devices may work better in certain brands of toilets than in others. Payback often occurs within one year.

- Target toilets that are in high traffic areas to be replaced proactively with Ultra Low Flow (six liter per flush) toilets; if it is not obvious which toilets have the highest usage, install count mechanisms.

- As old fixtures need replacement, install fixtures that are both cost effective and water (and energy) efficient. This especially holds true for fixtures like toilets, which have a relatively high capital and installation cost. The useful life of a toilet is often twenty to thirty years. Therefore, taking a small extra effort to research ULF toilets that have been used successfully would be worth the time. Information about toilets installed in other jurisdictions is available through Manitoba Conservation.

In some cases, the "footprint" (size of the base) of toilets differ by style and/or manufacturer, so replacement of the flooring may result in additional cost. Consider costs for the entire life of the item (including operational costs, expected useful life, and maintenance costs), as the item with the lowest initial cost may not necessarily be the most economical choice over the long term. ULF toilets with siphon action, or air or vacuum assistance may provide better performance in certain situations, such as when disposal of inappropriate material in a toilet is attempted.

- Urinals may be able to be adjusted to a lower flow rate. Retrofit devices to reduce volume used per flush, such as insert orifices or replacement kits may be available through your supplier or manufacturer.



Faucets

- A bathroom faucet is normally set at approximately 8 litres per minute. Flow control devices should be installed on faucets with excessively high flows to reduce splashing, water waste and hot water energy costs. However, taps in the janitor's rooms, and taps used for filling pots in the kitchen or pre-rinsing dishes should be left at full flow. Note: Low flow aerators may not fit on all faucets.

- In areas of facilities where people may have reduced immunity, retrofit faucets to have an optimal maximum flow, therefore reducing water flow without aerating the water (to reduce the possibility of facilitating airborne bacteria). In other areas, low flow aerators can be added to faucets during normal cleaning or maintenance operations.

- When replacing faucets, consider newer technologies. Metering faucets that deliver a measured quantity of water; self-closing faucets that close as soon as the user releases the knob; and automatic sensor-controlled faucets are all options that should be considered, depending on the type of use and amount of use of the faucet. Some faucets are manufactured to limit the maximum flow rate without using an aerator.

- When considering payback for reduction of flow rates with faucets and showers, water-heating costs may add substantially to predicted savings.

Developing a Water Use Plan

It is critical to the success of your water conservation efforts that your facility establish a plan. This should be written and should be distributed to everyone involved. Include these ingredients:

Action Plan - outline each specific task and support each action with a cost/benefit analysis where applicable. State:

- immediate actions that are no-cost or low-cost,
- actions that require capital expenditure, and
- actions that require water-use habit modification.

Assigned responsibilities for plan implementation

Establish a water conservation committee with a responsible committee leader, or, in smaller facilities, one employee who will develop and implement the plan.

Procedures for implementation, evaluation and revision

A viable plan is one that is flexible and evolving. It should be systematically reviewed and revised with the appropriate actions that need to be taken. The original plan should state at what intervals and how the plan will be revised.

A water use plan is one important element of environmental policy in your establishment. The concepts of reducing waste and optimizing processes can also be applied to other resources (e.g., paper, electricity, packaging materials, energy) for further savings.

Generic Facility Audit

The following generic facility audit can be customized to the building you are auditing. Simply include the pages of the audit that are applicable. To assist you in ensuring that all water is considered, please note the list below.

Areas of Water Use

Area	Fixture/Appliance/Device	Audit Sheet #
Bathrooms	Toilets	1
	Faucets	1
	Showers	1
Kitchens areas	Faucets	2
	Ice machines	2
	Garbage disposals	2
	Dishwashers/sanitizers	2
	Water cooled refrigerators	2
	Water cooled freezers	2
Cleaning and Maintenance	Miscellaneous	3
Heating / cooling	Boilers	4
	Once-through cooling	4
	Cooling towers	4
	Evaporative coolers	4
Laundry	Faucets	5
	Washing machines	5
Laboratory and X-Ray processing	Miscellaneous	6
Landscape	Design and Maintenance	7
	Irrigation	7
Pools and spas	Miscellaneous	8
Water use / building operations	Operations	9

Worksheets that can be used to complete a water audit for specific areas of a building are included. If these worksheets do not meet your needs, create your own. Include space for: item and location; water used per unit of time, i.e., hours used per day, per week or per month; total water used/year; and leaks.

Leaks

Throughout any audit, one of the easiest and quickest things to look for are leaks. Fixing leaks means an immediate water saving. If a tap is dripping, or your toilet is leaking, fix it.

To check for leaks in a building, read your water meter at the beginning and end of a time period when no water is being used in your building (for example, at night). If no water has been used, but the meter has moved, you have one or more leaks. If your building is on a well, the pump should only be activated when water is being used. Otherwise, water is leaking. Tracking down the leak before it becomes a problem may save expensive repairs to your ceilings and walls.

Water Balance

If your building's water use is metered, compare your calculated water use with total water billed. This is called a Water Balance.

- If your calculated water use is higher than the metered water use, your meter may be reading low. This especially likely if the meter has not been calibrated recently or if the meter is reaching the end of its useful life. Meter errors can also be caused by incorrect installation. The pipe running into the meter should be straight, or have a basket strainer to reduce turbulence.
- If the calculated and billed water use are within less than ten percent of each other, it may not be cost effective to determine why the difference exists.

- If the metered water use is higher than your calculated water use, you may have underestimated the amount of water used in one or several areas, or the plumbing may be leaking. To determine if there is a leak, check the meter periodically during a period with no (or low) water use.

- Once leaks have been identified, calculate the water consumed by those leaks. Include that number in your water balance.

Education and Continuous Improvement

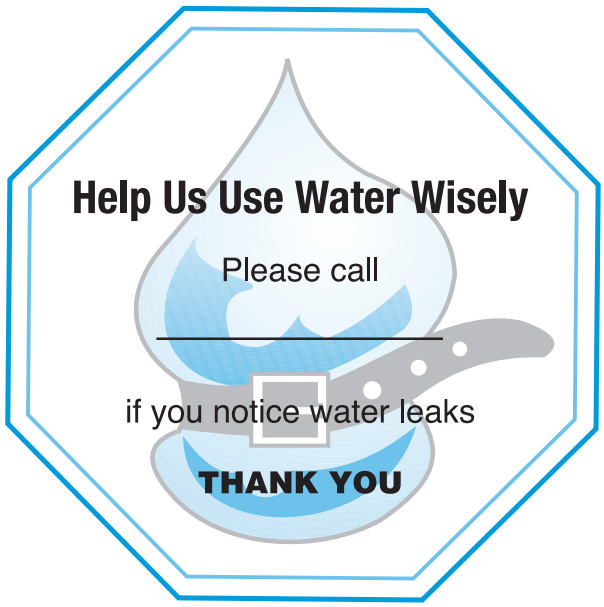
Employee awareness, cooperation, and involvement are critical to the success of your program. There are a number of ways in which a company can communicate the importance of water use practices to its employees:

- Initial material should explain the how and why of changes in practices, and the importance of participation by everyone. Periodic reinforcement of this message may occur in various ways - a note with their pay envelope, reminder signs above specific equipment, and positive feedback for employee and customer suggestions. For example, have a monthly or yearly draw of the employees' or customers' names who submitted suggestions or comments, with the winner receiving a token of appreciation.

- Some establishments may benefit from a program that offers significant rewards for employee suggestions that are implemented, such as a percentage of the first year's savings. This will help to develop a longer-term consciousness of water use. This could also be expanded into a reward program that considers any suggestion that helps reduce costs, improves efficiency or enhances customer service or resident care.

- The note with employees' pay statement may advertise the suggestion program, give a few tips about how to reduce water use, or give examples of suggestions that have been implemented (and the results).

- Stickers or inexpensive cardboard signs (water resistant if in the bathroom or above a sink) could indicate maintenance phone numbers and suggestions for reducing water waste. The facility could also use these signs to remind customers and employees of the drive to reduce water waste.



Employee and Customer Awareness

- Send reminders to employees to report leaks.
- Mention water conservation at staff meetings.
- Promote a suggestion and incentive system, and recognize people who have water saving ideas.
- Publicize your water savings to employees, the public and your community through newsletters and newspapers.
- Post water conservation stickers and signs in bathrooms, kitchens and cafeterias.

Please contact Manitoba Conservation's Water Efficiency Coordinator for possible technical assistance in these areas.

Water Audit Form #1
BATHROOM WORKSHEET

Complete one form for each bathroom in each of your buildings. The completed form is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____
Location of bathroom: _____

Designated users (please circle): male female handicapped

Bathroom

Fixture/Appliance	Leak?[1]	Flow Rate[2]	Usage[3]	Total water used/year[4]
Toilet				
Toilet				
Toilet				
Urinal				
Urinal				
Urinal				
Faucet				
Faucet				
Faucet				
Shower				
Shower				
Shower				

1. Fix toilet, faucet, shower, and bathtub leaks. To check for a toilet leak, put a non-toxic and non-staining dye in the toilet tank. Wait fifteen minutes. If the dye seeps into the toilet bowl (no flushing), you have a toilet leak. The most common cause is a flapper that needs to be replaced.

2. To determine flow rate:

   Toilets:
   Litres per flush is sometimes noted between the seat attachments and the tank; or note make, model and year made. If toilet was made prior to 1985, it uses more than 13 litres per flush; significantly older toilets can use 20, 25 or more litres per flush. Modern low flow toilets use 6 to 13.5 litres per flush.

   Faucets and showers:
   To make a measuring pail, use a 0.250 litre (one cup) measure to fill a 4 litre ice cream pail. Mark the water level with a water proof felt pen every 500 ml (1/2 litre).
   Run faucet or shower at reasonable rate. Fill the pail for 10 seconds. Estimate, using the pen markings, how much water filled the pail during that time. Multiply that amount by 6 to calculate the flow rate per minute.

3. Use:

   Toilets and urinals:
   Number of flushes per toilet/urinal per day (manual or automatic flushes) including times flushed when cleaning

Faucets and showers:
Estimated minutes of usage per day

4. Total water used per year per fixture:

Toilets and urinals:
Flushes per day X 365 days

Faucets and showers:
Usage per day X 365 days

Best Management Practices: (check as implemented)

- ❑ Toilets retrofitted with early closure devices to use less water.
- ❑ Showerheads flowing at a rate of less than 9.5 litres/minute.
- ❑ Bathroom faucets flowing at less than 3.5 litres/minute.
- ❑ Install six litre per flush toilets in new construction, as toilets need replacing and in areas of high use.
- ❑ Install low water use faucets in new construction, as taps need replacing and in areas of high use. Consider metering or spring loaded faucets, or faucets with sensors.
- ❑ Retrofit urinals with insert orifices or replacement kits.
- ❑ Remind users to conserve water; post name and number of who to contact for repairs.

Water Audit Form #2
KITCHEN AREAS WORKSHEET

Complete one form for each kitchen area in each of your buildings. The completed form is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____
Location of kitchen area: _____

Kitchen

Fixture/Appliance	Leak?	Flow Rate	Usage	Total Yearly Water Use
Faucet				
Faucet				
Faucet				
Dishwasher				
Garburator				
Ice machine				
Water cooled fridge				
Water cooled fridge				
Water cooled freezer				
Water cooled freezer				

Best Management Practices: (check as implemented)

- ❑ Look for water waste.
- ❑ Fix all your leaks, including those in steam and water lines.
- ❑ Hand scrape dishes into compost pail or garbage.
- ❑ Use a pressure hose for pre-washing or soak in basin of water.
- ❑ Collect sink garbage with a screen, to decrease garbage disposal water use.
- ❑ Set flow of water to dishwasher the lowest water flow recommended.
- ❑ Wash only full loads.
- ❑ Stop the flow of water through dishwasher when flow of items being washed stops.
- ❑ Replace once-through (single-pass) water cooled ice-making machines with air cooled machines.
- ❑ Control bleed-off from clear ice machines.
- ❑ Ice flake machines usually use less water than ice cube machines.
- ❑ Use bleed-off water for condenser cooling.
- ❑ Avoid using water to defrost food by planning ahead and thawing food in a refrigerator. If water-thawing is necessary, a running stream of water should be used for health reasons, but use a slow flow.
- ❑ Don't use running water to melt unwanted ice.

Water Audit Form #3
CLEANING AND MAINTENANCE

Complete one form for each of your buildings. The completed form is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____

Best Management Practices: (check as implemented)

- ❑ Think about how floors and other areas are cleaned. Is water necessary? Would brooms or wet wash rags work as well as hoses?
- ❑ Find alternative cleaning methods that require little or no water for washdowns.
- ❑ Switch from "wet" carpet cleaning methods, such as steam, to "dry" powder methods.
- ❑ Clean windows only when dirty, not on a rigid schedule.
- ❑ If it is necessary to use water (e.g., commercial kitchens, medical facilities), use high-pressure, low-volume sprays (which work better than low-pressure, high-volume sprays). Use portable high pressure pumps where needed to reduce the amount of water used for cleaning by up to 40 percent.
- ❑ Install spring-loaded valves or timers on all manually operated hoses.
- ❑ Install an on-demand water heater near sinks and other places where warm water is needed to avoid having customers and employees run water while waiting for hot water.
- ❑ Inspect steam lines and traps, all plumbing fixtures, hot and cold water lines, drinking fountains, and water-using appliances routinely in order to catch problems early and to keep these devices operating optimally.

Water Audit Form #4
HEATING AND COOLING SYSTEMS WORKSHEET

Complete one form for each of your buildings. The completed form is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____

Best Management Practices: (check as implemented)

Boilers

Operation

- ❑ Regularly check water treatment procedures.
- ❑ Maintain the total dissolved solids (TDS) of the boiler water suitably low.
- ❑ Operate at the lowest steam pressure or hot water temperature that is acceptable to the distribution system requirements.
- ❑ Condition fuel for optimum combustion.
- ❑ Minimize load swings and schedule demand where possible to maximize the achievable boiler efficiencies.
- ❑ Regularly check the efficiency of boilers.
- ❑ Regularly monitor and compare performance related data.
- ❑ Regularly monitor the boiler excess air.

Maintenance Routines

These should be done on a regular basis, and never less than once a year. They may be considered to be part of preventive maintenance procedures:

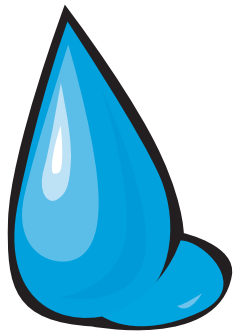
- ❑ Keep burners in proper adjustment.
- ❑ Overhaul the seals of regenerative airheaters during scheduled boiler shutdowns.
- ❑ Check for and repair leaking flanges, valve stems and pump glands.
- ❑ Maintain tightness of all air ducting and flue gas breaching.
- ❑ Check for "hot spots" on the boiler casing that may indicate deteriorating boiler insulation that should be repaired during the annual shutdown period.
- ❑ Keep the fireside surfaces of boiler tubes clean.
- ❑ Replace or repair missing or damaged insulation.
- ❑ Replace boiler observation or access doors, and repair any leaking door seals.
- ❑ Replace or repair any leaking or malfunctioning steam traps.
- ❑ Periodically calibrate measurement equipment and tune the combustion control system.

Low Cost Opportunities

- ❑ Install performance monitoring equipment.
- ❑ Relocate combustion air intake.
- ❑ Recover blowdown heat.
- ❑ Add insulation.
- ❑ Reduce boiler excess air.

Retrofit Opportunities

- ❑ Install economizer.
- ❑ Install airheater.
- ❑ Install new boiler.
- ❑ Upgrade burner.
- ❑ Install electric coil boiler.
- ❑ Install turbulator in fire tube boiler.
- ❑ Install flue gas condenser.
- ❑ Convert from oil to gas.



General

- ❑ Monitor systems for water leaks, and fix leaks immediately.
- ❑ Have an inventory, including capacity and what the system serves.
- ❑ Minimize and meter make-up and blow-down water.
- ❑ Know the purpose and action of any chemical used in your boiler.
- ❑ Consult with your chemical supplier about increasing cycles of concentration of chemicals.
- ❑ Consider adding sulfuric acid (observe safety precautions) to reduce carbonate scale and enable higher cycles of concentration. Check with your supplier to ensure this option is valid for your particular equipment.
- ❑ Record service calls including purpose, analysis and results.
- ❑ Require new boilers to comply with performance-based specification.
- ❑ Consider the use of ozone for boiler water treatment.
- ❑ Consider the use of reclaimed water for boiler make-up water. Ensure water quality is adequate.
- ❑ Consider the use of blow-down for lower-grade non-potable uses.

Once-through Cooling

- ❑ Eliminate single pass cooling, unless water is reused somewhere afterwards.
- ❑ Purchase air-cooled equipment when replacing water-cooled equipment.
- ❑ Consider connecting to recirculating cooling water loop.

Cooling Towers

- ❑ Monitor systems for water leaks, and fix leaks immediately.
- ❑ Have an inventory, including capacity and what the system serves.
- ❑ Minimize and meter make-up and blow-down water.
- ❑ Know the purpose and action of any chemical used in a recirculating cooling tower.
- ❑ Consult with your chemical supplier about increasing cycles of concentration of chemicals.
- ❑ Consider adding sulfuric acid (observe safety precautions) to reduce carbonate scale and enable higher cycles of concentration. Check with your supplier to ensure this option is valid for your particular equipment.
- ❑ Record service calls including purpose, analysis and results.
- ❑ Require new cooling towers to comply with performance-based specification.
- ❑ Consider possible applications for ozone use in cooling water treatment
- ❑ Consider use of reclaimed water for cooling tower make-up water. Ensure water quality is adequate.
- ❑ Consider re-use of blow-down for lower-grade non-potable uses.

Evaporative Coolers

- ❑ Monitor for and fix leaks.
- ❑ Recirculate water.
- ❑ Monitor and optimize bleeding rates.
- ❑ Use bleed off for landscape watering or other uses.

Steam and Condensate Systems

Housekeeping

- ❑ Steam trap maintenance program and procedures.
- ❑ Check and maintain proper equipment operation.
- ❑ Check and correct steam and condensate leaks.
- ❑ Train operating personnel.
- ❑ Maintain chemical treatment program.
- ❑ Check control settings.
- ❑ Shut down equipment when not required.
- ❑ Shut down steam and condensate branch system when not required.

Low Cost Opportunities

- ❑ Recover condensate.
- ❑ Overhaul pressure reducing stations.
- ❑ Operate equipment in efficient operating range.
- ❑ Insulate uninsulated flanges and fittings.
- ❑ Remove unused steam and condensate piping.
- ❑ Reduce steam pressure where possible.
- ❑ Repipe system or relocate equipment to shorten pipe lengths.
- ❑ Optimize location of control sensors.
- ❑ Insulate uninsulated piping.
- ❑ Add metering, measuring and monitoring equipment.
- ❑ Replace or repair leaking traps.
- ❑ Repair, replace or add air vents.
- ❑ Repair damaged insulation.

Retrofit Opportunities

- ❑ Upgrade insulation on piping to recommended insulation thickness.
- ❑ Institute a steam trap replacement program.
- ❑ Optimize pipe sizes.
- ❑ Recover flash steam.
- ❑ Eliminate steam use where possible.
- ❑ Stage the depressurization of condensate.
- ❑ Recover heat from condensate.
- ❑ Meter all steam and condensate flows.
- ❑ Consider cogeneration of heat and electrical power.

Water Audit Form #5
LAUNDRY WORKSHEET

Complete one form for each laundry area in each of your buildings. The completed form is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____

Location of laundry area: _____

Washing machines:

Brand	Leak?	Water use per load	Number of loads/week	Total water use/year[1]

1. To calculate total yearly water use, multiply: water use per load X number of loads/week X 52 weeks/year

Fixtures:

Fixture/Appliance	Leak?	Flow Rate	Usage	Total Yearly Water Use
Faucet				
Faucet				
Faucet				

Best Management Practices: (check as implemented)

- ❑ Monitor for and fix leaks.
- ❑ Consider using continuous-batch washers.
- ❑ Consider laundry (water) reclamation systems.
- ❑ Launder only full loads.
- ❑ Evaluate wash cycles.
- ❑ Review your use of laundry chemicals with your supplier to ensure efficiency.
- ❑ Consider water use when purchasing equipment.

Water Audit Form #6
LABORATORY AND X-RAY PROCESSING WORKSHEET

Complete one form for each laboratory in each of your buildings. The completed form is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____

Best Management Practices: (check as implemented)

- ❑ Monitor for and fix leaks.
- ❑ Explore alternatives for most efficient cleaning of equipment (i.e., dishwasher).
- ❑ Consider alternatives to water "powered" suction/aspiration.
- ❑ Re-consider alternatives for single-pass water cooling for instrumentation or analyzers.
- ❑ Ensure x-ray film processors have shut-off valves to stop water flow when not developing.
- ❑ Optimize flow rate of water through processors (check with your supplier). A flow rate of 8 litres per minute or less may be sufficient.

Water Audit Form #7
LANDSCAPE WORKSHEET

Complete forms for "green" areas. The completed form is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____

Irrigation Practices:

Irrigated Area	Length of time irrigated/week	Sprinkler flow rate	Total water use/week

Best Management Practices: (check as implemented)

- ❑ Specifically mandate the use of heat-tolerant low-water use plants.
- ❑ Limit turf areas.
- ❑ Mow regularly, but leave grass 2 1/2" - 3" high.
- ❑ Use mulch around groundcovers, trees, shrubs, etc.
- ❑ Do not over-fertilize or over-prune.
- ❑ Monitor for and fix leaks and broken sprinkler heads.
- ❑ Ensure your irrigation system is efficient (rates of water flow for each area are appropriate).
- ❑ Control application of water with moisture sensors or timers.
- ❑ If possible, irrigate in the early morning to reduce evaporation caused by heat and wind.
- ❑ Consider the use of a drip irrigation system rather than sprinklers.
- ❑ Be sure hoses have shut-off nozzles.

Water Audit Form #8
POOLS AND SPAS

Facility Name: _____

Pools and Spas

Location	Leaks?	Yearly Water Use

Best Management Practices: (check as implemented)

- ❑ Cover pools and spas when not in use.
- ❑ Adjust pool levels to minimize splash-out.

Water Audit Form #9
OTHER WATER USE/BUILDING OPERATIONS WORKSHEET

Complete forms for any water use that is not otherwise included in the audit. A complete accounting of water is a necessary part of the information needed to establish how your water is being used.

Facility Name: _____

General

Location	Equipment Type	Leaks?	Yearly Water Use

Best Management Practices: (check as implemented)

- ❑ Use water from a water treatment/softener only when necessary; do not use for drinking or cooking. Regenerate water softeners only when needed.
- ❑ Regularly check building and any equipment for leaks and optimal use of water.
- ❑ Repair leaks and malfunctions promptly, not only to save water, but also to show employees that their reports of leaks are taken seriously.
- ❑ Consider alternatives to bleeding water supply lines to prevent freezing or to optimize bleeding, such as heat tape or devices to keep the flow moving.
- ❑ Consider high pressure, low volume spray for cleaning applications.
- ❑ Use automatic valves that shut off water when equipment is off.
- ❑ Shut off water to unused areas.
- ❑ Install pressure reducing valves if pressure is high.
- ❑ Consider water use when purchasing equipment.
- ❑ Sweep when you don't have to mop or wash down.
- ❑ Read water meters monthly and compare to previous years to ferret out leaks.
- ❑ Make water use figures known to employees.

APPENDIX 1: Payback Periods for Water Savings

IN GENERAL		
Assuming a water rate of $2.25/1,000 Imp. Gal		**Save per day (litres)**
Per Dollar expended	Save 2,020 litres per year to have one year payback.	5.5
	Save 1,010 litres per year to have two year payback.	2.8
	Save 673 litres per year to have three year payback.	1.8
	Save 505 litres per year to have four year payback.	1.4
	Save 404 litres per year to have five year payback.	1.1

These paybacks do not consider sewage costs.

APPENDIX 2: Example Payback for Toilet Retrofits and Replacements

TOILETS (assume 5 flushes per day)

Toilet Retrofit Options	Approximate Cost of Device		Cost per 1000 imp. gallons	Potential Savings (litres) per flush		Water saved per year (litres)		Payback Period (years)	
	Low	High		Low	High	Low	High	Shortest	Longest
Fixed Volume	$0.25	$1.00	$2.25	2.3	2.8	4,143	5,183	0.1	0.5
Variable Volume	$2.00	$7.00	$2.25	3.0	4.8	5,530	8,778	0.5	2.6
Mechanical Devices	$1.00	$30.00	$2.25	2.1	5.3	3,796	9,673	0.2	16
Dual Flush Devices	$5.00	$40.00	$2.25	2.4	5.3	4,344	9,673	1.0	19
Flow Restrictors	$0.15	$6.00	$2.25	1.9	2.0	3,376	3,668	0.1	3.6
Flushometer Devices	$6.00	$18.00	$2.25	3.1	3.6	5,603	6,570	1.9	6.5

(Source: Metro. Water District of Southern CA)

Toilet Replacement			Cost per 1000 imp. gallons	Potential Savings (litres) per flush		Assume 5 flushes per day: Water saved per year (litres)		Assume 5 flushes per day: Payback Period (years)	
	Toilet Cost	Labour Cost		Low	High	Low	High	Shortest	Longest
Ultra Low Flow (ULF)	$150 or more	$150 or less	$2.25	7.5	20	13,688	36,500	8.3	22

APPENDIX 3: Example Payback for Low-Flow Showerheads and Faucets

SHOWERHEADS (Assume 2 five minute showers per day)								
Replacement	**Showerhead Cost**	**Assume save 6 litres per minute**	**Cost per 1000 imp. gallons**	**Savings (litres)/ 5 minute shower**	**Litres saved per year**	**Payback (years)**		
13.25 litre per minute	$10.00		$2.25	30	21,900	0.9		
FAUCETS								
bathroom		**Savings (litres) per minute**	**Cost per 1000 imp. gallons**	**Savings (litres) per minute**	**Litres savings if used 4.5 minutes/day**		**Payback (years)**	
	Unit Cost	**Medium flow**		**High flow**	**Medium flow**	**High flow**	**Medium flow**	**High flow**
retrofit-3.5 litre aerator	$2.00	8	$2.25	20	13,140	32,850	0.3	0.1
replace-3.5 litre flow	$50.00	8	$2.25	20	13,140	32,850	7.7	3.1
Kitchen/Lab		**Savings (litres) per minute**	**Cost per 1000 imp. gallons**	**Savings (litres) per minute**	**Litres saved yearly, if per day use in:**		**Payback (years)**	
	Unit Cost	**Medium flow**		**High flow**	**5 minutes**	**30 minutes**	**5 minutes**	**30 mins.**
retrofit-9 litre aerator	$4.00	8	$2.25	40	14,600	87,600	0.6	0.1
replace-9 litre flow	$75.00	8	$2.25	40	14,600	87,600	10	1.7

APPENDIX 4: Life Cycle Analysis Example

Life Cycle Analysis means to include all costs involved in purchasing, operating and disposing of an item. To compare the various options, divide by the cost per year.

Example of Life Cycle Analysis	Choice A	Choice B	Choice C
Initial Cost	$500	$700	$1,000
Predicted life of purchase (years)	15	15	20
Predicted cost of repairs over life of item	$150	$130	$200
Predicted water costs per year x Predicted life of purchase	$840	$750	$450
Predicted energy costs per year x Predicted life of purchase	$780	$700	$420
Total cost of each	$2,270	$2,280	$2,070
Average cost per year of each	**$151**	**$152**	**$104**

In this case, even though the initial cost of Choice C was substantially higher, it will prove to be a better buy over the long term. It will not always be true that the fixture or appliance with the highest initial cost will be the best buy, as other features may have an impact on the price. For example, a dishwasher with many types of cycles may be substantially more expensive than the dishwasher with three cycles; the dishwasher with three cycles may be less expensive to repair and use the same amount of water and electricity as the more expensive model.

Utility costs are available from the appropriate utility. Keeping track of the number of times your current appliance is used over a few weeks will enable you to guess how often the new model will be used.

APPENDIX 5: Conversion Table

1 cubic meter = 1,000 litres

1 imperial gallon = 4.55 litres

1 cubic meter = 219.3 imperial gallons