WATER EFFICIENCY

A best practice guide for Irish Healthcare Facilities

GreenHealthcare

epa Environmental Protection Agency

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

HBS Health Business Services
The business division of the HSE
National Health Sustainability Office

www.greenhealthcare.ie

HSE

Providing high quality care to patients is a core value of the Health Service Executive (HSE) and the organisation recognises that in providing this care, we may have an impact on the environment.

The HSE, through the National Health Sustainability Office (NHSO), is committed to become a leading sustainable organisation delivering low carbon quality sustainable healthcare, with the purpose of preserving natural resources, reducing carbon emissions, mitigating the effects of climate change and safeguarding high quality patient care. By reducing our environmental impact through resource efficiency and educational programmes, the HSE can help our clients and staff to live and acknowledge the importance of a healthier environment and the impact that this can have on population health and public finances.

The Green Healthcare Programme is co-funded by the NHSO and the EPA and works with healthcare facilities to improve resource efficiency in the areas of food waste, healthcare risk waste, recycling and water use.

Jim Murphy
National Lead
National Health Sustainability Office
HSE Estates

www.hse.ie/sustainability

EPA

The Environmental Protection Agency (EPA) is committed to playing a strong role in developing Ireland as a sustainable nation, where people can live healthy and fulfilling lives, without harming the ability of future generations to also live well. A key part of this is to appreciate the value of our natural resources – and water is one of the most important.

While Ireland has abundant natural water supplies, the processes involved in delivering clean, safe drinking water to the tap are complex, making it a valuable resource which should be used carefully. Through the National Waste Prevention Programme, the EPA supports organisations in assessing and adjusting their processes to be more efficient in terms of using resources – including water.

This is the latest in a series of outputs from Green Healthcare, funded by the EPA and HSE under the National Waste Prevention Programme. The water-saving guidance presented in this handbook offers real benefits to operators of healthcare facilities. The payback is twofold, comprising both immediate savings on water bills and overall reductions in water-use - protecting the availability of water for communities, now and into the future.

I hope this book proves to be a valuable source of information for improving efficiency of water usage at healthcare facilities across Ireland.

Dr Eimear Cotter,
Director, Office of Environmental Sustainability
Environmental Protection Agency

Clean water is a very important resource for for Irish health services. It is used all day, every day, for a variety of purposes – toilets, taps, dialysis, heating, showers, cooking, cleaning, etc. However, water is also an expensive resource – so managing it properly is important financially as well as ensuring quality healthcare services are provided.

This booklet, developed as part of the Green Healthcare programme, provides an overview of the main aspects involved in the efficient use of water in Irish hospitals. For more on the Green Healthcare programme visit:

In order to get the most out of your water system the following 3 areas need to be addressed individually, and in order.

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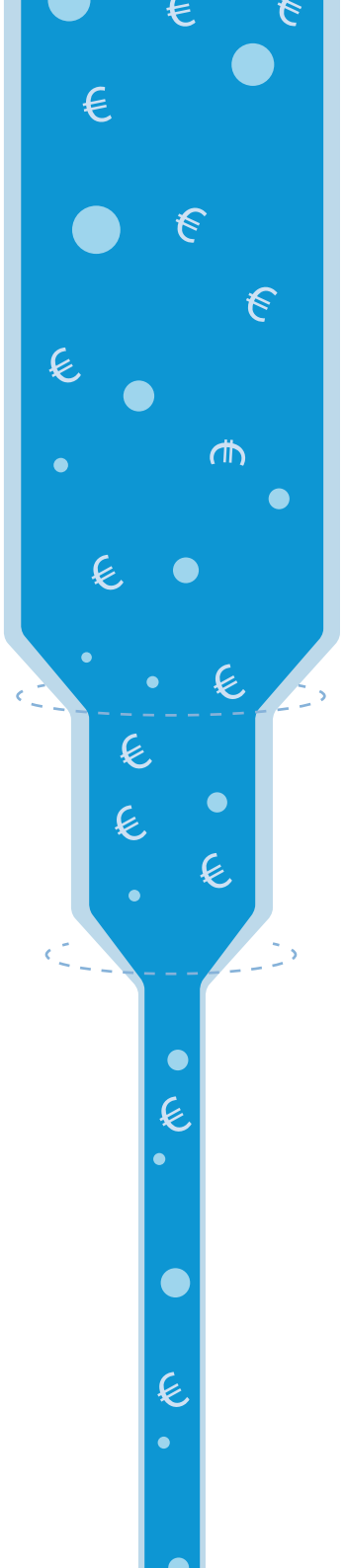


1. WATER PAID FOR

Clean water is an important resource for hospitals. It is used in multiple locations (e.g. wards, canteens, toilets) and for many different functions (e.g. dialysis, drinking, cleaning). In general, as long as water is there when it is needed, people tend not to worry too much about it. However, every litre of water that is paid for may not reach its intended tap, toilet or shower. As water is a costly resource ensuring that it is carefully monitored and tracked is an important job for every hospital.

When it comes to the water you pay for, there are three main aspects to get right:

1.1 Monitoring

1.2 Benchmarking

1.3 Leak identification

1.1 Monitoring

Monitoring water use on a regular basis is an essential element of good water management. However, as most mains water meters are read and billed quarterly (though in some cases, this can be monthly) there can often be months between bills. If a leak occurs in that time and goes unnoticed then the next bill may be a very expensive one.

Another issue is that bills are often paid and not really examined. By having a monitoring process in place that tracks water consumption regularly, hospitals can ensure that they know how much water they are using. Then, if leaks occur, they can be identified quickly. This ensures that those in the relevant departments who will use it (e.g. maintenance, accounts, hospital manager, budget holder) can easily monitor trends in water consumption.

Those in the relevant departments who will use it (maintenance, accounts, hospital manager, budget holder) can monitor trends in water consumption easily.

Methods for monitoring water use

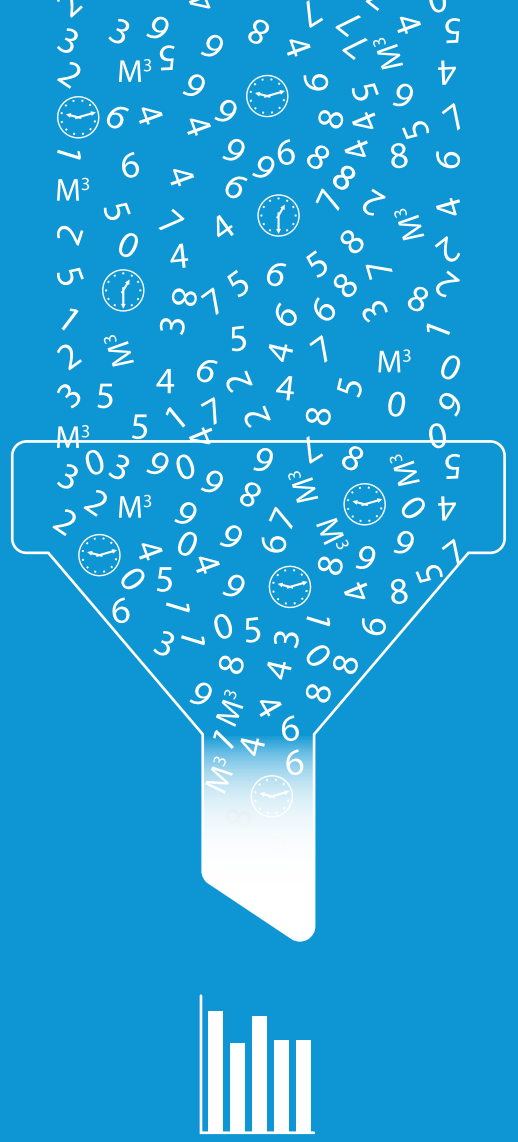
Regardless of how you monitor your water consumption, it is important to put the information into an easy to see, useful format. In terms of seeing trends, a chart, is a much easier way to interpret the data than lines of data on a spreadsheet.

There are 3 main ways to monitor a hospital's water use:

- **Scrutinise your bills** - use the consumption data (m^3) from water bills and chart it in a visually representative manner in Microsoft Excel. This ensures trends in water consumption can be easily monitored. When starting this process try to get at least 2 years of historic data so that annual trends can be identified. For more on understanding a water bill go to: *www.water.ie/for-business/billing-explained/understand-your-bill/*

- **Read meters manually** - this is more exact than just using bills and is especially important for sites that get infrequent water bills. The mains water meter is usually near the road in front of the main entrance to a site. If the location of the meter(s) is unknown contact your local authority office. When manually reading a water meter try and do it at the same time(s) every week. Then, once a charting system is established (e.g. using excel) this form of monitoring is very effective.

- **Use an online logger** - these can be installed on any meter (internal sub-meter or Council mains meter) to provide an online profile of daily water use. They can be configured to set off an alarm if either day or night water use exceeds a specified level. For less than €1,000, an online logger is cost effective and can be used for both early detection of new leaks and identification of ongoing leaks.



It is important to put the information you record into an easy to read, useful format.

1.2 Benchmarking

While every hospital is different in terms of size, services and on-site activity, benchmarking is a useful tool for comparing a facility's operation to others in the same sector, or comparing current performance with that of another period (e.g. 2017 vs 2016)

For water use, benchmarking involves comparing a hospital's annual water use with the number of patient bed-days provided by the hospital. Patient bed-days is a standard indicator of service activity used for benchmarking in the healthcare sector. While there are distinct limitations to using patient bed-days, it is a figure that is commonly used for reporting in the healthcare sector.

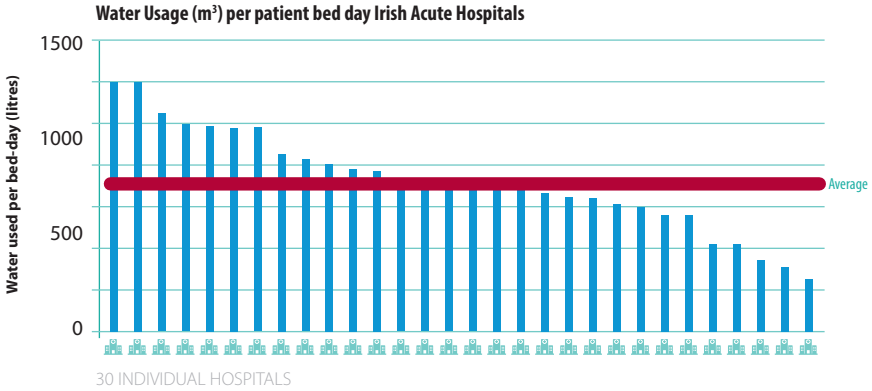
To calculate the water use benchmark for your hospital, input the following information for the most recent 12 month period:

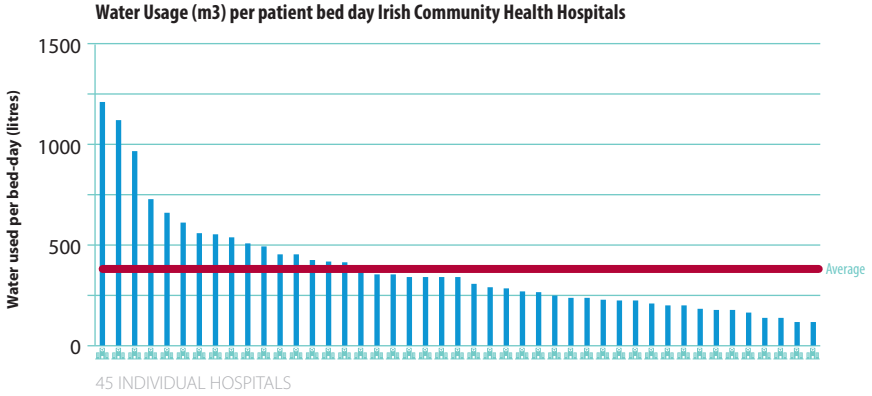
$$\frac{\text{Volume of water used (m}^3\text{)}}{\text{No. of patient bed-days (or number of beds * 365)}} \times 1000 = \text{Benchmark (litres per bed-day)}$$

* This assumes 100% occupancy which may not always be the case.

Depending on your type of hospital you can now compare your value with the initial benchmark profiles for Irish Acute and Community Health Hospitals which are shown here.

The following profiles show water benchmark data produced by the Green Healthcare programme. These are based on data from 30 Acute Hospitals and 52 Community Health Hospitals.





Note: These benchmark profiles will be updated annually by the Green Healthcare programme. It is anticipated that the average water use, in both Acute and Community Health Hospitals, will decrease as Irish hospitals continue to improve their management of water.

The importance of Benchmarks

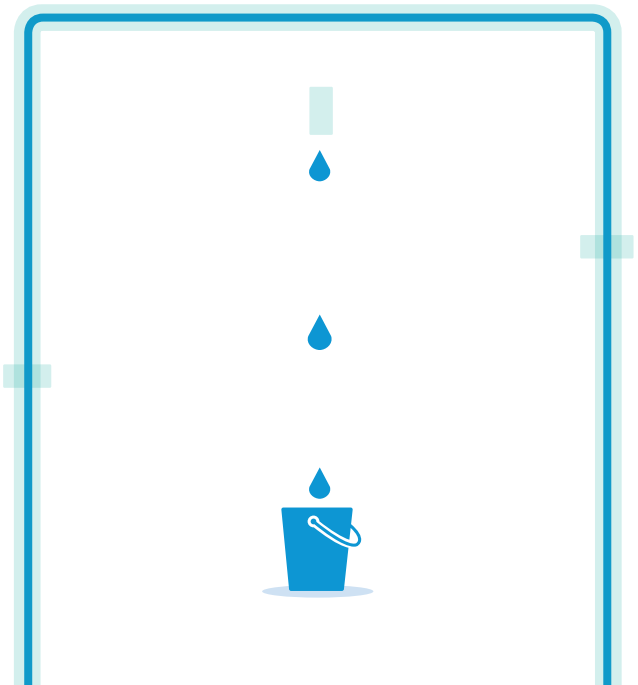
Most people assume that once water is flowing from the taps in a hospital that all is well in terms of water supply. However, until you benchmark against other hospitals of a similar type (in terms of size and services provided) you won't know for sure.

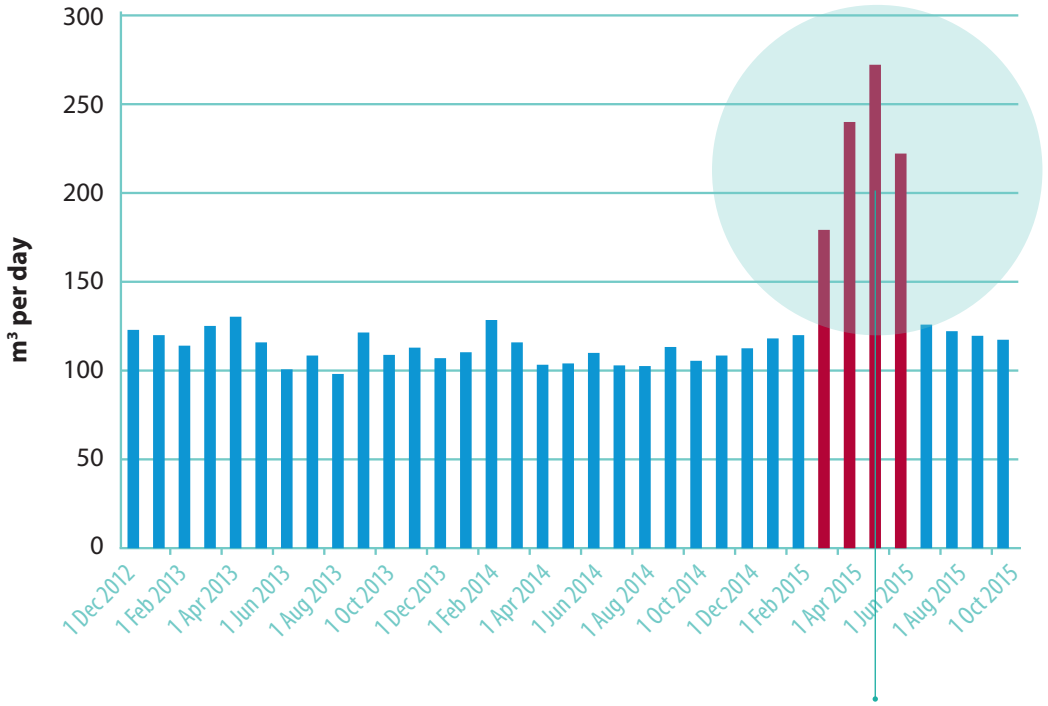
1.3 Leak identification

Leaks in a hospital equate to money down the drain. If there are significant leaks they can have long-term impacts on a site as well as impacting the quality of water supplied to the hospital (through dirt ingress into the system).

Water wasted due to leaks can be difficult to address. While a leaking tap is visible, most water leaks are not. Leaking underground pipes, faulty ballcocks and hidden overflows all contribute to making water leaks difficult to find.

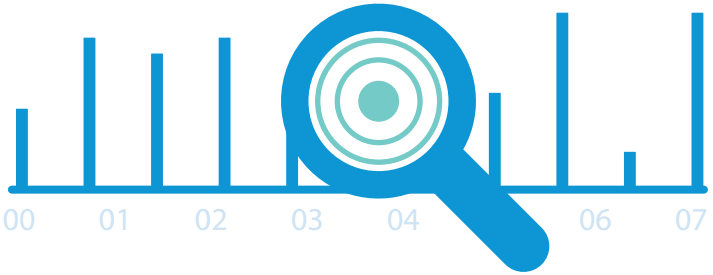
Once a leak has been identified it is important to repair it straight away. Leaks never get smaller and continue to cost money every hour they are left unrepaired. Also, where water leaks out, dirt and bacteria can get in. This is of particular importance in a healthcare setting where the prevention of infection is paramount.





This profile shows the water use data from a large Irish hospital campus over a 3 year period. A leak started in March 2015 and by the time it had been identified, investigated and repaired almost 4 months had passed. This significant leak involved a loss of 80m³ per day and cost almost €31,000.

How to carry out leak identification



Historical Data

By examining historical water use data* for a hospital, and comparing this with the number of bed-days provided annually, a water use benchmark can be generated for any hospital. If the benchmark value is much higher than the national average (see page 15) it is a strong indication of leaking water. However, even if a hospital's benchmark is lower than the national average, there may still be leaks.

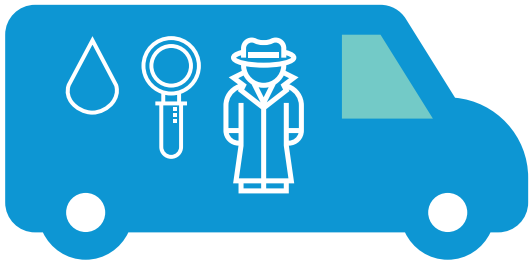
Background water use

Checking the mains meter in the evening (after the kitchen closes) and again first thing the next morning (before kitchen service starts) will provide information on the background water use. If there is a significant difference in the meter readings, then water is being used in the background and this usually indicates leaks.

Hospitals operate 24 hours a day so there will always be some water used overnight. However, the amount used overnight should be much less than during the day.

Online Data Logging

Using a data logger on the mains water meter is the best and most effective way to monitor background water use in a hospital. These loggers can be installed permanently (recommended) or on a temporary basis. Costing less than €1,000, they can be used to show the costs associated with existing leaks as well as monitor for new leaks.



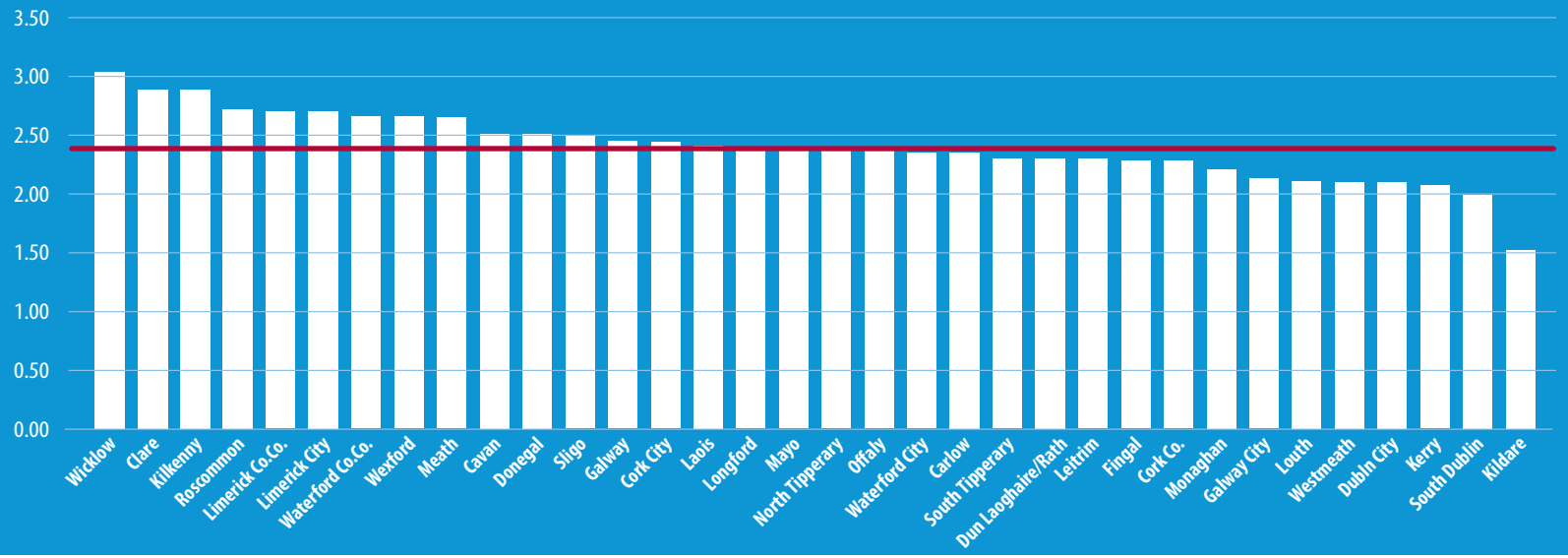
Leak detection companies

Once the existence of leaks has been confirmed, the next job is to find and fix them. Some are easy to track down (e.g. faulty ballcocks) but most are not. There are a number of leak detection companies throughout the country who will assist hospitals pinpoint leaks, even if they are underground.

If the cost associated with leaks has already been estimated, then the cost benefit of the leak repair work can be calculated. Remember, leaks will never fix themselves and will continue to cost a hospital money every hour of every day until repaired.

* If you don't have access to historical data contact Irish Water or your local authority

Irish Local Authority Water Rates 2017 (€ per M³)



Calculation for background water use

On the right you can see 2 Tables. The first, blank Table, provides a Template for a hospital to calculate its annual costs of background water use. All that is needed to fill this out this are 2 meter readings (evening and following morning) as well as the cost of water (per m3) for the hospital *. The second Sample Table shows how it would typically look when completed, and how the data from a background water check can be used to estimate the cost of water wasted annually in a hospital.

* The current cost of water (per m3) in different local authority areas is shown in the graph above.

Sample Table

METER READING 1	9pm Tuesday - 34566 m^3
METER READING 2	7am Wednesday - 34584 m^3
THE DIFFERENCE This is your background water use	= 18 m^3
COST OF WATER (PER M^3)	x €2.50
COST OF WATER PER NIGHT	= €45.00 x 365
COST OF NIGHT TIME WATER USE EACH YEAR	= €16,425

Template for calculating costs of background water use

METER READING 1	
METER READING 2	
THE DIFFERENCE This is your background water use	
COST OF WATER (PER M^3)	
COST OF WATER PER NIGHT	
COST OF NIGHT TIME WATER USE EACH YEAR	

2. WATER USED

Once a hospital is tracking and monitoring water supply, and has repaired its background leaks, it is time to examine where and how water is used within the hospital. While every hospital is different, the services they all provide are fairly consistent. Typically, water is used for services (toilets, taps, etc.), heating and hot water, cleaning and cooking. In addition, Acute hospitals can also use water for dialysis, sterilisation and HVAC.

In order to understand where and when the water is used in your hospital, and to get the most out of the water you are paying for, the following 3 areas need to be addressed.

2.1 Daily use profile

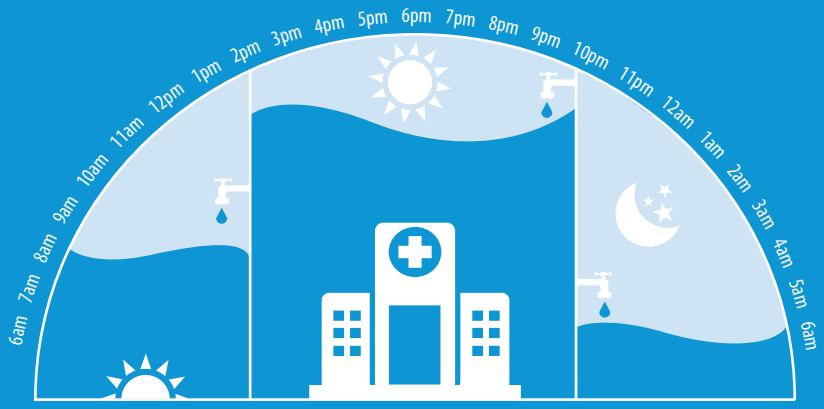
2.2 Sub-metering

2.3 Survey of main water users

2.1 Daily use profile

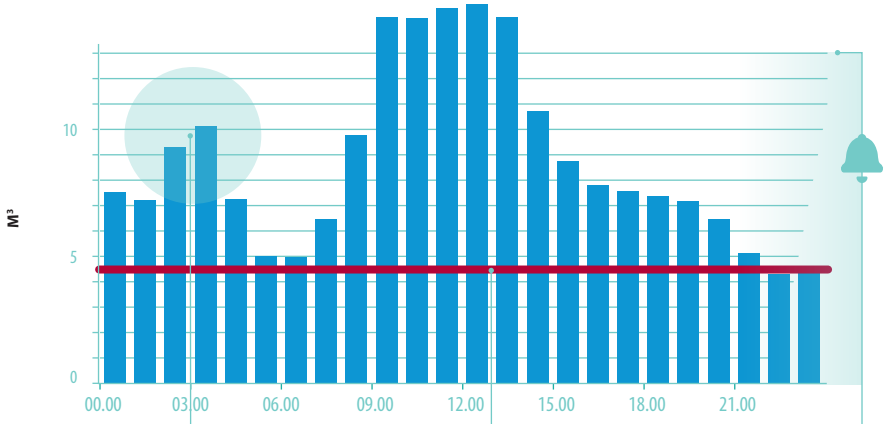
As every hospital is different, so too the daily water use profile will vary, over 24 hours.. However, the daily use profile for most hospitals will be fairly consistent week-to-week, though weekend and weekdays do tend to differ.

A typical daily use profile should have very low volumes of water used during the night. While there will be some activity (and this will be determined by the services provided) this is usually relatively low. Water use ramps up quickly in the morning as soon as on-site services begin. Water use usually peaks between mid-morning to mid-afternoon. This is when the main activity occurs in hospitals and will often be related to when the main meal is served. After the final meal, water use decreases over the evening time, returning to the low night time level around midnight.



The following daily use profiles from an Irish Acute and a Community Health Hospital illustrate the type of useful information that can be gathered from daily use profiles via data loggers.

Example of a daily use profile for a large Irish Acute Hospital

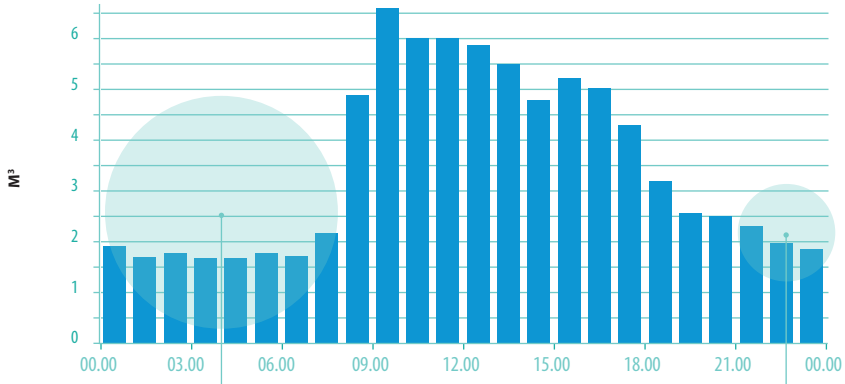


An unexplained peak occurs during the night. This was investigated and found to be due to dialysis backwashing.

High background water use at 5 m^3 per hour. If this is due to a leak then it could be costing over **€10 per hour or almost €90,000 per year.***

An alarm is set to alert maintenance staff if the daily consumption exceeds 450 m^3. As leaks are repaired, and the daily consumption decreases, this can be changed accordingly.

Example of a daily use profile for a Community Health Hospital



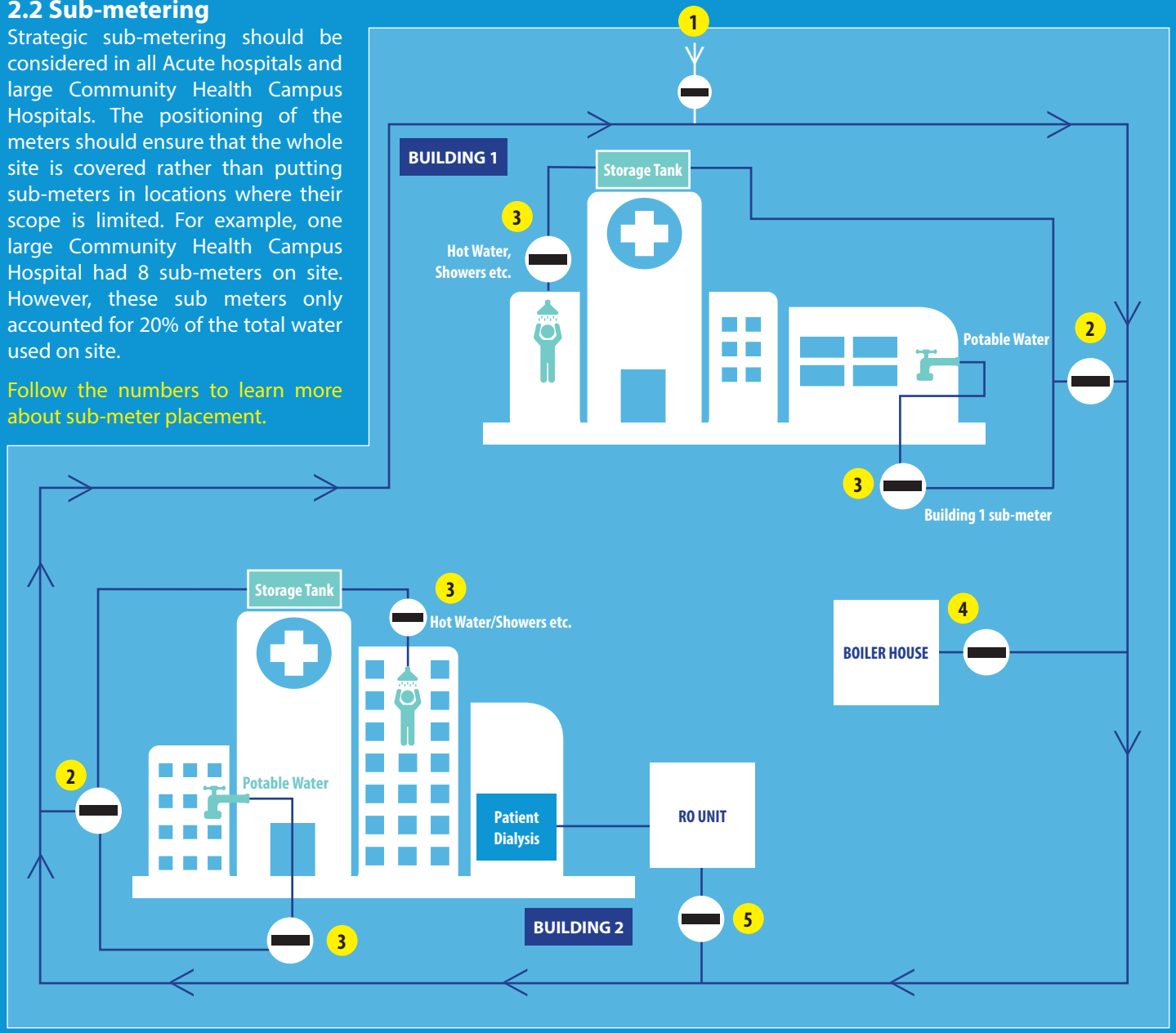
* (Note: costs are based on a water charge of €2.50 per m^3)

There is a steady background water use of 2 m^3 per hour from 10am to 7pm. This type of night time profile is consistent with a background leak. Assuming 2m^3 is lost every hour then this is costing the hospital **€120 a day or €44,000 annually.***

2.2 Sub-metering

Strategic sub-metering should be considered in all Acute hospitals and large Community Health Campus Hospitals. The positioning of the meters should ensure that the whole site is covered rather than putting sub-meters in locations where their scope is limited. For example, one large Community Health Campus Hospital had 8 sub-meters on site. However, these sub meters only accounted for 20% of the total water used on site.

Follow the numbers to learn more about sub-meter placement.



1. Ideally, hospitals should have only one mains supply meter. This allows all water supplied to the hospital to be monitored from one location. Many older sites have more than one mains meter and while these can be useful if all data is gathered together, the exact areas serviced are often unknown.

2. All main building areas on a hospital site should have an individual sub-meter. If correctly implemented then the sub-meters should cover all water used on the site. Then, if leaks are noted in the mains meter (1) the leak can be quickly tracked to the building or area where it occurs.

3. Ideally each major building on a large campus should have 2 internal sub-meters. 1 would cover all direct mains fed potable water and the other be positioned after the main storage tank. These, in conjunction with the building sub-meters, (2) ensures that any leak that may occur can be quickly narrowed down.

4. Hot water is a major cost for hospitals - it is usually 5 times the cost of cold water due to the heating costs. A meter on the water feed to the boiler or heat exchanger will give information on hot water use.

5. If your hospital provides dialysis then you should have a sub-meter on the reverse osmosis plant. These can be significant water users with great potential to save money.

2.3 Survey of main water users

Once you have identified the main water using areas/buildings within your hospital, the next step is to assess the main water users in those areas. If you have sub-metered some of the large users (e.g. boilers, reverse osmosis) then this step usually involves assessing the main fixtures and fittings.

Due to the nature of hospitals, taps, showers and toilets are used more frequently than most other businesses. By having efficient fixtures and fittings the water use can be reduced. This reduces water costs, including the cost of hot water, which can be up to five times that of cold water.

A fixtures and fittings survey typically examines the following:

- Tap and shower flow rates
- Toilet cistern sizes
- Urinal use and controls
- Water used by other large users (e.g. dishwashers)

By doing these surveys it should become evident which fixtures and/or fittings are inefficient. By comparing your findings with best practice values (more on this later) you can then target areas, buildings or specific fixtures that should be addressed.

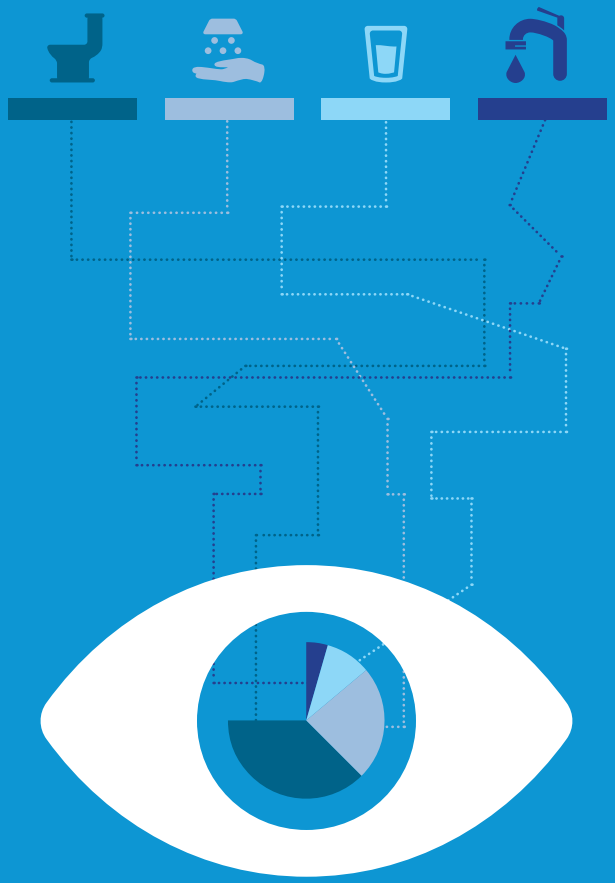
Most hospitals have an asset register for the purposes of legionella prevention and management. This is a valuable resource as it provides an inventory of the type and location of the main fittings in the hospital. It is recommended that any survey results are included in this inventory. This will then provide a comprehensive database that can be used to help prioritise those fixtures and fittings that should be replaced.

How to measure the flow rates in your taps or showers?

A flow cup gives litres per minute readings

If you don't know the flow rates from your taps or showers you can easily measure them with a bucket and stopwatch. By recording the time it takes to fill a certain volume you can estimate the flow rate per minute. Using a graduated container makes this job easier.

Flow cups make this process even easier, though for some showers they may not be appropriate. When using flow cups, make sure you record the flow rate at the maximum flow.



A fixtures and fittings survey will help identify cost savings for a hospital.

3. WATER THAT SHOULD BE USED

At this stage, participating hospitals should have a system in place to monitor and check water use, be aware of the hospital's daily use profile, have repaired most leaks and know how much water is being used by the main water consuming fixtures, areas and/or buildings.

Now, in order to start reducing costs and making sure the hospital is as water efficient as possible, the following areas should be considered:

3.1 Best practice benchmarks

3.2 Best practice flow rates

3.3 Water pressure

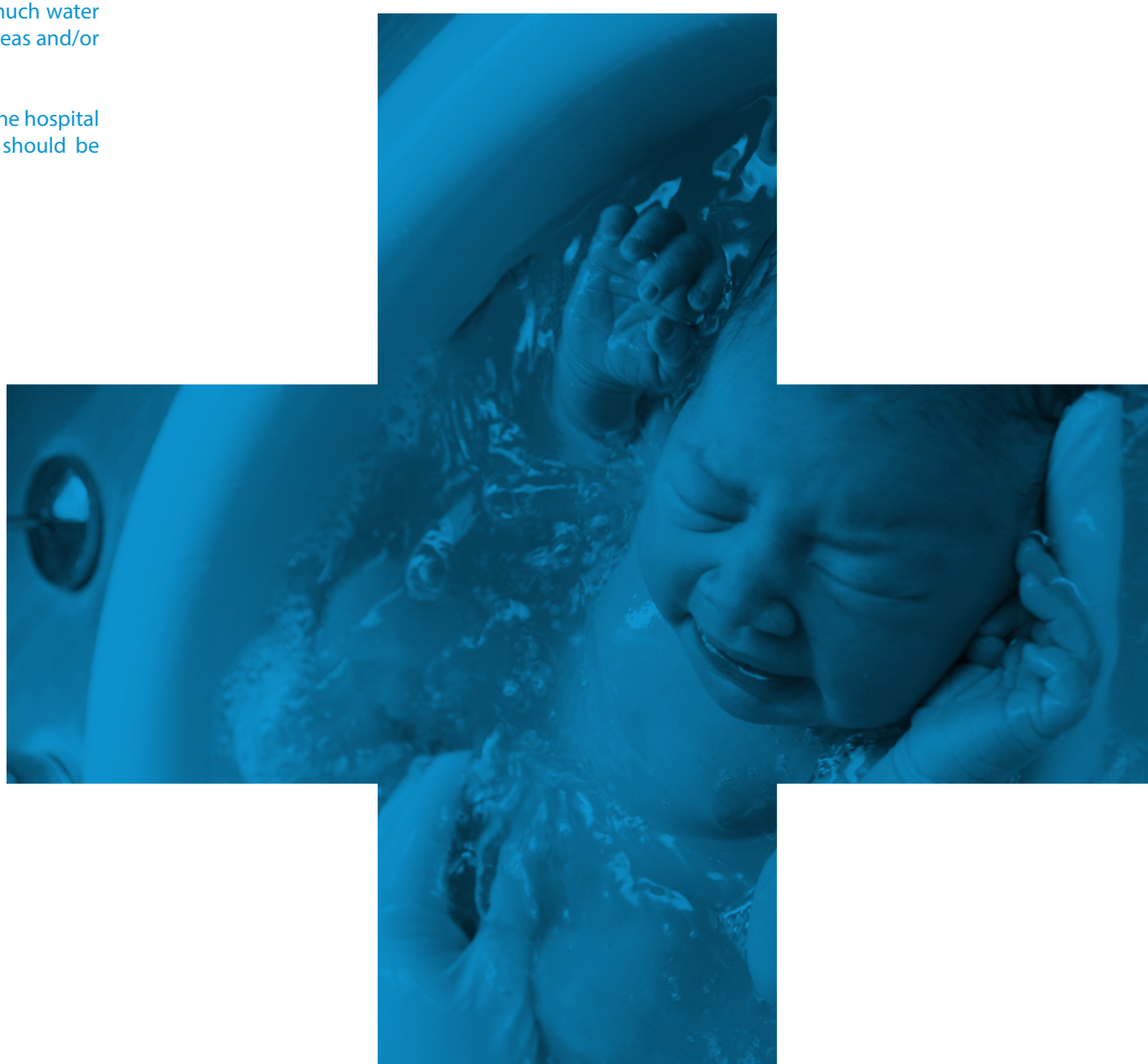
3.4 Water network drawings

3.5 Other large consumers

a. Reverse osmosis

b. Kitchen

3.6 Water efficiency programme



3.1 Best practice benchmarks

The amount of water used by hospitals depends on the services provided, the number of overnight patients and the number of day consultations and visitors, etc. The most effective way of comparing how efficiently different hospitals use water is to calculate how much is used per patient bed-day. The Green Healthcare programme gathers water use data from Irish hospitals every year and, based on these, the best practice benchmarks are estimated and updated.

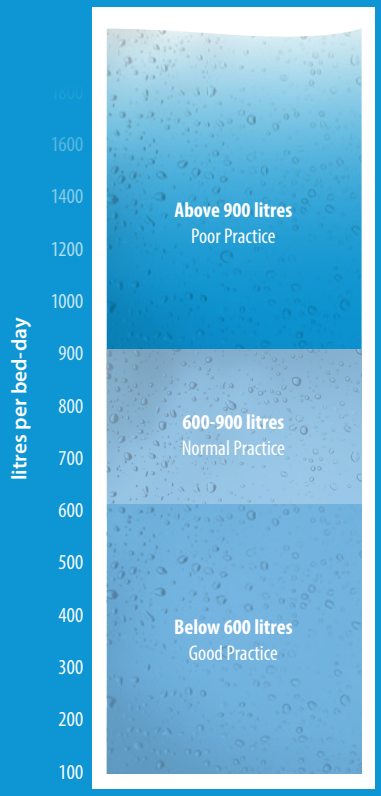
It is important to note that while patient bed-days is a relatively consistent indicator to base benchmarks on, due to the variety of services that are offered in hospitals, direct comparisons may not always be possible. However, for the purposes of national best practice values, patient bed-days is the indicator used.

Calculating internal water use indicators on a regular basis is an excellent method of monitoring how well a hospital is performing, internally, relative to how busy it is. Instead of just patient bed-days a hospital may wish to base its internal indicator on patient interactions. This could include any or all of the following: patient bed-days, births, A&E attendances or outpatient attendances, etc.

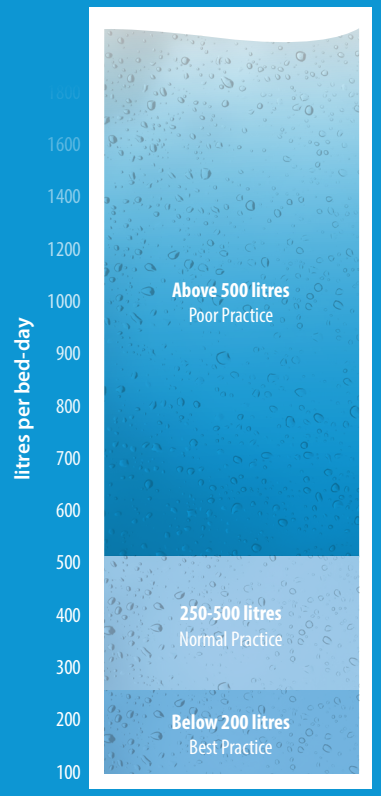
Regardless of how a hospital determines its internal benchmark, it is important to remember that there will always be variability. Therefore, as long as a consistent method is used it can effectively track and monitor water use.

Best practice benchmarks for water usage in Irish hospitals (litres per Patient Bed-day)*

Acute -
Water per patient bed-day (litres)



Community Health Hospital -
Water per patient bed-day (litres)



* These bands were determined based on statistical analysis of water use data for 30 Acute and 70 Community Health Hospitals.

3.2 Best practice flow rates

The water used by fixtures and fittings in Irish hospitals varies considerably. The pressure of water supplied, the types of taps or shower heads used, the frequency of use – all of these will impact on the overall quantity of water consumed, and to the annual cost of water to the hospital.

While taps, showers and toilets are used more frequently in the healthcare sector than in most other businesses, it is difficult to accurately determine how much water is used by any individual tap or toilet. Without this information it is therefore difficult to quantify the potential savings associated with upgrades.

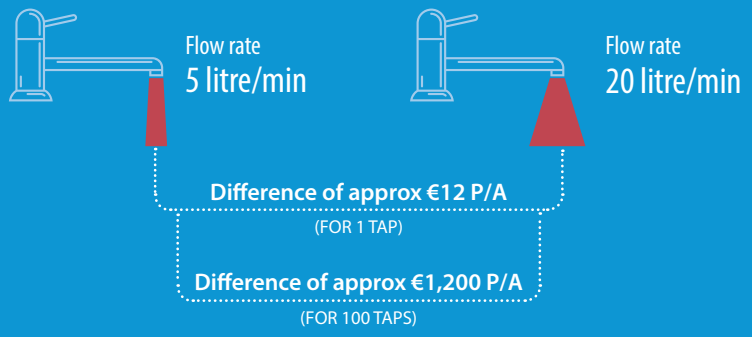
For example, in one Irish hospital where water use in toilets was being measured by a sub-meter, it was assumed that the toilet in a 6-person ward was flushed 12–15 times a day. When actually measured it was found that it was flushed over 35 times daily. Such information makes it possible to quantify savings but gathering such information is a difficult task.

Best practice values for the main fixtures and fittings are presented here. By comparing these to the flow rates or volumes noted in the fixtures and fittings survey (see pg.13) it is possible for a hospital to identify where improvements are needed.

The cost benefit

The diagram below shows the cost difference between 2 hot water taps that are flushed once a week, for 3 minutes, as part of a legionella prevention flushing schedule. For more on legionella flushing, refer to the Health Protection Surveillance Centre Guidelines for the Prevention and Control of Infection from Water Systems in Healthcare Facilities (2015).

The cost difference annually between a 5 litre/min and 20 litre/min hot water tap is approx €12. Scaled up for 100 taps this is almost €1,200 a year.



Taps

Tap flow rates can vary significantly, even within the same area of a hospital. In a recent hospital survey, flow rates were found to vary between 4 litre/min to over 50 litres/min! While certain areas may need higher flow rates (e.g. sluice rooms or pot washing sinks in kitchens) most taps in hospitals should be less than 10 litres/min. New low-flow taps use as little as 2 litres/min though most high efficiency taps use about 4 litres/min.

Tap controls, like timed push taps and sensors, can save water. There are also hygiene benefits. Such taps do need to be set up carefully and subsequently maintained (an example of a sensor tap that turned on every time a person entered the bathroom was observed in one hospital).

Washrooms & public toilets
Public restrooms and basins where hand washing only occurs

Best practice flow rate: 2 - 4 litres per minute

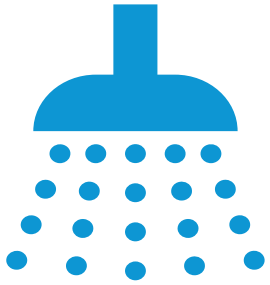
Toilets
In hospital wards and other areas where more than just hand washing may occur

Best practice flow rate: 4 - 6 litres per minute

Kitchens & canteens
Higher flow rates are recommended for kitchen taps where filling of containers is more frequent

Best practice flow rate: 6 - 8 litres per minute

NOTE: Before replacing any water using fixtures, it is imperative that all changes conform to the standards and regulations set out in the Guidelines for the Prevention and Control of Infection from Water Systems in Healthcare Facilities as prepared by the HSE and HSPC.



Showers

Most showers in Irish hospitals now use mixer systems (TMVs - Thermostatic Mixing Valves). Aside from the safety benefits, these allow for quick adjustment of the water temperature and also save on water used. However, when it comes to showers, the vagaries of personal preference will often dictate how much water is used. Therefore, in reality, it is very difficult to estimate how much water is used by showers, even if you do know the flow rate

Flow rates in showers are usually in excess of 12-15 litre/min but best practice volumes are ideally less than 8 litre/min.

The temperature range of water typically used in showers is about 40 – 45°C so careful consideration must be given to preventing risk from legionella. This is often managed by weekly flushing and, due to the costs associated with hot water, proper shower management along with optimal flow rates will save on water and heating bills.

Healthcare shower facilities

There are low flow shower heads specifically designed for the healthcare sector. These are designed for ease of sterilisation and some shower heads have inserts that can be changed instead of sterilising the complete head.

Best practice flow rate: 6-8 litres per minute

Toilets

Similar to other fittings, it is difficult to know how much the typical toilet is used in a hospital setting, either in a ward or public toilet. Minimising the water used for toilet flushing will reduce water costs. However, if considering changing toilets it is important to note that in older sites the wastewater pipework may not be compatible with reduced flow rates and this can lead to blockages.

Older, single flush toilets

Many older cisterns have volumes in excess of 12 litres and while this can be reduced by displacement (e.g. hippo bag) or adjusting the ballcock, it is best not to go below 9 litres as this can impact the ability of the toilet to flush properly.

Best practice flow rate: 9 litres per flush

Single Flush Toilets

Modern single flush toilets are designed to flush with volumes of 6 litres or less per flush.

Best practice flow rate: 6 litres

Dual flush

The volume of the cistern, the design of the toilet and the ratio of full to small flush are all variables that need considering when determining which dual toilet is best for you.

Best practice flow rate: 4.5 litres (Full)

Best practice flow rate: 2.5 litres (Half)

Urinals

Urinal flushing, if not controlled, can be a significant waste of water as it leads to an unnecessary constant flow of water. If you have such a continuous system in your urinals it should be replaced with a sensor or manual flushing system.

Waterless urinals are now available and have become much more commonly used in public bathrooms. These urinals require no flushing and a simple trap, usually filled with oil, will block any odours coming back up through the pipework. There are specific cleaning materials for these systems and some training is required prior to installation.

Uncontrolled continuous systems

These are the most inefficient urinal systems and should be replaced with some form of controlled system. An uncontrolled 9 litre cistern flushing three times an hour will use approx 236 m^3 a year. This will cost approx €600 annually.

Best practice flow rate: < 7.5 litres per hour, per bowl

Controlled Systems

The best controlled systems employ individually sensored flushes that use 1 litre per flush. These systems, if not used for a certain period of time, will periodically flush to minimise odours. For the same reason they also flush once or twice a night.

Best practice flow rate: 1 litres per flush

3.3 Water pressure

While some hospitals may suffer from low supply pressure, it is more common that the supply pressure is higher than needed. Hot water is usually supplied by a pumped system with cold water typically gravity fed from a storage tank in the roof, or pumped from a ground level storage tank. Regardless of how water is supplied, water pressure should be assessed on different floors and in different locations.

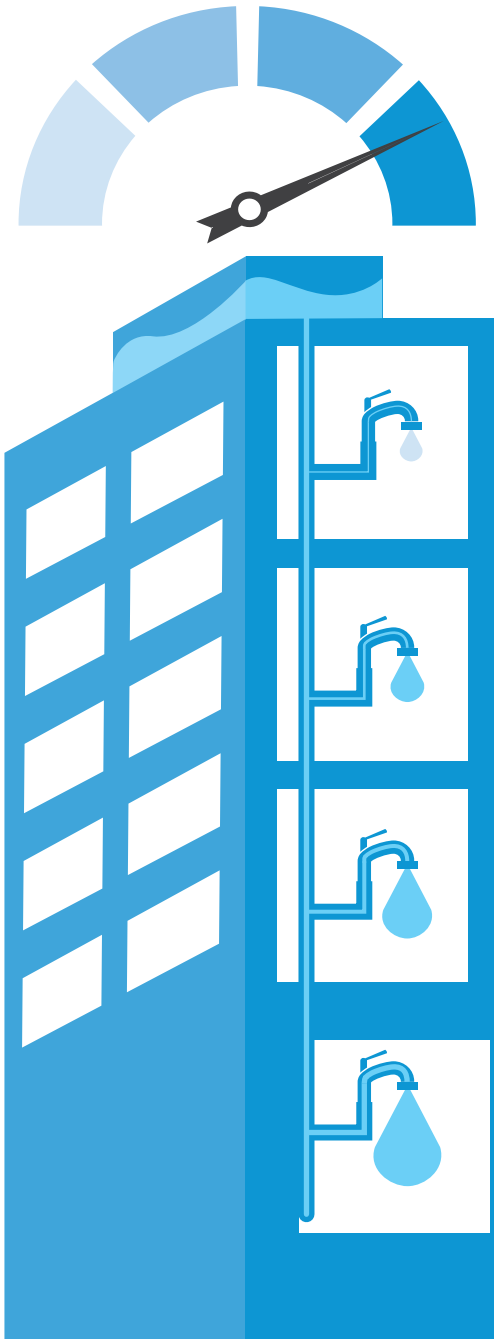
The best way to measure pressure accurately is with an in-line pressure gauge. These can be attached to threaded taps (if there are any) or else will need to be fitted by a plumber at appropriate locations. If a water survey is being conducted on the main fixtures and fittings then a water pressure assessment should also be carried out.

Where water pressure is found to be excessive there are a number of potential solutions. Locally, if there are isolation valves then they can be adjusted to reduce the flow. However, while isolation valves are an essential part of any water distribution network, using them to control pressure overlooks the real issue which is excessive water pressure. Therefore, isolation valves should not be used as a long term solution for pressure control.

The best method of controlling pressure locally is with Pressure Reducing Valves (PRVs). These valves control pressure to a chosen value and can be used for areas, individual floors or whole buildings.

Remember, the aim of any pressure management plan for your hospital is to ensure that the supply pressure throughout the site is as consistent as possible.

High water pressure can lead to excessive water consumption at points of use (e.g. taps and showers) and increased loss through any leaks that exist on site.



3.4 Water network drawings

All hospitals should have detailed schematic (record) drawings of the water distribution network within their site. However, many are old and whether the drawings are accurate or not is very difficult to assess. Accurate drawings are hugely important from a water management perspective as they help with repair work, upgrades, isolation, maintenance, legionella control: and, of course, water efficiency initiatives.

Formal policy

Typically, the building layout plans and associated water distribution drawings that have been produced during the initial planning phase of a new build will change during the building phase of a project. Where this is the case, then the water distribution drawings should be updated accurately during the construction process and checked before finalising. While this does sometime occur, few projects teams have a formal checking process in place where changes are monitored and constantly updated. Consequently, the final record drawings on file often do not accurately reflect what is above ceilings, under sinks and, of course, below ground.

In addition to new builds, or significant refurbishment projects, this policy should extend to any works that take place on site, for example, installing isolation valves, changing sections of piping, or just replacing fittings. Where works occur the on-file record drawings should always be cross-referenced. If changes are made during the works, these should be reflected in an up-to-date version. More importantly, if the drawings are found to be inaccurate then they should be updated accordingly.

Through having a formal process of checking and updating the site water distribution drawings, an accurate map will be developed and maintained and this will help the long-term management of water in the hospital.

3.5 Other large consumers

a. Reverse osmosis (RO)

Reverse Osmosis is an essential part of the day-to-day operation of modern Acute Hospitals. RO units provide ultra pure water for a variety of services – sterilisers for endoscopes, as well as sterilisers for theatre instruments and dialysis.

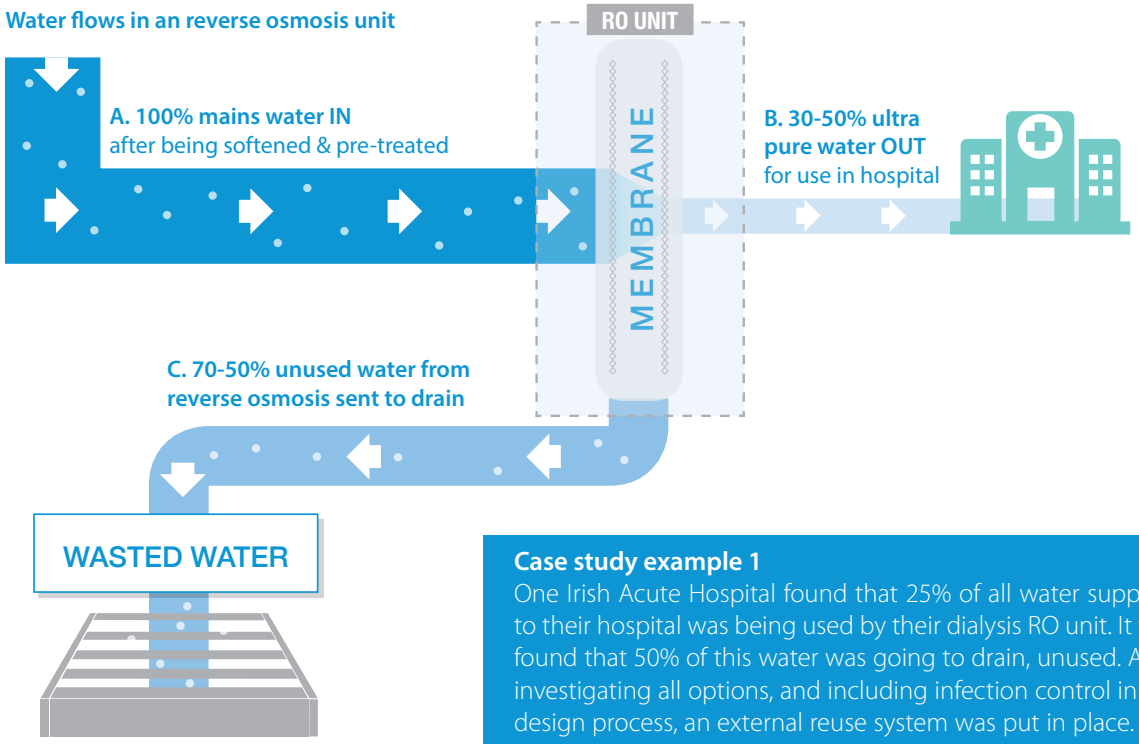
However, usually only 30-50% of the water that goes into an RO unit becomes ultra pure water with the remaining (70-50%) unused and discharged to drain. As RO services can account for a significant portion of the water used in Acute hospitals (thought to be as much as 25% in some Irish Acute hospitals) the unused water may represent a significant and valuable, yet wasted resource - particularly since it is of good quality.

In order to reduce the costs associated with wasted water from RO units, and depending on the type of RO in a hospital, there are 2 main options to consider:

- **Reduce** the volume of water discharged through fitting a high efficiency recycling kit. These kits are usually product specific, relatively inexpensive and can halve the quantity of RO wasted . It is important to note that they can change the quality of pure water coming out of the RO (though only by small amounts).

- **Reuse** the discharged water for other services within the hospital. This option, especially for larger RO plants (e.g. dialysis) can take some time to organise in terms of initial assessment and subsequent civil works, but the savings can be significant.

For more information on reducing water losses from dialysis plants see the Green Healthcare "RO How to Guide" available at: *greenhealthcare.ie*



Case study example 1

One Irish Acute Hospital found that 25% of all water supplied to their hospital was being used by their dialysis RO unit. It was found that 50% of this water was going to drain, unused. After investigating all options, and including infection control in the design process, an external reuse system was put in place. The water is now used in their dedicated sluice system.

Annual savings approx €12,000 saved per annum

Case study example 2

The CSSD unit in one Irish hospital was fitted with a machine specific internal recycling kit. This halved the incoming water consumption from 1000 litres/hour to 500 litres/hour. While the water conductivity increased from 9µS/cm to 11µS/cm this was still comfortably within the specified limit of 20µS/cm.

Annual savings approx €2,400 saved per annum

Note: The extent of the success of such kits is dependent upon many factors including raw water quality, hours of use, etc.

b. Kitchens

Water consumption in a canteen or kitchen can be substantial. Activities such as food preparation and cooking, as well as dish washing and cleaning can use substantial amounts of water. If the canteen or kitchen is sub-metered it is easy to find out how much water is used specifically in this area. Otherwise a survey of the flow rates and/or volumes used by the main fixtures and fittings, along with estimated hours of use, can be used to provide an approximation.

Choice of equipment

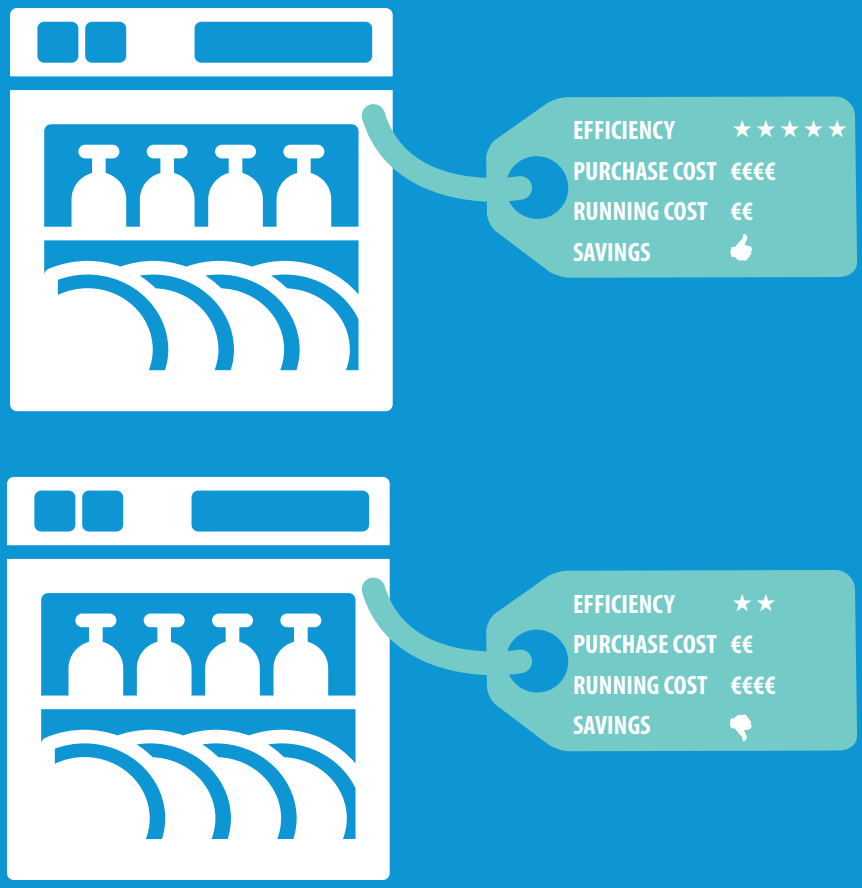
While higher flow rates may be required in taps used to fill containers (e.g. potwash), flow rates can be reduced on taps for hand washing and fruit and veg washing (see taps section - pg.16, for recommended flow rates). However, the largest users of water in big kitchens will be dishwashers. Dishwashers are expensive to run in terms of electricity, water and detergents. Modern dishwashers address this through a combination of measures:

- Using hot water from the hot water distribution system. These are usually gas or oil fired and are much more efficient than heating cold water electrically to over 90°C.

- Reusing the final rinse water for the pre-rinse phase. The final rinse water is hot and almost clean. By using this to pre-rinse the next batch, energy and water costs are minimised.

When upgrading kitchen equipment, especially those that use hot water, always consider the life-cycle costs rather than just the up-front cost. These involve all the costs of operation used over the lifetime of a machine including, for example, water, electricity and detergents.

When upgrading kitchen equipment, especially those that use hot water, always consider the life cycle costs rather than just the up-front cost. This means the total cost in water and energy that it will use over its lifetime.



3.6 Water efficiency programme

For most people working in hospitals, the only time water may become an issue is if it doesn't come out of a tap. While the people in the maintenance department (Building and Estates) do their best to ensure this is the case, leaks, pipe breakages, boiler issues, etc. can occur at any time and without warning.

Therefore, in order to have as effective and efficient a water service as possible, hospitals should put in place a water management programme. This has 2 goals: firstly, to provide a plan to ensure that the hospital continually improves the provision of water services in the most economic and efficient manner; and secondly, to ensure that the maintenance department has the appropriate support from all other people working in the hospital.

The following are some recommended aspects of a hospital water management programme:

1. Set up a water efficiency team: as with any good management initiative a multidisciplinary team is essential. This allows all different groups within a hospital to be involved and, if the correct people are included (finance, management, nurses, doctors, hygiene, maintenance, etc.) it will ensure all staff are on the same page. The team should meet on a regular basis and try to follow an annual continual improvement model of: plan, do, check, act.

2. Report leaks: maintenance staff cannot be everywhere so, the reporting of leaks or water issues by staff will ensure these can be identified quickly. However, it is imperative that when leaks are reported by staff (or the public) they are repaired or addressed straight away. This will build the credibility of the water management programme as well as that of the maintenance department.

3. Communicate: In order to raise the awareness of all staff it is important to communicate directly with them about issues such as water costs, on-going water initiatives, successful projects, leak repairs, benchmark values and future plans.

4. Ask for ideas: the people who work and use services on a daily basis often have a very different perspective on issues and problems. Including all staff in the improvement of water services by asking for water efficiency ideas is a great way to identify on-going issues.

The following checklist of action items provides a summary of the main topics addressed in this booklet. It can be used as a basis for developing a hospital water management programme.

Water efficiency action checklist

☑ Do you **monitor** your water use on a regular basis? (minimum of monthly)

Start by examining your bills. If these are only issued quarterly then read your meter manually at least monthly.

☑ Do you present water use data in a **graphical format?**

If gathering manual readings, or water consumption data (m^3) from your bills, set up a spreadsheet that automatically graphs water use data as it is inputted.

☑ Have you calculated your **water use benchmark** and compared it with other similar hospitals (Acute or Community Health Hospitals)?

Calculate your benchmark by comparing your total annual water use with the number of patient bed-days provided by your hospital.

☑ Have you checked your site for **leaks?**

Even if your level of water use is consistent, or your benchmark compares favourably with others, there may still be undetected leaks in your hospital.

Have you used an **online data logger** to check your daily water use profile?

Online loggers can be fitted permanently or for a short period and provide a profile of when, and how much, water is used. This can help identify background water use (leaks) or unexplained high use trends.

Have you installed **sub-meters** in appropriate locations on your site?

While the data from your mains meter will give information on the total water used by your hospital, sub-meters help track the main buildings/areas within the site.

Has a survey of the main **fixtures and fittings** been carried out?

These surveys will help identify any fixtures, fittings, buildings or areas where unusually high volumes of water are used. Sometimes certain taps will have high flow rates, in other cases specific floors may have consistently high flows.

Have you compared your hospital with the national **best practice benchmarks** or generated specific internal indicators?

By comparing with best practice benchmarks, or continually comparing specific internal indicators, you can set improvement targets for your hospital while also ensuring high efficiency standards are maintained.

Have you assessed your main fixtures and fittings relative to **best practice flow rates?**

There are established best practice flow rate for the main fixtures and fittings used in hospitals (taps, showers, toilets and urinals). If yours are higher than these then you are using, and paying for, more water than you need.

Have you examined the **supply pressure** of water throughout your hospital?

A consistent supply pressure throughout your hospital ensures a consistent level of service and also ensures that water use by fixtures and fittings is relatively consistent. In-line flow restrictors are an effective way to reduce high pressure supply areas.

If you have **reverse osmosis** on site have you checked it for internal recycling or external reuse (usually from dialysis only) of discharged water?

RO is a very important part of modern hospitals but RO units can waste significant volumes of good quality water. Depending on the type used there are internal and external reuse options that will reduce overall water use without impacting on the quality of ultra pure water supplied.

Are there any other **large consumers** that should be examined in your hospital?

Every hospital is different so you may have other areas where large volumes of water are used (e.g. kitchens, ambulance washing, fire hydrant flushing). It is important to firstly identify these and, once quantified, identify ways to reduce the water volumes used.

Whenever any changes are being considered make sure to consult and involve your maintenance department and plumbers beforehand.

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