Julie's Bicycle
SUSTAINING CREATIVITY

Julie's Bicycle Practical Guide:

Water Management for Buildings

Supported using public funding by
ARTS COUNCIL ENGLAND

Water Management for Buildings Version 2016

Who This Guide Is For

This guide is aimed at anyone involved in the operation of a building, including managers, maintenance staff, facilities and operations teams.

What This Guide Does and Doesn't Do

This guide focuses on water management in the context of environmental sustainability and is not intended to be a comprehensive overview of water provision, infrastructure, and wastewater in general.

This guide will help those working in a building to:

- Understand where water is used and the relationship between "fresh" water use and wastewater generation (sewerage).
- Measure whole site water use and zonal or local appliance water use.
- Compare their water use to industry benchmarks.
- Develop a plan which prioritises actions to reduce use and costs.
- Monitor and review progress.

Further artform-specific information, case studies, and support can be found on the Julie's Bicycle website. www.juliesbicycle.com

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Creating the Conditions for Change

There are four key stages to taking action on environmental sustainability:

- Commit: put in place the structures, resources, policies and responsibilities necessary to support and action your initiatives.
- Understand: understand your impacts and establish systems to measure and monitor them continually.
- Improve: implement an action plan to reduce your environmental impact.
- Communicate: involve your team, suppliers and audiences; share and exchange knowledge with others.

Your key ingredients are knowledge, skills, time, and enthusiastic people.

Your success at integrating environmental sustainability into your workplace is often dependant on the internal culture of your organisation and the resources available to you.

Without buy-in from colleagues you will at best limit, and at worst fail, to achieve your goals. It's important that the whole organisation is involved in the process – this is an opportunity to test new ideas, build support and use existing experience.

And finally, some dedicated, even if modest, budget is also helpful!

Contents

Julie's Bicycle
SUSTAINING CREATIVITY

Introduction

Access to clean drinking water is a big problem in many global areas and the situation is expected to become worse as populations grow, especially in urban areas. Globally there is plenty of fresh water for the current world population; the problem is that fresh water supplies are often far removed from the population centres where they are required.

The UK isn't immune – areas such as the South East of England often experience drought conditions, whilst substantial water reserves exist in other regions of the UK. Moving water from one area to another is difficult and expensive and, whilst the UK has an electricity and gas grid covering a large part of the country, it does not have a UK-wide water grid. As such, it's increasingly common for certain areas of the UK to experience water shortages while others enjoy a plentiful supply.

Water is the ultimate "circular resource". It is not created for us nor do we "use it up". More often than not we simply "borrow" water and use it to carry other substances for us, whether these are nutrients around our bodies, heat around our buildings or waste from our toilets.

Water is an essential part of the planet's ecosystem. We rely on that ecosystem to process wastewater for us, and the ecosystem relies on us to not pollute water. So we also need to be aware of the waste stream from our buildings both in terms of wastewater (sewerage) but also "surface runoff" from rainfall on our buildings.

Water efficiency makes good business sense because:

- It is perhaps the planet's single most precious resource and without it, life as we know it could not exist.
- Controlling the amount of water you use will help to reduce your carbon emissions, especially if you can reduce the amount of hot water you use.
- Water is often a high and unseen cost to our businesses.
- Water is the ultimate circular resource: it needs to be treasured, used wisely and passed on as unpolluted as possible.

"Demand for freshwater is growing. Unless the balance between demand and finite supplies is restored, the world will face an increasingly severe global water deficit."

"Increasing resource use efficiency, reducing waste and pollution, influencing consumption patterns and choosing appropriate technologies are the main challenges facing Europe and North America".

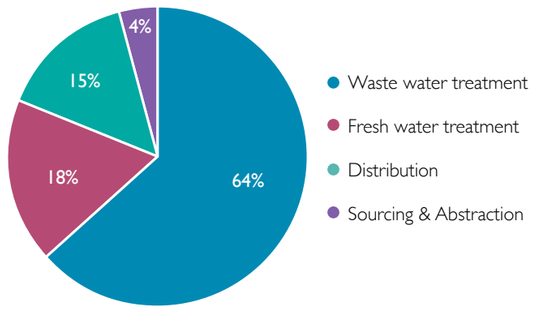
The United Nations World Water Development Report 2015 "Water for a Sustainable World"

Water and Carbon Emissions

Water's role in the creation of carbon emissions is a subtle one. In general terms, cold water will arrive at your building having created relatively low carbon emissions compared to electricity, for example. Emissions are largely generated as a result of the treatment of natural water stocks held in reservoirs and aquifers, and the treatment of wastewater which is mixed with natural water stock. When you heat water emissions can rise dramatically, depending on how it's done.

The emissions from heated water can be seven times the emissions of cold water.[1] In a typical domestic setting, only 11% of the carbon emissions related to water use come from providing the home with clean water; the other 89% is attributable to what happens during and after its use.

Emissions from water supply to the building



.Types of water

Types of water	Definition	Uses
Potable water	Drinking water.	For drinking and food preparation.
Blue water	Natural "fresh-water", found in rivers, streams, underground aquifers, not suitable for drinking.	Washing, showering and other "human contact" activities. Not suitable for drinking.
Grey water	Water that has been used for washing or showering, and that doesn't have any organic contamination.	Can be recycled for toilet flushing (once it's been filtered) or other "non-human-contact" activities, or for land irrigation.
Brown/black water	Effluent/sewage/dirty waste water.	None. This will flow into the mains sewer system, or standalone sewage systems e.g. septic tank.
Rainwater and surface run off	Rain water or run off from outdoor activities, e.g. vehicle washing, land irrigation	Rainwater can be "harvested" and held onsite for similar uses as grey water. Contamination of surface water (pollution) must be avoided as this can cause harm "downstream".

1. AECB Water Standards, Delivering buildings with excellent water and energy performance, Vol 1,

Water arriving at the majority of UK buildings will be supplied by a water company as "fit for human consumption", meaning it is safe for drinking and for food preparation. This is known as "potable" water.

Within commercial buildings, as with many residential properties, some outlets (taps) will be connected directly to the mains supply and others will be connected to a high level storage tank, which itself is connected to the mains supply. Water for drinking and food preparation is often supplied from such a storage tank, especially in more modern buildings. These tanks require careful management regimes to ensure no contamination occurs.

Potable water is generally used throughout buildings, with only a very small proportion actually being used for drinking or food preparation. As much as 30% of a typical household's water use can be for the flushing of toilets.[2]

After potable water is used, it becomes either grey water or black water. Grey water is that which has been used for washing, showering etc. Black water has been used for toilet flushing and contains human waste. Water leaving a building as black or grey will usually enter a public sewer.

Historically, rainwater falling on a building's roof and surrounding hard landscaping also enters the public sewer. This "surface run-off" can, in high volumes, cause flash floods as a result of sewers filling too quickly. To prevent flash floods, modern buildings are often designed to divert rainwater into temporary "attenuation" devices, such as underground tanks, surface ponds, or other Sustainable Urban Drainage Systems (SUDS), which all allow a slower release of water into the sewer or ground.

It is becoming increasingly common for grey water and/or rainwater to be collected (harvested), and used for non-potable uses, such as toilet flushing.

Liverpool Everyman

Water efficiency was a consideration in the Everyman's 2015 award-winning capital redevelopment project. Rainwater is now collected from the roof, filtered and used to flush toilets, reducing mains water consumption for flushing by up to 45 per cent per year. Aerated taps, dual flush toilets, leak detection and occupancy triggered shut-off valves also help to conserve water.

Read the full case study here.

However a 2010 study by the Environment Agency concluded that, "buildings using harvested rainwater or treated grey water typically increase greenhouse gas emissions compared to using mains water"[3].

The study calculated the emissions from the manufacture and installation of a typical underground tank, and added the emissions from the electricity required to pump water from the tank to the point of use for the tank's life span (30 years). The result was compared to the emissions from the same quantity of mains fed cold water.

Despite these findings harvested water may still be worth considering if you need to use large volumes of non-potable water for toilet flushing, land irrigation or vehicle washing, for example, which would otherwise come from the mains at a higher financial cost.

2. http://www.waterwise.org.uk/pages/water-saving-advice-and-tips.html#Toilets

3. Energy and carbon implications of rainwater harvesting and grey water recycling, Environment Agency – August 2010

Cost of water

Water use can be surprisingly costly, especially if your building has areas of high use like a commercial catering facility, which may use a large amount of cold water for food preparation and hot water for dishwashing.

Your water company will charge you for the amount of mains water you use based on the readings from a meter, plus a standing charge[4] . Your meter readings and the "rateable value" (RV)[5] may also be used to calculate your sewerage charges. So, by reducing your water usage you will also save on your sewerage charge.

Sewerage charges often include contributions for road drainage and may make assumptions of the type of surface drainage your building has. If you can demonstrate that some of your surface drainage does not enter the public sewer, you may be able to reduce these charges.

If you do not have a water meter your charges for both water and sewerage will be based on the property's rateable value. This does not accurately reflect your water use, so having a water meter fitted is the first step to managing your water use.

Always check water bills against your own meter readings to make sure they are accurate and prevent the accumulation of errors over time due to estimated readings.

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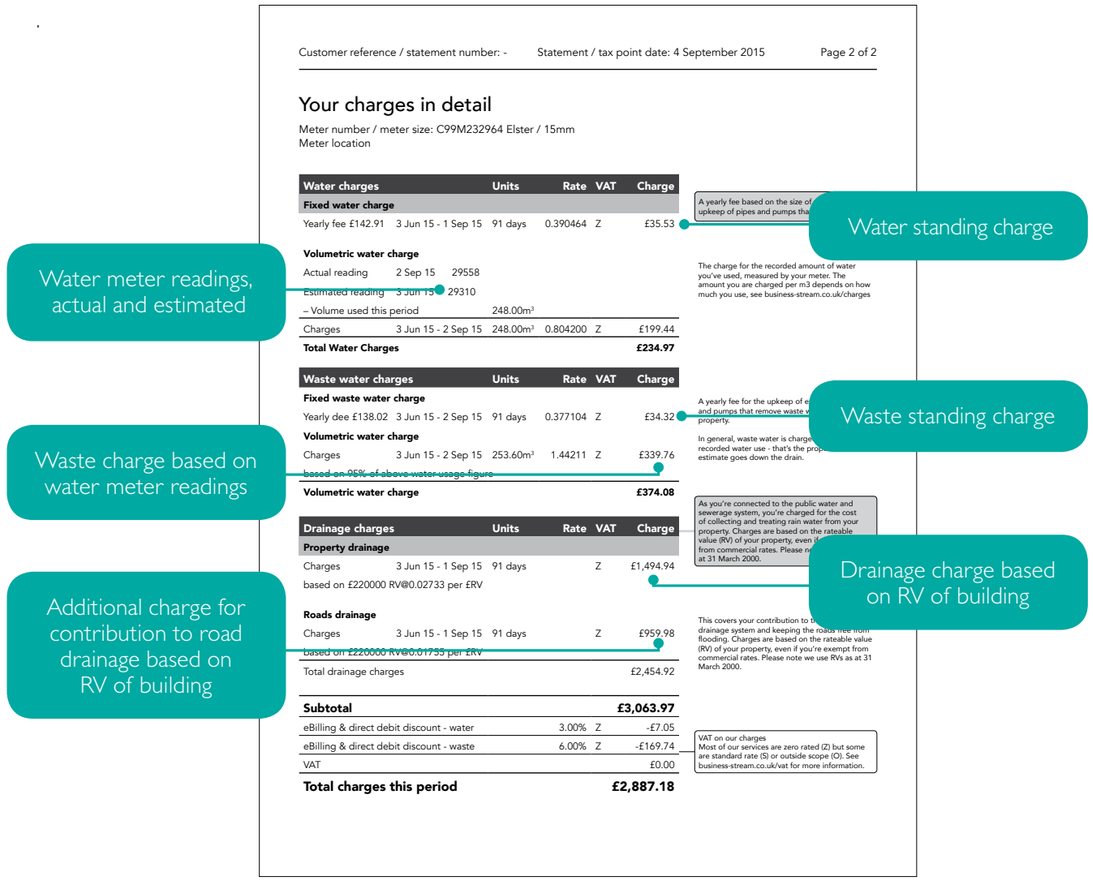

Customer reference / statement number: - Statement / tax point date: 4 September 2015 Page 2 of 2

Your charges in detail

Meter number / meter size: C99M232964 Elster / 15mm
Meter location

Water charges		Units	Rate	VAT	Charge
Fixed water charge					
Yearly fee £142.91	3 Jun 15 - 1 Sep 15	91 days	0.390464	Z	£35.53
Volumetric water charge					
Actual reading	2 Sep 15	29558			
Estimated reading	3 Jun 15	29310			
– Volume used this period		248.00m³			
Charges	3 Jun 15 - 2 Sep 15	248.00m³	0.804200	Z	£199.44
Total Water Charges					**£234.97**

Waste water charges		Units	Rate	VAT	Charge
Fixed waste water charge					
Yearly dee £138.02	3 Jun 15 - 2 Sep 15	91 days	0.377104	Z	£34.32
Volumetric water charge					
Charges	3 Jun 15 - 2 Sep 15	253.60m³	1.44211	Z	£339.76
based on 95% of above water usage figure					
Volumetric water charge					**£374.08**

Drainage charges		Units	Rate	VAT	Charge
Property drainage					
Charges	3 Jun 15 - 1 Sep 15	91 days		Z	£1,494.94
based on £220000 RV@0.02733 per £RV					
Roads drainage					
Charges	3 Jun 15 - 1 Sep 15	91 days		Z	£959.98
based on £220000 RV@0.01755 per £RV					
Total drainage charges					£2,454.92

Subtotal			**£3,063.97**
eBilling & direct debit discount - water	3.00%	Z	-£7.05
eBilling & direct debit discount - waste	6.00%	Z	-£169.74
VAT			£0.00
Total charges this period			**£2,887.18**

A yearly fee based on the size of ... upkeep of pipes and pumps tha...

The charge for the recorded amount of water you've used, measured by your meter. The amount you are charged per m3 depends on how much you use, see business-stream.co.uk/charges

A yearly fee for the upkeep of e... and pumps that remove waste ... property.

In general, waste water is charge... recorded water use - that's the prop... estimate goes down the drain.

As you're connected to the public water and sewerage system, you're charged for the cost of collecting and treating rain water from your property. Charges are based on the rateable value (RV) of your property, even if ... from commercial rates. Please n... at 31 March 2000.

This covers your contribution to t... drainage system and keeping the roads free from flooding. Charges are based on the rateable value (RV) of your property, even if you're exempt from commercial rates. Please note we use RVs as at 31 March 2000.

VAT on our charges
Most of our services are zero rated (Z) but some are standard rate (S) or outside scope (O). See business-stream.co.uk/vat for more information.

4. Bills will be based on cubic meters used - 1000 litres = 1 cubic metre.
5. Rateable value (RV) is the annual rent the property could be let for on the open market.

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Waste and Pollution

The way you choose to operate your building will have a wider impact both "upstream" in terms of the volume of water you remove from the system, and "downstream" in terms of the volume and quality of waste water (sewerage) you put back into the system. The way you manage water use may also have a bearing on your other environmental initiatives.

Pollutants

Care must also be taken to not add pollution to wastewater or surface run-off, as this will create additional problems downstream. Potential pollutants such as paints, solvents and oils should be disposed of through the appropriate waste management systems, and never "flushed" away.

Royal Central School of Speech and Drama

Solvents are disposed of safely in the paint workshop using a Bristol Water Aqua Service Unit for washing painting equipment. The unit separates the toxic paint residue for responsible disposal and filters and reuses the water used for washing.

The school has also researched paints with low VOCs (volatile organic compounds; toxic components) to further reduce the toxicity of the waste generated by their production activities.

Kitchen staff should never flush oils, fats and dairy products down the sink, as these will congeal and in time block pipes. Dairy products are also extremely nutrient rich and will encourage bacterial growth with resultant smells. On a commercial scale, pouring dairy products down the drain is actually a criminal offense. Small amounts of oil and fats can be disposed of with your general waste, large amounts of oil may be able to be recycled or used in the manufacturing of bio-diesel. If in doubt contact your local authority for advice on local schemes.

Wastewater

Almost two-thirds of the emissions resulting from the supply of water to your building are attributable to cleaning the wastewater sent into the sewer system before it can be returned for re-use. If you can reduce the amount of pollutants entering the sewer, less treatment will be required.

Reducing the volume of water entering the sewer and amount of pollution it contains will reduce the number of overflows and the harm done to natural ecosystems as a result. If a sewer is inundated and overflows, the excess waste will be discharged into a natural watercourse or in coastal areas, directly into the sea. Thames water reports that discharges into the Thames occur up to 60 times a year on average resulting in 39 million tonnes of sewage pouring into the river in a typical year[6].

The Complexity of Conflicting Priorities

Sometimes water conservation solutions seem to conflict with other competing environmental priorities. Some of the common conundrums building managers face include:

- You choose water-based paints instead of solvent-based products for sound ecological reasons, but in doing so, you might increase your water use.
- You choose to offer paper towels in washrooms instead of hot air hand dryers, creating waste, but saving on electricity; or you provide cloth towels, and save electricity and waste, but increase water use in laundering of the towels.
- You provide plastic cups instead of glasses for drinks taken into the auditorium, increasing your solid waste stream, but saving water from washing glasses.
- You provide a drinking water fountain rather than selling bottled water. This will reduce emissions associated with bottled water but increase your water use.
- You incorporate rainwater harvesting as part of a building development, saving on mains water use, but potentially increasing carbon emissions in the long term.

There are no right and wrong answers to these conundrums. What is more important is that you make a decision based on your own circumstances, an understanding of how and what resources you are using, and your wider environmental strategy, focussing on reducing energy and the use of all finite resources both "upstream", within, and "downstream" of your business.

6. http://www.thameswater.co.uk/about-us/10115.htm.

Lyric Hammersmith: Water Bottles for Everyone

The Lyric Hammersmith noticed that plastic water bottles were a large part of their waste, cluttering rehearsal rooms and offices. Making a plastic water bottle also uses approximately seven litres of water, so using reusable bottles avoids both waste and water usage. In their commitment to save waste and water, they created Lyric Water Bottles. They banned disposable plastic in the theatre and bulk bought boxes of Lyric Hammersmith branded reusable plastic water bottles. Every team member, freelancer or artist that comes into the building gets a Lyric bottle and the ban on plastic bottles clause is written into their contracts. It's a really effective way of reducing waste and spreading the identity of the theatre!

Managing Water and Wastewater

Step 1: Measuring Total Water Use

The first step to managing your water use is to measure the total amount of water used in your building.

Types of Water Meter

Most non-domestic buildings will have a water meter, usually situated just beyond the building boundary in the pavement or sometimes within the building in a plant-room. It is not uncommon for buildings that have been redeveloped to have more than one meter.

Your meter will either record the water used on a series of numeric dials or a digital display, or send automatic readings of usage every half hour directly to the water supplier via the mobile phone network. These are referred to as "smart" or "pulse" meters.

Best practice is for building zones with high water use to be fitted with separate "sub-meters". This can be especially important if you have a catering operation provided by a third party, as the operation may be responsible for a large proportion of the total water use for the building. Much of the water used in facilities like these will also be heated, adding to CO_2 emissions and energy use. Having a sub-meter fitted allows you to quantify and charge the water costs to the café operator, which may incentivise reduced water use, emissions and costs.

Manual Meters

A nominated person should take a note of your meter readings at frequent intervals to learn when your water peak usage occurs and to check your actual use against your billed use.

- Take weekly readings on the same day and the same time each week to understand patterns of use.
- Take a number of readings before and after particular events (performances) to understand their impact.
- Take a shut-down reading as the building is being locked up for the night and another when the building is opened the following day to determine if water is being used out of hours without your knowledge. This may indicate toilets or urinals flushing out of hours, equipment being left on, dripping taps or unseen leaks, all of which can be addressed.

Did you know?

A broken tap running with a constant 3mm flow can cost an organisation around £700 pounds a year in water and sewerage charges.

Smart Meters

If you have a "smart meter" (a pulse meter which takes half hourly readings automatically) you should:

- Make sure your water provider sends you the readings or makes them available online.
- Look for usage when the building is closed as this may indicate a leak or automatic usage of which you are unaware.
- Check readings closely through the day as you may find peaks of use, which you can then investigate in more detail.
- Produce graphs which illustrate patterns of use, and notate the graphs with known activity such as a performance interval.

Monitoring Tools

Whatever type of meter you have, there are a variety of tools available that can – over and above the humble spreadsheet – help you to analyse and translate your data into action.

Creative IG Tools

Designed by and for the creative industries, the Creative IG Tools help you to create an annual snapshot of your water use and associated carbon emissions to compare progress year on year, and measure performance against industry benchmarks.

Did you know?

Data gathered by IG Tools over the last 3 years shows that while average annual savings on energy use of 5% have been achieved across the arts and culture, the water use of approximately 400 organisations has remained stable at around 800 million litres each year. This suggests that water has not been a priority as it doesn't have as significant an impact on CO_2 emissions as energy use.

Cloud-based Software Tools

There are many online apps and software solutions that help you track and analyse water data. These either take manual meter readings or connect with your smart meter to generate reports and intelligence using half-hourly meter readings. While these often cost, the time saved and the rapid analysis can often lead to quicker, better water management and efficiency savings.

Tyne & Wear Archives & Museums

TWAM has been working with Demeter to install water monitoring across the Discovery Museum to identify leakages and improve water use management. Demeter's online monitoring system tracks water consumption and identifies trends in water use, areas of excessive use and associated costs in real time. This feedback helps prioritize action and allows for rapid responses to any leaks, system inefficiencies or instances of over-use.

Benchmarks

The Julie's Bicycle Benchmarks relate water use to floor area, making it possible for organisations to compare their performance with industry averages no matter what their size or scale. The Creative IG Tools automatically compare users' water use against these benchmarks. All building-related benchmarks are based on a "per m^2, per year" metric[7].

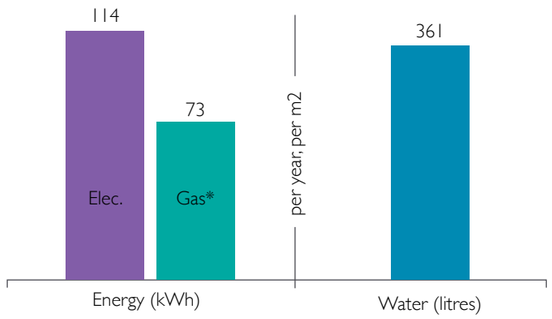
Offices are the least water intensive, followed by museums and galleries, and performing arts buildings are the most water intensive. Offices tend to have limited operating hours compared to cultural buildings, and performing arts buildings have the longest average opening hours.

7. Floor area is defined as gross internal floor area, i.e. all spaces and floors within a building. Only balconies are excluded.

Offices

Data from 196 offices, occupied by creative businesses during 2012/13 and 2013/14, contributed to this benchmark.

Office Benchmark 2015



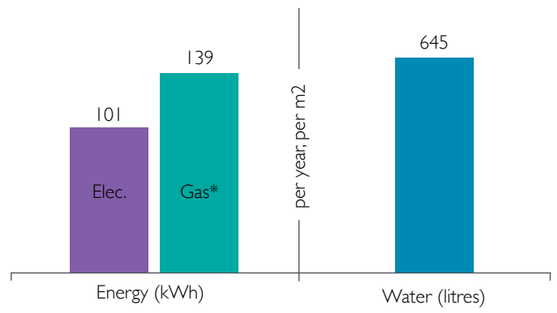
Museums and Galleries, and Performing Arts Buildings

For cultural buildings, Julie's Bicycle benchmarks have two sub-categories:

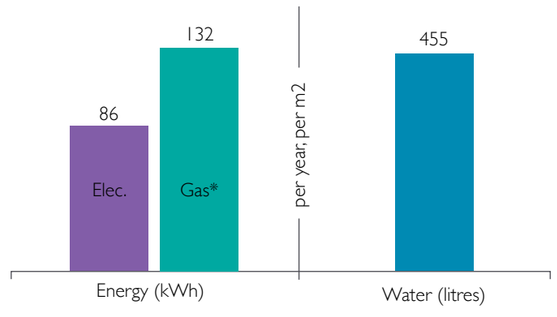
- Museums and Galleries – museums, galleries and art centres
- Performing Arts – theatres and concert halls

This data was derived from the Arts Council environmental reporting initiative (2012/13 and 2013/14), ATG Theatres and sMeasure users. Arts Council environmental data from 294 cultural buildings contributed to this benchmark.

Performing Arts Benchmark 2015



Museums and Galleries Benchmark 2015



Step 2: Identifying How and Where Water Is Being Used

The typical pattern of water use in an office environment results in 53% of water being used in toilets and washrooms[8]. While this provides a useful indicator of potential use, many cultural buildings may also have catering facilities, laundry facilities, workshops and paint-shops all of which have the potential to be high water users.

Typical areas of water use and potential sources of wastewater:

Areas and stakeholders to consider	Areas to manage
Audiences	Access to drinking water from fountains or chillers. Use of toilets – WC flushing volumes, gents' urinal flushing frequency, and hand washing.
Artists	Access to drinking water and kitchen facilities. Use of bottled water. Use of toilets. Use and flow rate of showers. Use of laundry facilities.
Contractors	Access to water for washing and cleaning. Access to drinking water. Maintenance and flushing of plumbing systems.
In-house workshops & paint-shops	Cleaning of equipment. Use of toilet and showers for staff.
Crew	Access to drinking water. Use of toilets and showers. Access to water for cleaning and washing.
Catering	Food preparation, dishwashing, hand washing, cleaning.
Outside	Vehicle washing, irrigation, window cleaning.

Dumfries House

Dumfries House is a museum and gallery in Ayrshire. Working with Business Stream, they identified that their typical water use was extremely high when compared to benchmarks. After educating their staff about their meters, water supply pipes and leak detection techniques, a number of leaks were found. When repaired, they reduced average daily consumption from 64m3 to 3m3, saving the organisation over £11,000.

www.business-stream.co.uk/sites/default/files/Dumfries_Study.pdf

8. https://www.dwrcymru.com/english/library/publications/DIY%20Water%20Audit%20(Business)/index.asp

Measuring Flow Rates

Understanding where water is used and at what flow rate will help you to plan equipment upgrades or instigate behavioural changes. Once you have a flow rate in litres per minute, it can be multiplied by an estimation of minutes used each day/week/year to obtain an approximate use for each appliance, from this you can calculate potential water saving and the financial payback of making changes.

Water flow rate data can be obtained in a number of ways:

- Look up tables. If you know the maker and specification of the equipment e.g. tap or toilet cistern, you can look up flow rates on either the manufacturer's website or on a central Europe-wide database.

Note that the published data will be based on a typical mains pressure, which may not be the same as your building. The data is, however, very useful for comparing alternative equipment prior to purchase.

- Clamp on meters. These use ultrasound to measure water flowing through a pipe leading to an appliance or group of appliances, for example in a kitchen. They vary in accuracy depending on the type of pipe but can be useful for measuring approximate use in a particular building zone.

- Bucket and stopwatch. By timing how long it takes to fill a bucket of a known volume from a particular outlet, like a shower, it is possible to calculate typical flow rate. For example, if a 5-litre bucket fills up in 15 seconds, you will fill 4 buckets (20 litres) in a minute, so your flow rate is 20 litres per minute.

Having estimated water used on each occasion at each appliance, you will need to estimate the number of occasions in a typical day, and build a table of values from which you can estimate daily use across the building. At this stage you are looking for general estimations of trends not 100% accuracy. Compare the result to your meter readings and investigate any large variances.

Point of use (appliance)	No. of appliances	Litres/minute	Mins used		Per Action/flush (L)	events/day	Daily use (L)	Yearly use (m3)- assumes 300 working days	unit cost water (£)	Annual cost water	Unit cost sewerage	Annual cost sewerage
Gents WC Audience	8				9	6	432	130	1.10	143	1.40	181
Gents urinals Audience flush every 5 mins	30				2	288	17,280	6,307	1.10	6,938	1.40	8,830
Gents hand wash sinks (basic tap)	30	40	0.25		10	6	1,800	540	1.10	594	1.40	756
Ladies WC Audience	24				9	8	1,728	518	1.10	570	1.40	726
Ladies hand wash sinks (basic tap)	30	40	0.5		20	8	4,800	1,440	1.10	1,584	1.40	2,016
Gents WC staff	2			*or*	9	12	216	65	1.10	71	1.40	91
Gents urinals staff flush every 5 mins	8				2	288	4,608	1,682	1.10	1,850	1.40	2,355
Ladies WC staff	6				9	12	648	194	1.10	214	1.40	272
Café dishwasher - 4 times per day not full	1				15	4	60	18	1.10	20	1.40	25
Costume washing machines	2				70	4	560	168	1.10	185	1.40	235
Tap dripping every second	1						10	3.7	1.10	4.0	1.40	5.11
Paint shop sink used to clean equipment	1	9	60			2	1,080	324	1.10	356	1.40	454
								11,390		12,529		15,946

The Whitworth Art Gallery

As part of its 2008–9 redevelopment, The Whitworth reduced annual water consumption by more than 155m3. Based on typical charges for water and sewerage, this will have saved around £400. A green roof planted in sedum also reduces the volume of rainwater entering the sewer and increases the site's biodiversity.

http://www.juliesbicycle.com/latest/case-studies/5611-the-whitworth-art-gallery

Step 3: Identifying Possible Actions

Having completed your estimations and identified areas of high use, you can now begin to list actions that will support efficient water management.

There are many things you can do to reduce water use and the impacts of wastewater, both behavioural and technical. These are some of the actions other cultural buildings have found effective.

Technical

- Install a smart meter to monitor water use and better understand where efficiency savings can be made.
- Fit leak detection equipment which will sense unusual "spikes" in use and shut off the supply.
- Inspect all your water system on a frequent basis to locate minor leaks. These not only waste water but also damage equipment and the building.
- Put water displacement devices such as a "hippo" or a homemade device using a used plastic water bottle in the cisterns of old toilets to reduce the flush volume or upgrade to new more efficient dual-flush cisterns if possible.
- Correctly installed urinals use far less water than WCs but the timing and frequency of flushes needs to be carefully managed to match occupancy patterns; install sensors to ensure urinals only flush when required.
- Avoid water coolers if possible – the electricity used to cool the water, the plastic used to make the bottles and the transport required to bring you the water all make them a less than ideal choice. However, water coolers are still preferable to individual water bottles.
- Purchase low-flow taps to replace old ones, and purchase low-flow showerheads if relevant.
- When upgrading taps choose percussion or timed taps (with supporting signage), to improve efficiency.
- If your supply is at a particularly high pressure it will generally lead to higher use, fitting a pressure regulator will reduce this effect.
- Ensure all hot water pipes are well insulated. This will prevent wasteful "running out" of cold water while users wait for hot water to arrive at the tap. These lengths of inefficient plumbing are referred to as "Dead Legs", and are to be avoided when planning any plumbing work.
- Provide a fresh water fountain for public use and discourage or ban the sale of water in plastic bottles
- Provide or sell branded re-usable water bottles for staff, visiting artists and members of the public
- Consider harvesting rainwater or grey-water for re-use especially if you have a large volume of potable water currently being used for low grade purposes such as irrigation or vehicle washing.
- Consider diverting rainwater from your roof into Sustainable Urban Drainage System (SUDS) to reduce the impact on the mains sewer.
- If you have areas of expected high use such as a catering operation, install a sub-meter and discuss water reduction with your operator. Monitor use over a reasonable period e.g. six months. Use this data to identify and agree changes and, if possible, make utilities (water, gas and electricity) a factor in your tenancy agreement.
- Use signage to explain to staff and visitors what you are seeking to achieve and why.
- Use signage to encourage your team and visitors to turn off taps fully when they are finished.

Theatre Royal Plymouth

Theatre Royal Plymouth took steps to conserve water use, including the installation of urinal control and percussion taps following the advice of South West Water, their sponsors. This saved 2,300 tonnes of water and £10,000. Hippo water savers have been installed in every toilet back of house, which saves 3 litres of water with every flush.

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Behavioural

Behavioural and technical actions should ideally reinforce one another – often technical solutions will require behavioural changes to maximise their impact. Below are some examples of behavioural interventions, and to learn more about how to design and implement behaviour change initiatives successfully, use our Team Engagement Guide.

- Only run a dishwasher when it is full and ensure it's on the eco-cycle.
- Discourage staff from flushing substances down the toilet and provide other methods to dispose of waste products.
- Discourage kitchen staff from pouring grease or oil down the sink – it will solidify as it cools and cause a blockage. Soured milk and other dairy products should be disposed of with solid wastes.
- Don't flush coffee grounds down the sink; these are rich in nutrients and will be welcomed by mushroom growers or gardeners for compost heaps.
- Prohibit vehicle washing unless you are able to use recycled grey water or rainwater.
- Encourage staff to report dripping taps or other broken appliances.
- Encourage your staff to drink tap water – provide safe drinking water, glasses and reusable bottles.

Consumer Campaigners Which?

Which? estimates that the number of plastic bottles sent to landfill each year would fill Wembley Stadium twice over and describe bottled water as an unnecessary drink that costs us £1.68bn a year. It takes approximately 7 litres of water to produce 1 litre bottle – ironically it's a very water intensive product!

Step 4: Devising an Action Plan

Having estimated your water use in various areas and planned where you can save, you now need to prioritise your actions.

Your action plan should cover all areas of your operation, but start with the areas of highest use where your influence will have the greatest impact.

Prioritise your actions by initially pursuing "quick wins" within your financial reach, such as behavioural changes, e.g. encouraging the turning off of taps or fitting homemade displacement devices in large cisterns. You can attend to other areas which might need wider engagement or investment in the future, as you achieve savings.

Your plan should include a range of options and levels of investment, and span at least one year of business, ideally 3-5 years to outline a longer-term vision and goals.

Norwich Theatre Royal: Team Awareness Water Campaign

'With the help from a new watersmart meter we had fitted we are now able to take half-hourly readings of our water consumption. This enables us to monitor our usage in depth, highlighting peak times of the day but also flagging up potential wasted water use when the building is closed. The graphs we create from the results make a great visual aid for the staff, helping us to communicate our environmental impact. To increase their understanding of our water usage we label interesting parts of the day which they can relate to, trying to cover the water used in all departments, for example when the restaurant is busy pre-show or when the bars are busy during the interval. We also label which shows were on that day and how many tickets were sold as those figures can affect the results shown.'

Helen Tully, Environmental Champion, theatreroyalnorwich.co.uk

If investment is hard to find, create some initial savings from no-cost behavioural solutions, quantify them and make a case for reinvesting these savings in a small programme of low-cost interventions. You can build on this case by projecting expected savings from further investment, and continuing to reinvest savings in subsequent years in other areas.

To the right is a sample investment and payback table illustrating a number of potential changes which could be made based on the sample water use table above. Payback periods are shown to allow prioritisation.

		Original associated charges	New changes	Saving	Estimated investment	Payback (years)
Gents WC Audience	Fit twin flush cisterns	324	180	144	1500	10.4
Gents Urinals Audience flush every 5 mins	Add timer - 6 hrs per day	15768	3240	12528	200	0.0
Gents hand wash sinks (basic tap)	Replace with push taps	1350	135	1215	2500	2.1
Ladies WC Audience	Fit twin flush cisterns	1296	540	756	4000	5.3
Ladies hand wash sinks (basic tap)	replace with push taps	3600	270	3330	2500	0.8
Gents WC staff	Fit twin flush cisterns	162	90	72	600	8.3
Gents Urinals staff	Add timer - 16 hours per day	4205	3240	965	200	0.2
Ladies WC staff	Fit twin flush cisterns	486	270	216	1400	6.5
Café Dishwasher	Use less but always full	45	34	11	0	0.0
Costume washing machines	No changes	420	420	0	0	0.0
Tap dripping every second	Fix dripping tap	9	0	9	50	5.5
Paint shop sink used to clean equipment	Staff encouraged to use less	810	203	608	0	0.0

For support with developing your policy and action plan, use our guidelines: www.juliesbicycle.com/resources/environmental-policy-and-action-plan-guidelines

Gaining Support

Ensure the environmental and financial reasons for minimising water use are understood and supported by your colleagues throughout the organisation.

Make sure that water management is part of your environmental policy and action plan. Possible inclusions to the policy could be:

- To reduce the overall consumption of water
- To reduce the overall production of waste water
- To reduce the amount of water pollution generated by building activities

Explain to your board and staff why saving water is an important part of your sustainability agenda as it can often be overlooked. Involve colleagues directly in the action planning process, if possible. This builds ownership and increases the likelihood of change.

Having a senior sponsor – a senior member of staff that endorses your plan and the changes you seek to make – will emphasise that environmental sustainability and water management is a priority, and encourage support and action.

For more support with engaging colleagues, read Julie's Bicycle's Team Engagement Guide.

Step 5: Implementing your plan

With all the planning done, you now need to implement your plan and review its effectiveness.

It should be easy to make a number of low cost changes resulting in high savings at the start of your plan.

Savings will become harder to achieve as you work through all the potential areas. But keep looking, keep involving colleagues by asking for suggestions and you will find more.

Procurement

Ensure that your plan also influences wider procurement decisions – in the same way that you might buy a new fridge which is A* Rated, investigate potential water use for all appliances and business processes. You might want to consider making water impacts part of your procurement criteria. Read our Sustainable Procurement Guide for more information.

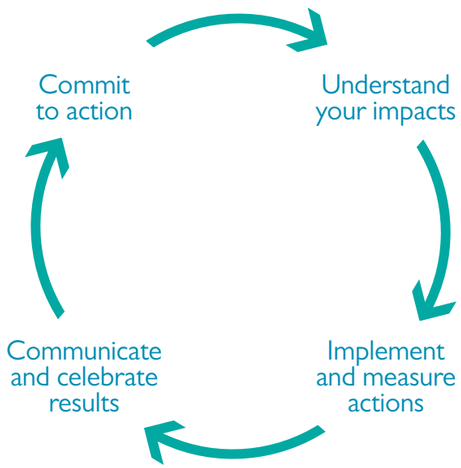
Evaluation

Follow the cycle below to evaluate the changes you have made. If the changes are different to what you expected, (higher or lower), investigate the possible reasons to improve and inform future decisions. Keep reading your meters and identify in your records where and when you made changes.

Use resources like the Julie's Bicycle Benchmarks to identify how well you're performing on water use compared to like organisations, and communicate progress and learning to colleagues and peers in the sector.

Celebrate your successes to draw attention to your efforts, reward your team and collaborators, and incentivise more savings.

For support with developing your policy and action plan, use our Environmental Action Planning Guidelines.



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Resources and Links

Practical Guides

Julie's Bicycle Benchmarks:
www.juliesbicycle.com/services/ig-tools/julies-bicycle-benchmarks

Julie's Bicycle Case Studies:
www.juliesbicycle.com/latest

Environmental Policy and Action Plan Guidelines:
www.juliesbicycle.com/resources/environmental-policy-and-action-plan-guidelines

Sustainable Procurement Guide:
www.juliesbicycle.com/resources/procurement-guide

Team Engagement Guide:
www.juliesbicycle.com/resources/team-engagement-guide

Water Management for Outdoor Events:
www.juliesbicycle.com/resources/water-management-at-outdoor-events

Supporting Links

www.water.org.uk
www.resourceefficientscotland.com/content/save-water
www.waterwise.org.uk
www.wrap.org.uk/content/rippleffect
www.europeanwaterlabel.eu/home.asp
www.business-stream.co.uk/sites/default/files/Dumfries_Study.pdf

Tools

Julies Bicycle Industry Green Tools: www.ig-tools.com

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