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Sustainable Campus Water Use:

A guidance document for sustainable water management in UK campus environments

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Abstract

Due to its relatively low cost and perceived abundance, water is often overlooked and left behind when it comes to managing and tackling utilities in campus environments. However, due to a combination of increased sustainability awareness, rising costs and climatic changes, increasing numbers of institutions are seeking to better manage and reduce their onsite water use. This document brings together existing standards, academic literature, and industrial experience from across the sector to provide a structured approach to sustainable water management for UK campuses and estates management. This document tackles issues such as metering, engagement, drinking water and drainage. It adopts a 6-tier approach, allowing users to place themselves on the hierarchy from minimal effort at Level 0 to state of the art and sector leading measures in Level 5. This allows users to identify areas to target.

Introduction

Why sustainable water use and why now?

There are many reasons to push for more sustainable water use. Not least the increasing costs to non-domestic customers, with some regions of the UK experiencing three consecutive years of 10%+ price increases on the cost of supply. There is also less water available than many people would think. Although the UK as a whole is viewed as a relatively wet country, the UK has less water resources per capita than Australia, Italy or Spain, while England as a whole experiences less rainfall than South Sudan and London receives less than Lisbon, Paris or Rome (FAO, 2020). To exacerbate the issue the UKs is using largely the same infrastructure and supply set up we had in 1990 while our population has grown by 11 million over the past three decades.

One of the most pressing reasons to push for sustainable water use is the risk that climate change brings. In addition to the expected increase in demand during warmer weather, the National Infrastructure Commission (for England) predicts that by 2050 we will face an annual risk of a 1 in 4 chance of a drought equal to the 'worst in recent history', a 1 in 7 chance of a 'severe drought', and a 1 in 17 chance of a 'extreme drought' (UK Building Regulations, 2016). The levels of water stress within the UK vary significantly by region, and the prediction is that climate change will exacerbate this, increasing the probability of seasonal drought in all areas and multi-year droughts in many. This is highlighted by reports from NatureScot, the Welsh Government and the Committee on Climate Change (CCC). Scotland is expected to see an increase in extreme drought months, increasing in frequency from 1 in 20 years to 1 in 3 (by 2040) (Kirkpatrick, et al., 2021), with Wales expecting to see a decrease in summer rainfall by 16% (by 2050) (Llywodraeth Cymru/Welsh Government, 2018) and Northern Ireland expecting up to 60% less summer precipitation (by 2100) (CCC, 2017).

An industry wide challenge

Water is often overlooked or left as an afterthought when tackling institutional utility consumption. There is often little awareness around both of what can be done and what others within their sector are doing. As such, this document is designed to provide support for UK based Sustainability and Energy Managers operating in campus-based environments. It is not an exhaustive list of tactics, strategies and standards, and its usefulness and applicability may vary significantly based on the region and function of the site(s). However, this document does bring together what are considered to be some of the 'best practice' options available, grouping them into levels of efficiency.

This document consists of advice on 16 major areas of water management and is split across 6 levels of difficulty and progress. It has been developed based on a combination of academic literature review, existing standards such as BREEAM, ISO46001:2019 and LEED, government guidance and the onsite experiences of 50 UK based Sustainability professionals collected through interviews*. The interview process involved an hour-long recorded call to discuss the experiences, opinions and perceptions of sustainability and energy managers across the higher education and healthcare sectors.

*A copy of the report containing the results and output from the interview process is available on request from the first author and results from this will be included in a Doctoral Thesis expected to be available from the University of Surrey by early 2023.

	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
		All from level 0+ (where not superseded)	All from level 1+ (where not superseded)	All from level 2+ (where not superseded)	All from level 3+ (where not superseded)	All from level 4+ (where not superseded)
Staffing	No one responsible	A member of staff who is known to be responsible for water consumption	A member of staff who has managing water consumption within their job description	A full-time member of staff with Fixed KPIs relating to water consumption	A full-time member of staff whose primary remit is controlling/reducing water consumption	A Board/Executive member who has responsibility for, and whose bonuses are linked to, water consumption (Generally packaged within other sustainability measures)
Metering	Collect annual meter reads at fiscal meters	Collect weekly meter reads	Install sub-metering in key locations and install AMR on fiscal meters	Install sub-metering on all buildings and AMR on all meters	Install sub-metering within buildings and AMR on all meters	Install smart meters that have the ability to correlate leaks across network between buildings
Analysis	Compare annual change	Look for significant changes in consumption	Monitor for trends in consumption, look for areas with unexplained baseloads	Monitor trends, identify locations where targeted interventions can be introduced	Set fixed point alarms where, if consumption exceeds the expected norm (plus a margin), it alerts staff to investigate	Set up intelligent alarming, using moving averages/consumption during the same period the previous year, or using A.I. and machine learning.
Urinals	Constant fill and flush cisterns 10L+/urinal	Timed flush 6L/urinal	Timed flush 3L/urinal	-1.5L/bowl or less -User based instant flush on each urinal, either manual or P.I.R.	User based delayed action urinal flush, triggered by P.I.R.	Grey-water or rainwater flushed urinals

	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
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Leaks	Fix leaks where they are causing operational issues	-Fix all leaks when identified. Investigate to identify leaks when analysis shows an increase in consumption -Walk around areas where pipework is exposed or known to be buried, looking for leaks and pooling water	-Periodic analysis comparing total incoming water consumption with consumption on sub-meters and look for unexplained differences. -Target unexplained baseloads to look for leaks in those buildings	-Conduct systematic leak detection of the full network once every 5 years (or less) -During quiet periods, where possible, do short shut offs on individual runs of pipe, checking if meters continue to progress, or if pressure drops	Where alarming indicates an unexplained excess consumption, conduct investigations and repairs, or make changes as appropriate	Use smart metering with the ability to identify and correlate leaks around network. Fix and repair leaks, as and when they are identified
Engagement	None	Signs asking users to turn off taps	-Share water saving tips -Promote reporting of leaks/drips etc.	Run water saving competitions/sprints	Implement year-round gamification, rewarding sustainable actions and engagement from users	Create Water Champions within each Team/Department /School/Ward
Taps	No control, planning or standards.	-Washroom Taps <5L/min -Kitchen Taps <8L/min (9L/min if commercial)	-Washroom Taps <4L/min -Kitchen Taps 5L/min (8L/min if commercial)	Use Sensor or Concussive Taps <4L/min	-Use Sensor or Concussive Taps 3L/min -Commercial Kitchen Taps 6L/min	-Have self-flushing taps that remove the need for manual Legionella flushing,
Showers*	18+ L/min	14L/min	10L/min -Encourage users to have '1 song shower' (radio edits)	8L/min -Encourage users to turn off showers while soaping up	6L/min -Engage with users by placing messages encouraging shorter showers in the showers -provide sand timers	<6L/min -Install smart shower timers such as Aguardio G2 or Amphiro AG

*Ongoing research is implying that although flow is a key component of water consumption in showers, other factors such as dispersal pattern and pressure can affect the length of showers, meaning the lowest flow isn't always the best

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Toilets	8+L/flush	6L/flush	5L/flush	4L/flush Or 6L max dual flush	-3L/Flush Or 4L max dual flush -Install leak detection technology on toilets	Vacuum flush toilets such as Propelair
Rainwater Harvesting	None	None	Water collected in water butts for use on grounds	Small scale RWH capable of supplying up to 5% of site water used for Toilet/Urinal/ Irrigation purposes	Medium scale RWH capable of supplying up to 20% of site water used for Toilet/Urinal/ Irrigation purposes	Large scale RWH capable of supplying more than 20% of site water used for Toilet/Urinal/ Irrigation
Greywater	None	None	None	Collect small volumes of greywater for use on plants	Collect wastewater from sinks directly into toilet cisterns	Systematic collection, redistribution and low-level treatment of greywater for use in toilets, urinals and grounds, primarily collected from sinks and showers.
Commercial Dishwashers	7L+/rack	<6L/rack	<5L/rack	<4L/rack	<3L/rack	2L/rack
Commercial Laundry	14L+/kg	<12L/kg	10L/kg	7.5L/kg	5L/kg	<4.5L/kg
Grounds Watering	Regular watering of all green spaces with mains water	Only watering key areas and plant beds	-Using captured rainwater to reduce mains water used to water key areas -Use of drip irrigation	Targeted use of drought resistant species to avoid watering beyond bedding in phase	Only using rainwater or greywater for any grounds watering	Avoiding any grounds use, accepting seasonal browning of areas of campus
Drinking Water Provision	Kitchen Taps only	Water refill stations in key high use areas of the site	Water refill stations in every building	Water refill stations on every floor	Impose a plastic bottle 'tax'	Full ban on single use water bottles on campus

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Sustainable Urban Drainage	Surface water flows to combined sewer	Surface water flows into surface water/highway drainage system	Surface water flows directly to surface water body	Surface water flows to surface water body via abatement, (either subterranean or in the form of abatement ponds etc.)	Surface water is allowed to infiltrate directly into the ground, through minimising paved areas, use of green infrastructure etc.	Use of surface water in RWH systems, with the remainder directed through natural filtration systems ensuring water is clean before using soakaways where possible, or being diverted into local waterways where not
Other measures		Pre-defined list of products or detailed specification for new build, retrofits and repairs	Remove Baths from all accommodation (excluding disabled where appropriate)	Use of 'Blue Infrastructure' to promote wellbeing within the site	Unified and enforced legionella flushing policy across site, minimising flushing in areas which have been used.	Reuse backwash water from swimming pools to provide Greywater for toilets and urinals
		Limit vehicle washing, use appropriate equipment, and only clean in areas with oil traps to prevent contaminant run off	Remove all macerators/in-sink food disposal	Restrict use of Reverse Osmoses (R.O.) water to essential use and prevent excessive use in Labs.	Remove all cooling towers and replace with zero water or low water alternatives	Developing a fully worked Day Zero contingency plan

Conclusion

The table above provides a framework for assessing the current level of institutional water management, and the steps required to advance institutions. This table also provides ideas for how to progress sustainable water management within campuses. This document is applicable and relevant to all UK campus environments. However, no two sites are the same and as such implementations may be more difficult in some locations. For any queries on the content of this document please contact the lead author.

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