WEEG NEWSLETTER August/September 2020

The newsletter is published monthly by the University of Southampton's Water and Environmental Engineering Group WEEG, and reports things of interest in this field worldwide, as well as ongoing undergraduate student and research work in WEEG itself.

We believe that water and energy are the most important topics worldwide for the next decades. Our work covers river and coastal engineering, water and wastewater and energy related to water.

Editorial: Most of the developed world can turn on the tap and access clean water. This has perhaps led to the belief that fresh water is bountiful and unlimited. This, of course, is not the case. In fact, many parts of the world are already facing water shortages. So how bad is this ***fresh-water crisis***, and what can be done about it? Read on to find out.

Hydraulic Engineering International: *The Fresh-Water Crisis*

Water is essential for life, it also surrounds us and is used by us. For centuries we have built cities by it, and in many places it is believed to have healing or spiritual properties. Whilst this last point is debatable, one thing is for sure: without water we die, and there is no substitute. Water has all the characteristics of an extremely valuable commodity that should be preserved at all costs, and yet when we turn on the tap at home there is a disconnect about the true cost of water.

Just 1% of the world's water is considered fresh and accessible (Fig. 1), relying on the small percentage of surface water such as rivers and lakes to supply the population.

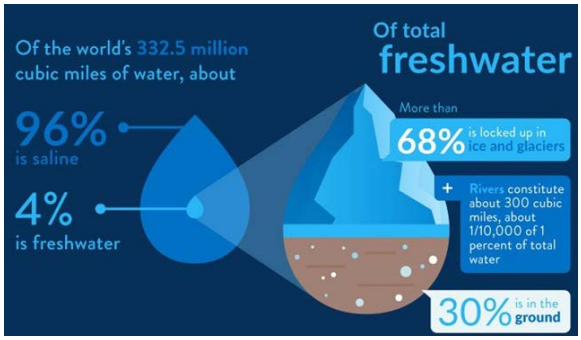

Fig. 1: Breakdown of the world's water

This already sounds problematic for future supply, but a growing population and a changing climate are exacerbating the issue. Water consumption has increased 7-fold over the last 100 years alone. Meanwhile, rising sea levels and groundwater extraction are causing salt-water intrusion into previously fresh supplies, and changing weather patterns are causing more frequent droughts. In addition, water resources are not evenly spread, with some countries being water-rich and some water-poor. All of this is leading to a fresh-water crisis across the globe.

Cape Town, South Africa is a high-profile example. Relying mainly on rain fed dams, three straight years of drought resulted in Cape Town becoming the first major city to run almost completely out of water. Fortunately, the day when taps would have to be shut off through lack of water, ominously known as 'day-zero', was avoided through a combination of social change surrounding consumption and a much-welcomed healthy rainfall in 2018., South Africa is the 30th driest country in the world, however, and has a continued high-water risk (Fig. 2).

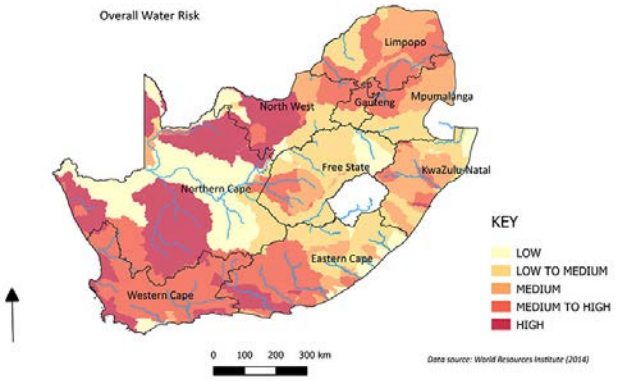

Fig. 2: South Africa's water risk by region

This issue is not confined to South Africa. One quarter of the world's population is already facing water shortages. Melbourne, Jakarta, London, Beijing, Istanbul, Tokyo, Bangalore, and Barcelona are just a handful of major cities expected to have their own water crises by mid-century. So, what can be done?

Well, one possibility (and we will report on others) is to generate additional fresh water supply through purification of salty or contaminated sources. Desalination is the removal of salinity from contaminated water, most commonly achieved through a high-pressure membrane separation process known as reverse osmosis. Distillation is another option, often achieved using thermal processes such as multi-stage flash, which evaporates the contaminated water and condenses the clean product. This has the advantage over desalination that microbiological contaminants

which may cause disease or illness, are dealt with by the process. Desalination capacity has more than doubled in the last decade with many large-scale plants being built (Fig. 3). But it still meets less than 1% of world demand, and major barriers include energy usage and cost, so there is more work to be done.

Fig. 3: Desalination plant in Germany

To help create a sustainable fresh water supply and demand we must also work to reduce consumption: this was a vital step in Cape Town avoiding day-zero in 2018. Whilst this starts at home, for example by turning off the tap when you brush your teeth, it extends to how we manage water, and design and manufacture our goods and services. For example, the cup of coffee you are drinking took around 130 L of water to produce, from crop to cup.

Water is becoming one of the most valuable resources in the world, something to think about the next time you turn on your tap. Fortunately, as hydraulic engineers we are uniquely placed to do something about the fresh-water crisis.

New grant: *Integrated solar thermal system for desalination / water purification and power generation*

Together with the University of Stellenbosch / South Africa we have just won funding to develop a solar thermal system to purify water and generate power from the same process. This exciting project will deliver a stand-alone system for use in rural South Africa.

Contact: G.Muller@soton.ac.uk

Webinar series: *Environmental Biotech - starting with Aerobic Granular Sludge*

The Environmental Biotechnology Network is hosting a series of specialist webinars to replace its annual Research Colloquium. The series starts with 'Aerobic Granules in Wastewater Treatment – Combining Novel Molecular Techniques and Technologies for Environmental Biotech', on Tues 3 Nov.

In the Chair is WEEG's Dr Yongqiang Liu, who will be joined by invited speakers Dr Zhiwu (Drew) Wang of Virginia Polytechnic Institute and State University, USA and Prof Jeremy Webb of the National Biofilms Innovation Centre (NBIC) and University of Southampton, UK. The event is free to members and you can register via Eventbrite (https://ebnetgranules.eventbrite.co.uk). Non-members can join for free on https://ebnet.ac.uk/join, or email Network Managers Louise Byfield and Angie Bywater on EBNet@EBNet.ac.uk. Future webinars will cover *N&P in WWT*, *Biosensors and Epidemiology*; *Scale-up issues* and more.

More info: https://ebnet.ac.uk/new-ebnet-webinar-aerobic-granules-in-wastewater-treatment-combining-novel-molecular-techniques-and-technologies-for-environmental-biotech/

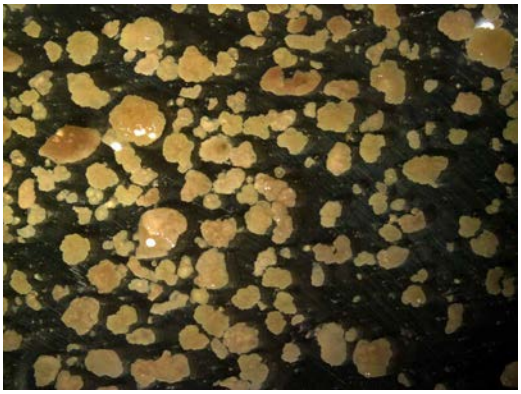

Fig. 4: Aerobic granular sludge for municipal wastewater treatment

Jobs in water engineering:

This section gives you an idea of the type of work you can do working in industry.

Advert: A job at the top of the profession with a major UK water company

Head of Civil Engineering

https://jobs.thameswater.co.uk/VacancyInformation.aspx?Vld=20374

Civil and Environmental Engineering at Southampton University:

WEEG: Civil and Environmental Engineering modules offer the chance to deepen your knowledge in water-related areas, and prepare you for environmental engineering projects.

Contact: Dr Sonia Heaven, s.heaven@soton.ac.uk, Bldg 178, Room 5015

Further information:

We have two Facebook pages, which provide a logbook of our laboratory activities:

www.facebook.com/Hydraulicslaboratory/

www.facebook.com/environmental.lab.university.of.southampton/

Brought to you by:

UNIVERSITY OF Southampton