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Thirsty Cities: might our ever-expanding cities be both the cause and the solution to the burgeoning water crisis?

Professor Chad Staddon, University of the West of England, Bristol

Funded by Lloyd's Register Foundation

Led by University of the West of England, Bristol

In partnership with Monash South Africa; The University of Arizona, Udall Center for Studies in Public Policy

AQA

Core Physical Section

Rivers, floods and management

The drainage basin hydrological cycle: the water balance.

Factors affecting river discharge: the storm hydrograph.

The long profile – changing processes: types of erosion, transportation and deposition, types of load; the Hjulstrom curve.

Valley profiles – long profile and changing cross profile downstream, graded profile, potential and kinetic energy.

Changing channel characteristics – cross profile, wetted perimeter, hydraulic radius, roughness, efficiency, and links to velocity and discharge.

Landforms of fluvial erosion and deposition – potholes, rapids, waterfalls, gorges, meanders, braiding, levees, flood plains and deltas.

Process and impact of rejuvenation – knick points, waterfalls, river terraces and incised meanders.

Magnitude-frequency analysis of flood risk.

Physical and human causes of flooding – **two** case studies of recent flooding events should be undertaken from contrasting areas of the world.

Impact of flooding – **two** case studies of recent flooding events should be undertaken from contrasting areas of the world.

Flood management strategies – to include hard engineering – dams, straightening, building up of levees, diversion spillways, and soft engineering – forecasts and warnings, land use management on floodplain, wetland and river bank conservation and river restoration.

channels, kames, eskers and outwash plains.

Periglacial processes – nivation, permafrost formation, frost heave, solifluction. Periglacial landforms – nivation hollows, ice wedges, patterned ground, pingos and solifluction lobes.

Exploitation and development in tundra areas and the Southern Ocean. Traditional economies of an indigenous population and recent changes/ adaptations. Early resource exploitation by newcomers – whaling and/or sealing. More recent development – oil in Alaska, fishing, tourism. The concept of fragile environments. The potential for sustainable development.

The future of Antarctica – to consider the contemporary issues of conservation, protection, development and sustainability in a wilderness area.

Coastal environments

The coastal system – constructive and destructive waves, tides, sediment sources and cells.

Coastal processes – marine erosion, transportation and deposition; land-based sub-aerial weathering, mass movement and runoff.

Landforms of erosion: headlands and bays, blow holes, arches and stacks, cliffs and wave cut platforms. Landforms of deposition – beaches and associated features: berms, runnels and cusps, spits, bars, dunes and salt marshes.

Case study of coastal erosion – specific physical and human cause(s) and its physical and socio-economic consequences.

Sea level change – eustatic and isostatic change. Coastlines of submergence and emergence and associated landforms. Impact of present and predicted sea level increase.

Case study of coastal flooding – specific physical and human cause(s) and its physical and socio-economic

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Edexcel

3.4 Topic 2: Water conflicts

Water resources	Water, like energy, is a fundamental human need, but is not evenly distributed. Physical factors play a key role in determining the geography of surface and groundwater supplies, as does human management and mis-management of the water resource base. Increasingly demand for water, which is growing, does not match supply and this can have implications for human wellbeing. Demand for water resources comes from various users, and in addition water resources are often trans-boundary in nature.
Water conflict	The potential for conflict – both local and international – is high, and in many cases water resource use exceeds recharge capacity leading to long-term degradation. The future of water supply is in doubt in many areas, due to unsustainable use and the threat of climate change; increasingly it is already vulnerable populations who stand to suffer the most. Developing management strategies to ensure supply will require the co-operation of many different players, and changes in the way water is valued and used.

1 The geography of water supply

Enquiry question: *What is the geography of water supply and demand?*

What students need to learn	Suggested teaching and learning
■ Water supply is controlled by physical factors, such as climate, geology and surface processes; supply can be from surface or groundwater sources; fresh water supply is a finite resource.	■ Investigating the world's global fresh water supply, and developing an understanding of its link to climate zones, river systems and subsurface geology in terms of aquifers.
■ There is often a growing mismatch between water supply and demand, which can lead to water stress either locally, or across whole regions eg economic growth in the RICs such as China and India.	■ Researching trends in water use, stores and supplies and identifying areas of water stress.

OCR

What are the environmental issues associated with urban change?	Urban change can put increasing pressures on the environment including: • traffic congestion; • atmospheric pollution; • water pollution; • urban dereliction; • waste disposal.	The study of two contrasting urban areas, including practical research or out-of-classroom work – fieldwork, to illustrate: • the problems of traffic congestion and atmospheric pollution and their management; • the problems of managing increasing volumes of waste; • the problems of managing the growing demand for services such as water and sanitation; • how urban change can create areas of dereliction.
How can urban areas be managed to ensure sustainability?	Sustainable management requires an understanding of the dynamic nature of social/economic/political processes in urban areas. The sustainable development of urban areas requires a careful balance of socio-economic and environmental planning.	The study of at least one example to illustrate how planning and management practices are enabling urban areas to become increasingly sustainable.

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1.6 What are the environmental challenges and solutions facing India?	• The causes and consequences of (i) deforestation; (ii) soil erosion; (iii) industrial pollution in major cities; (iv) sustainable use of water resources. (v) the need for energy supplies. • The balance between economic growth and sustainable development.	Research one controversial environmental issue or location.	The water crisis of Delhi and the Yamuna River. A case study of the Ganga Action Plan. The impact of citizen's groups (People's Movements) in challenging environmental degradation and urban development such as Sardar Sarovar project and the Chipko movement.

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This talk will explore the idea that the well-known **threat** of too many people using increasingly scarce water resources can also be seen as an **opportunity**…..

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……what if the long-term solution to water shortage lies not in fewer, but MORE, people in ever larger cities?

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Part of the problem in seeing this as an “un-paradox” is that most people simply do not understanding the complexities of the water (and energy) networks upon which modern life depends.

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Whereas WE (water professionals) tend to see process, complexity, systems……

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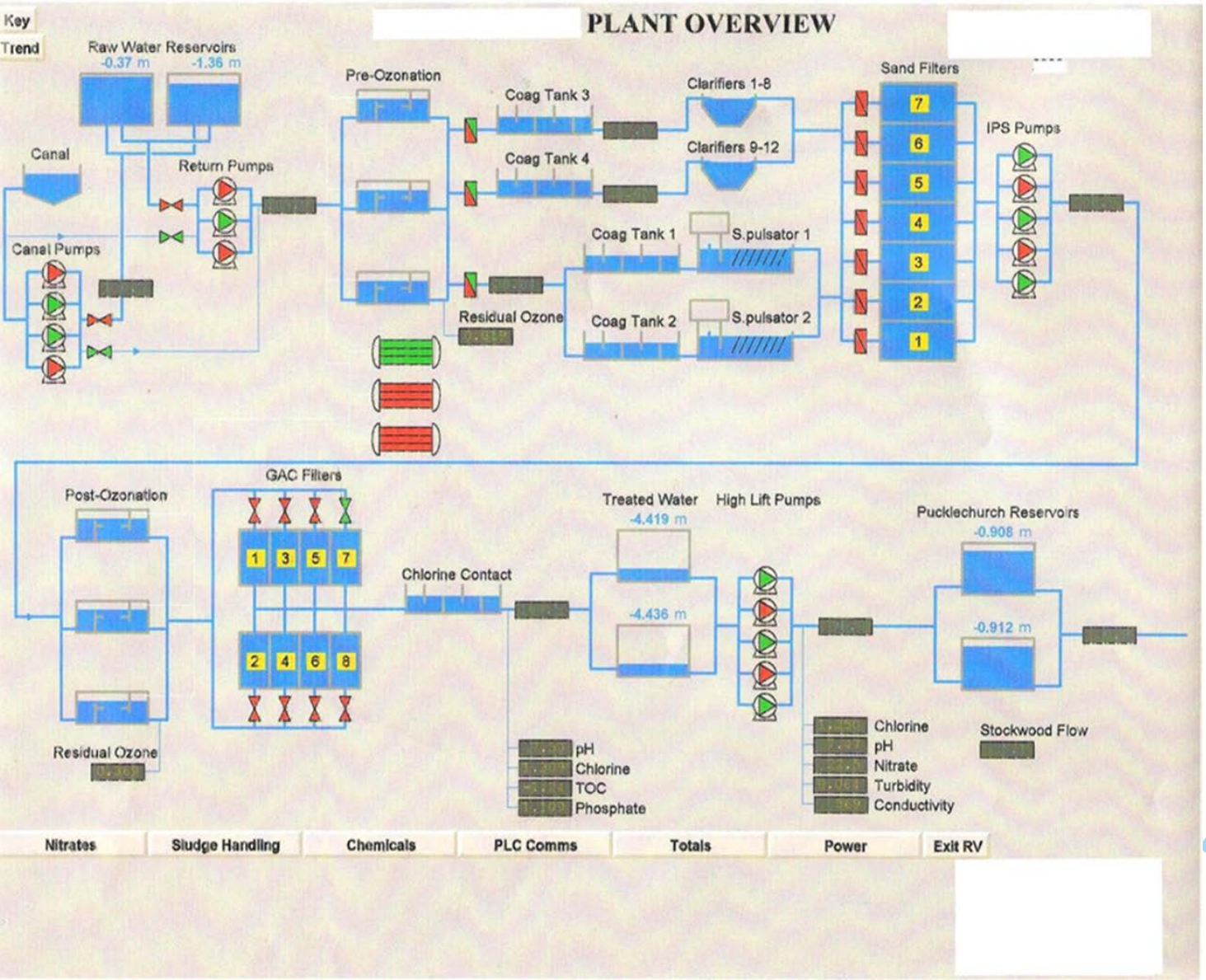
Whereas WE (water professionals) tend to see process, complexity, systems……***like THIS:***



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…the other 99.5% of the population tends to see ***this***:

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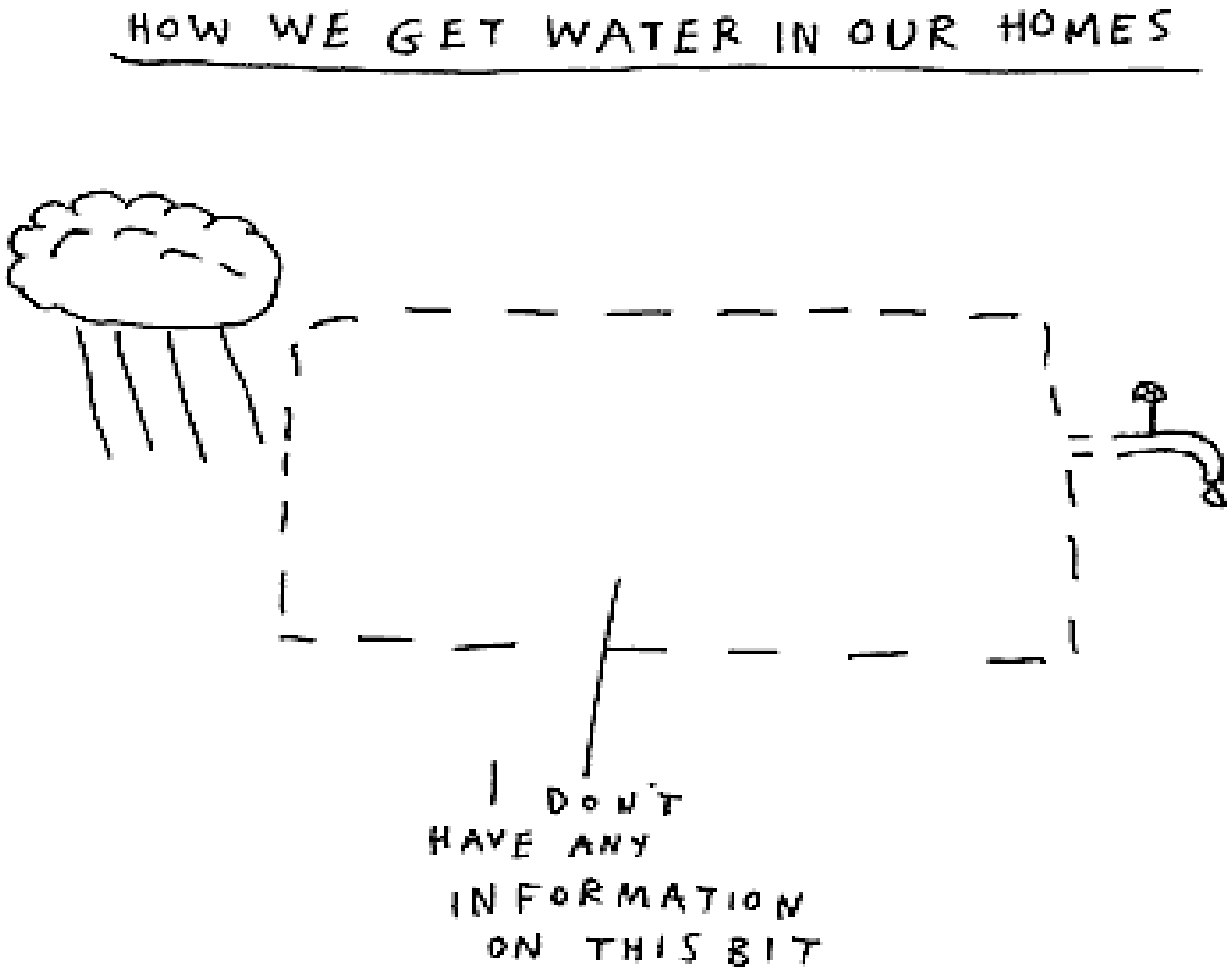

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Nevertheless, cities use LOTS of water and this can be readily enumerated…..

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Nevertheless, cities use LOTS of water and this can be readily enumerated…..let's explore this idea step-by-step, starting with a basic unit of analysis: ***US***

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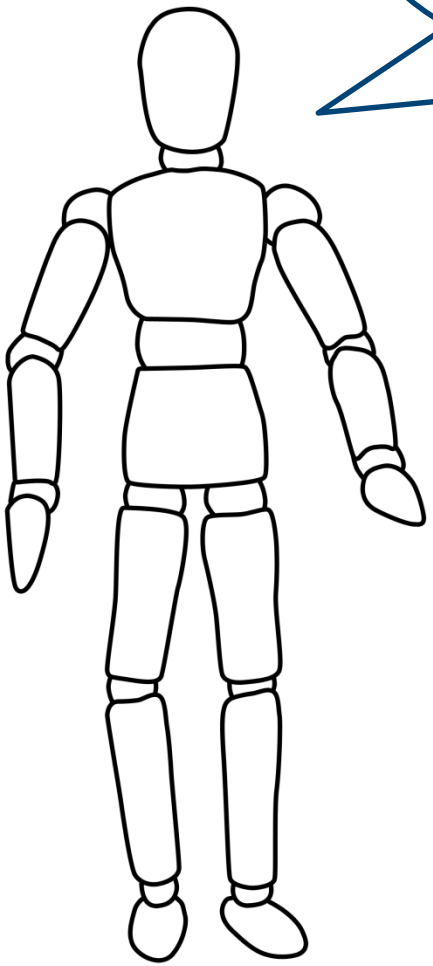
Cities are full of people, and people are highly dependent on water!



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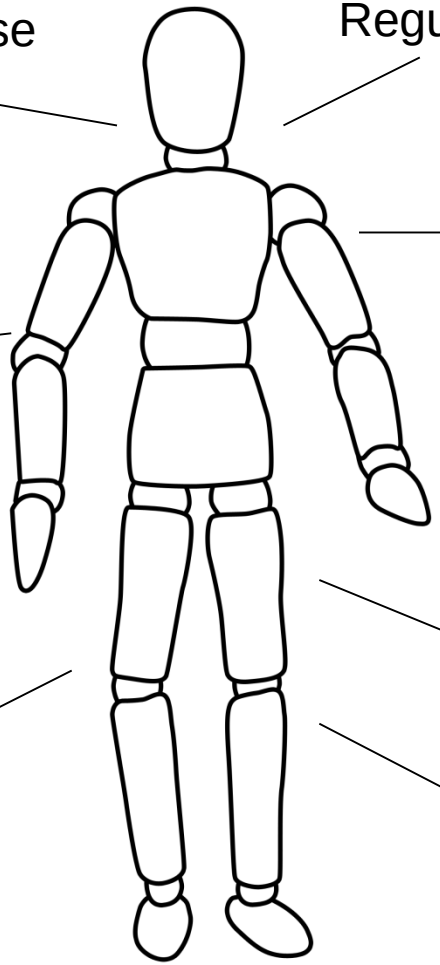
What water does for us:



Moistens tissues such as those in mouth, eyes and nose

Regulates body temperature

Carries oxygen & nutrients to cells

Protects body organs and tissues

Helps prevent constipation

Lessens the burden on kidneys and liver by flushing waste

Helps dissolve minerals and nutrients, making them available to the body

Lubricates joints

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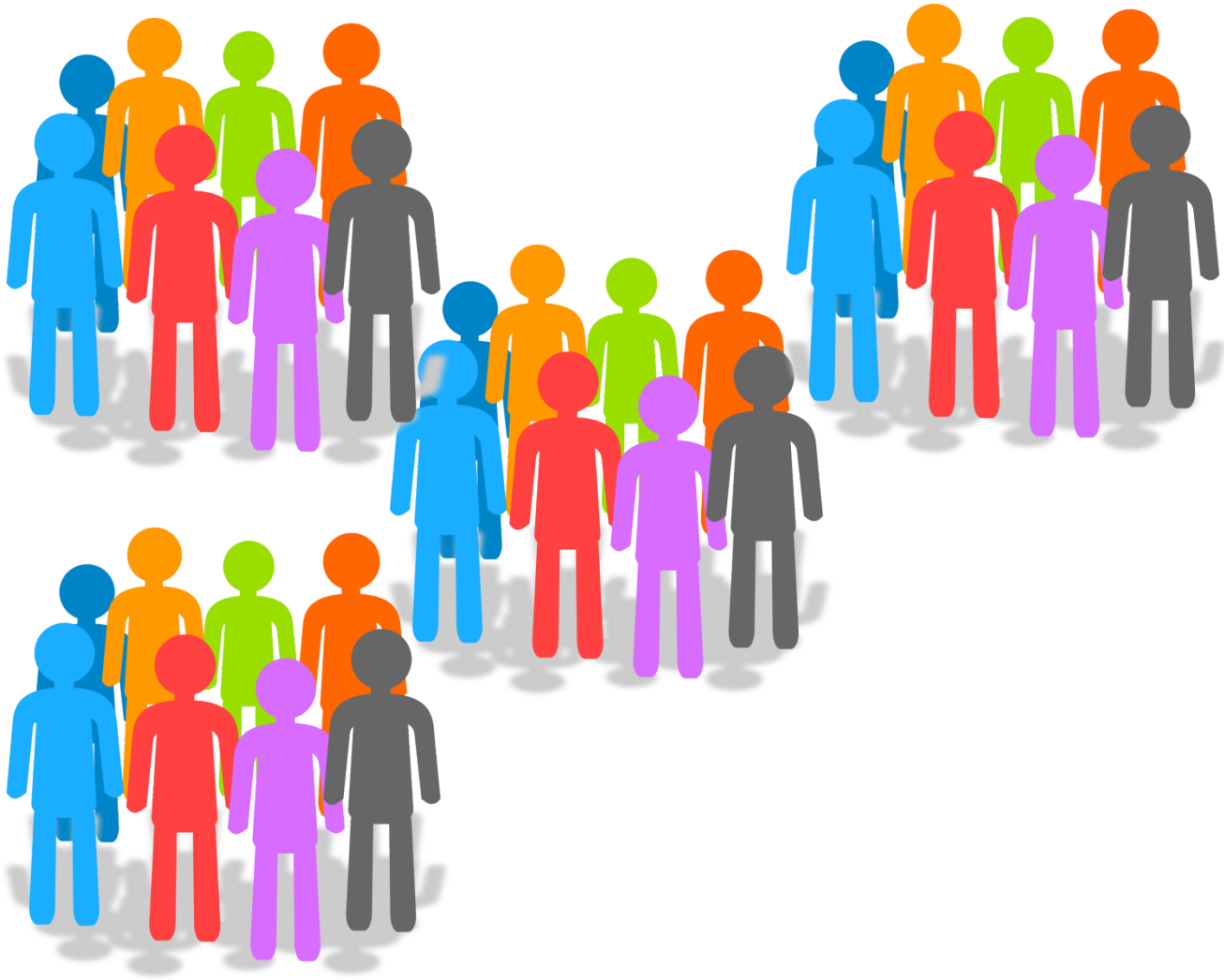

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But that is not all

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But that is not all ..... to support our standard of living we depend on much, much more water to produce the food, energy, clothes, infrastructure, buildings, etc., etc.

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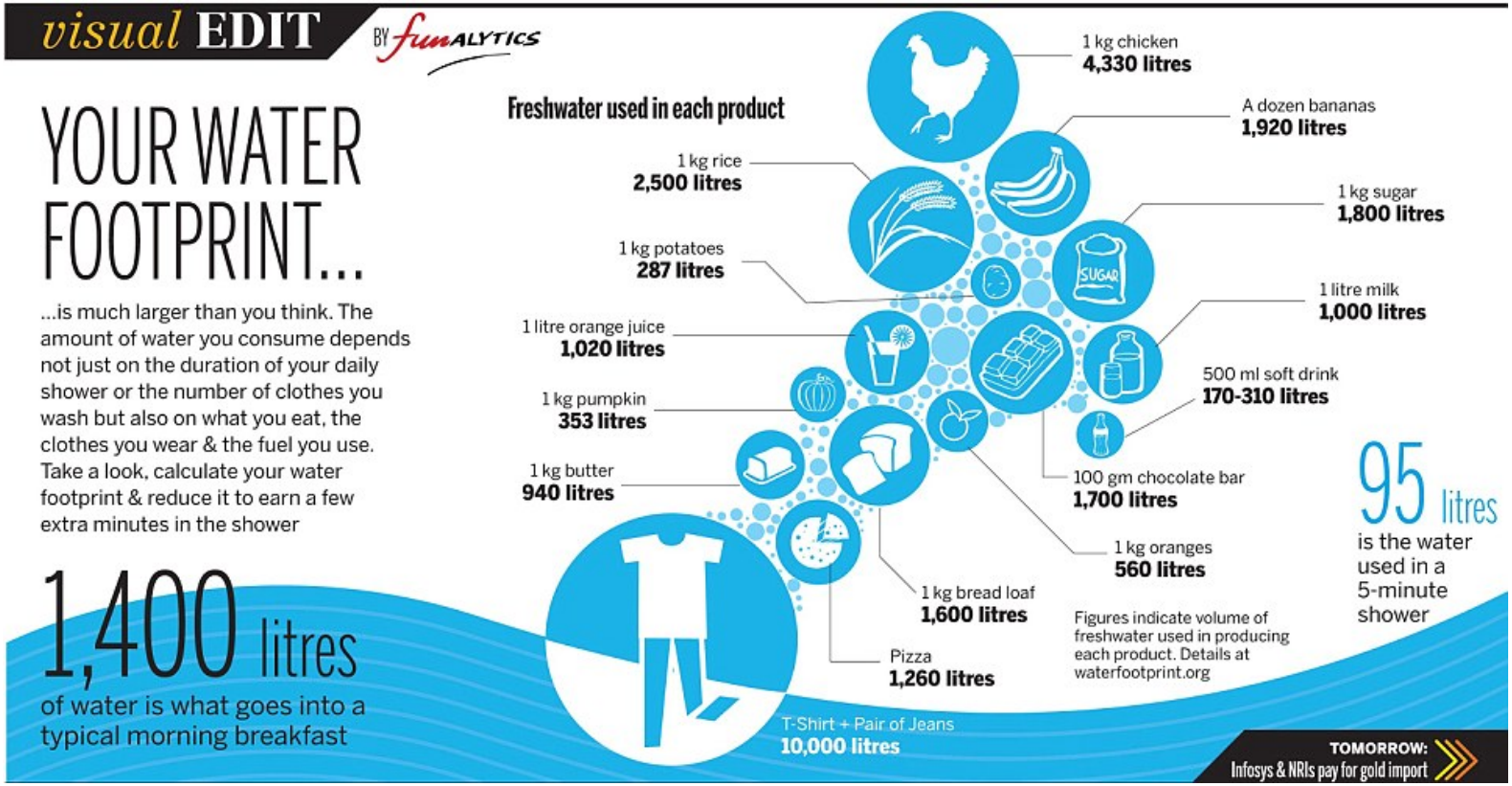
…..that's a LOT of water!

But that is not all – to support our standard of living we depend on much, much more water to produce the food, energy, clothes, infrastructure, buildings, etc., etc.



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Two Additional Key Drivers/Challenges:

1. Unequal access to water services worldwide: *is it right that more than a **BILLION** people, mostly in the developing world, lack access to basic water services?*
2. Climate change: *many world regions are predicted to experience lower annual precipitation, delivered in fewer, more intense storm events.*

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These are some of the challenges that researchers at UWE, Bristol are attempting to grapple with, through the…

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This project is funded by Lloyd's Register Foundation, a charitable foundation helping to protect life and property by supporting engineering-related education, public engagement and the application of research.

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Water security is defined by the UN as "the capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."

Water security is an ever more important global issue, of relevance and importance to individuals, businesses, governments and organisations.

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IWSN visits Reno to discuss mountain water towers
The marvel of drinking water
IWSN on the move in South America
Introducing Rossi Taboada

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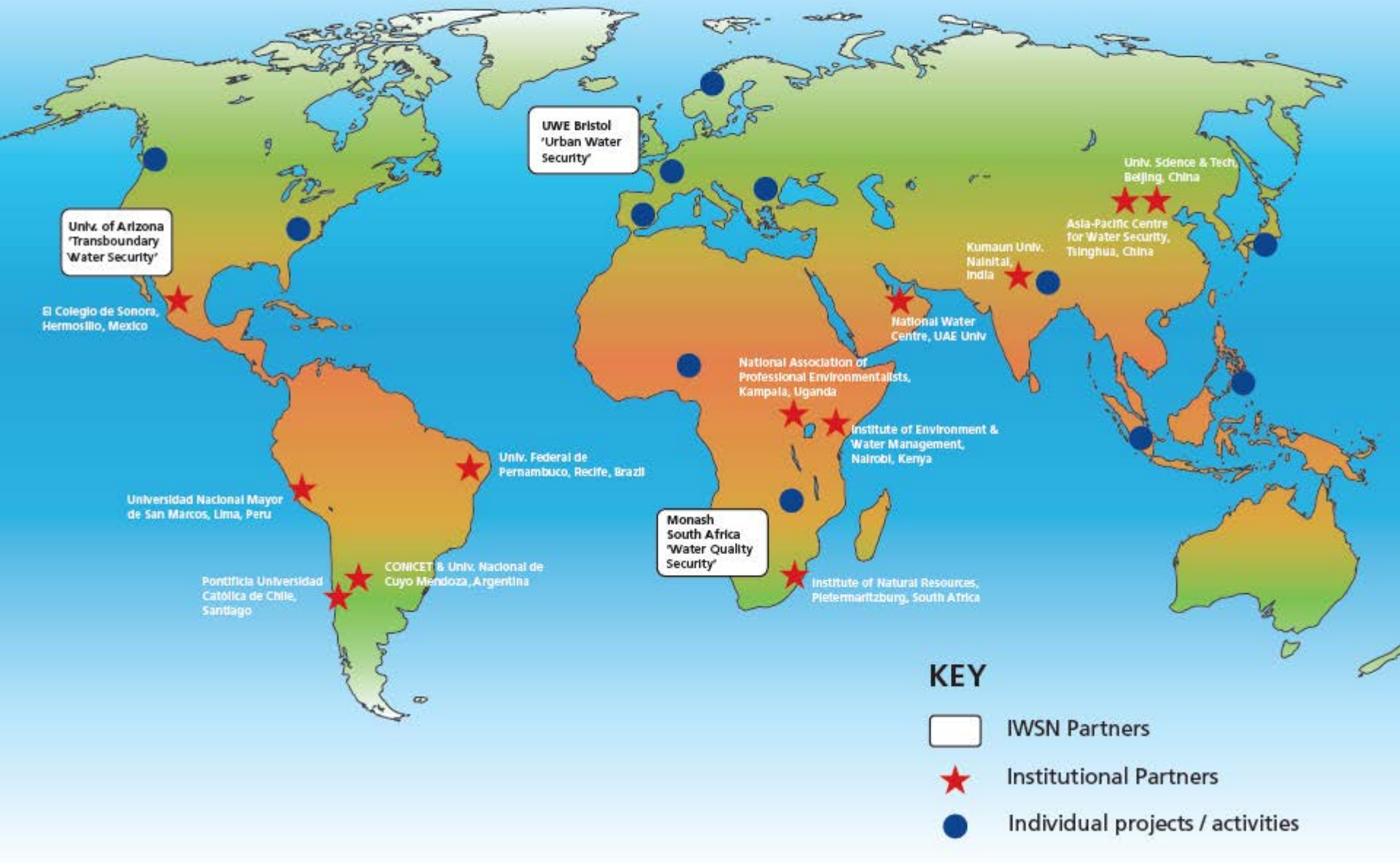
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'Urban Water Security'
Univ. of Arizona
'Transboundary Water Security'
El Colegio de Sonora, Hermosillo, Mexico
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Universidad Nacional Mayor de San Marcos, Lima, Peru
Pontificia Universidad Católica de Chile, Santiago
CONICET & Univ. Nacional de Cuyo Mendoza, Argentina
Monash South Africa 'Water Quality Security'
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National Association of Professional Environmentalists, Kampala, Uganda
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Kumaun Univ. Nainital, India
Asia-Pacific Centre for Water Security, Tsinghua, China
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Individual projects / activities

There are solutions to the growing challenges of water insecurity around the world

Let's look quickly at a few examples

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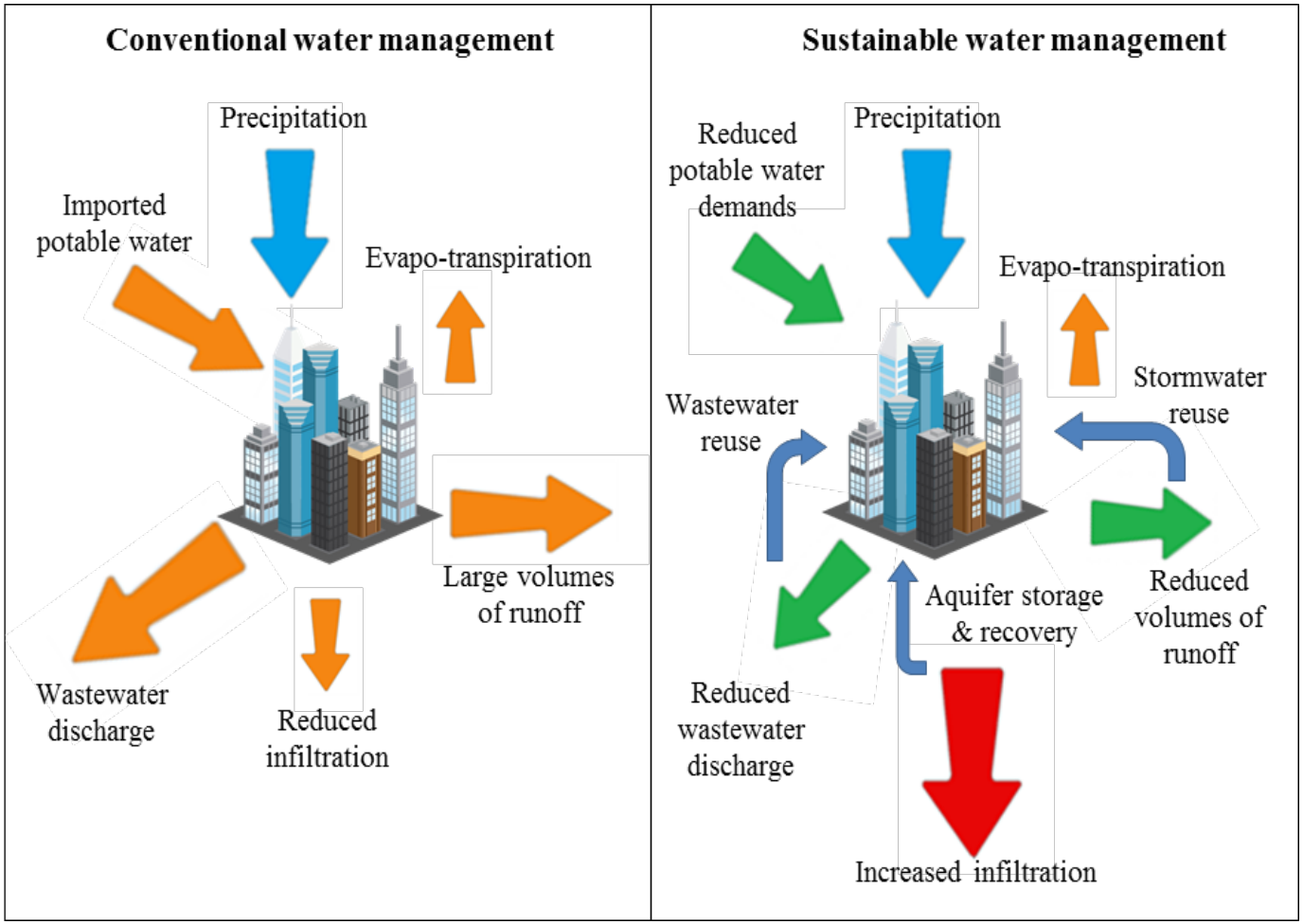
1. In cities more users are served per unit length of underground network!
2. Possible (but not yet common) to include water in development planning
3. Green infrastructure: permeable paving, urban green spaces, passive heating and cooling, rainwater harvesting, etc.
4. Wastewater re-use is “more than” possible



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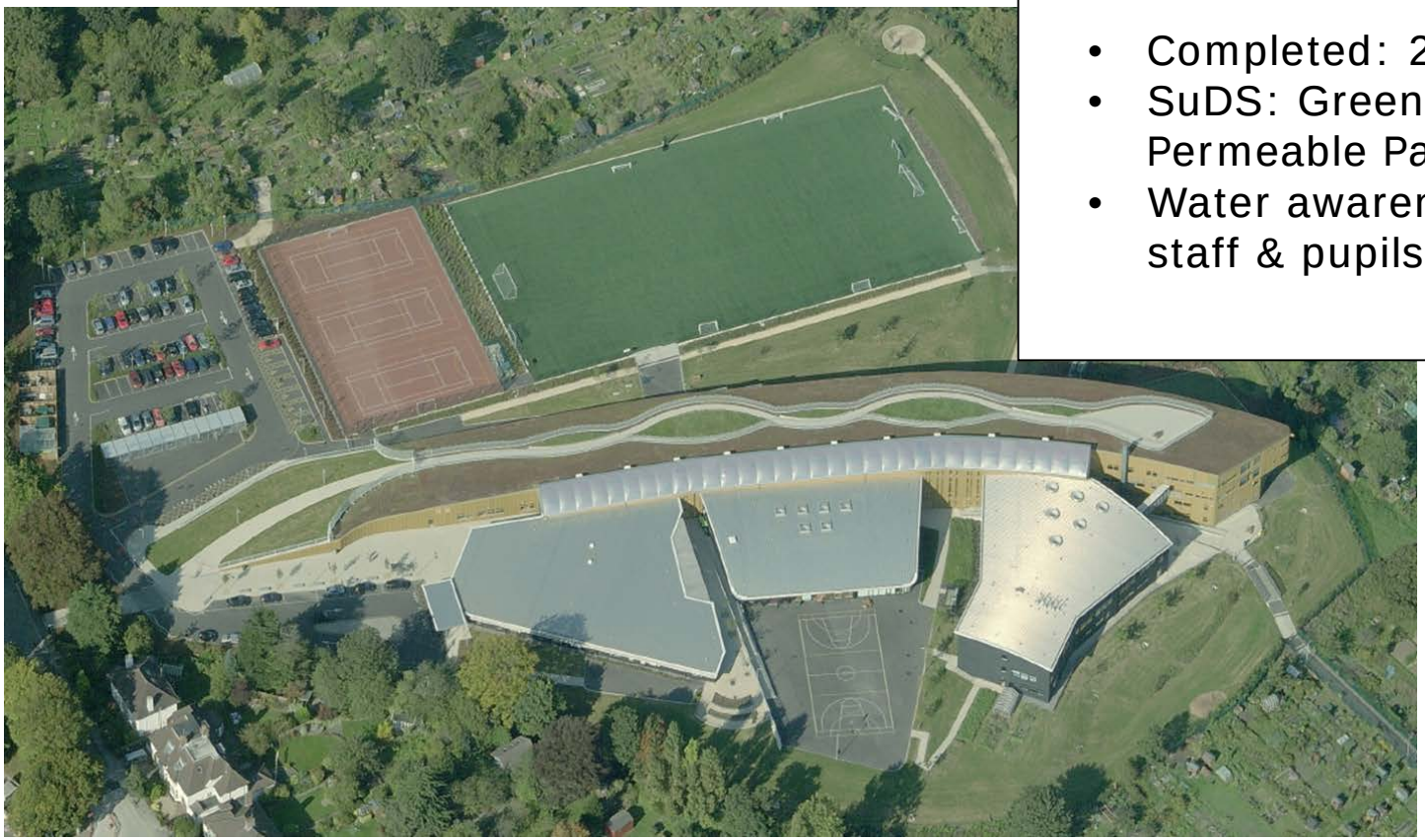

Redland Green School, Bristol, UK

- Completed: 2007
- SuDS: Green Roofs, Swales and Permeable Paving
- Water awareness education for staff & pupils

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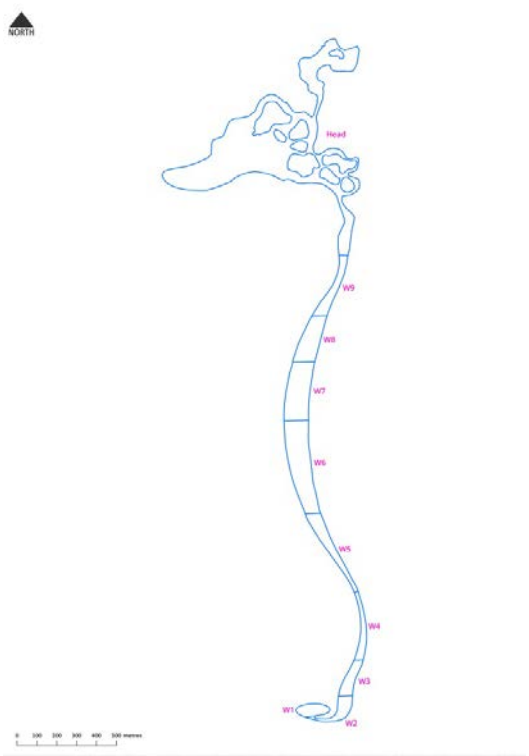
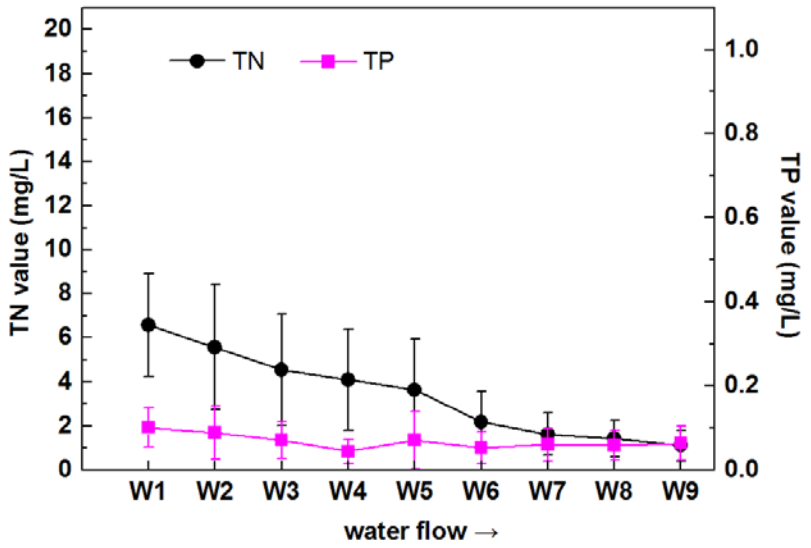


with Dragon Lake and



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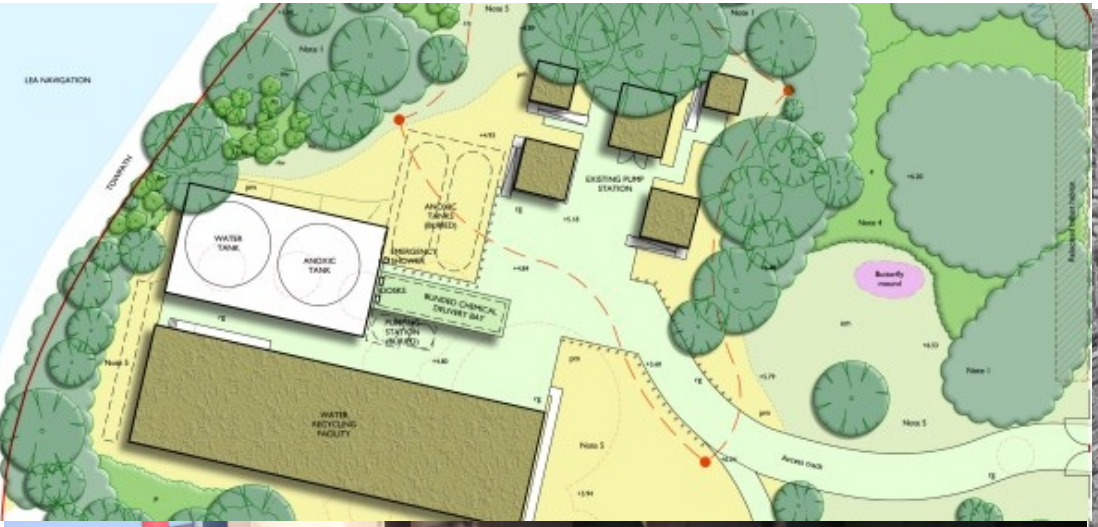
Wastewater recycling

1. Partial (non-potable) reuse



Wastewater recycling

1. Partial (non-potable) reuse)
2. Full (potable and non-potable) reuse: Singapore's "Four Taps"

"The best experience of my life": UWE student reflects on his rainwater harvesting research in Uganda

By: Josh Rogers on 2nd Feb 2016

Josh Rogers is a third-year BA (Hons) Geography student at UWE, who travelled to Uganda in the summer of 2015 as part of the UWE-Africa Water Security Programme.

My placement to Uganda has undoubtedly been the best experience of my life, to date. Not only was I able to conduct research for my final year dissertation but I was also given the opportunity to observe new cultures and have new, challenging and thought provoking experiences over the three month period. My dissertation, which aims to assess adoption trends of domestic rainwater harvesting in rural central Uganda and thereafter examine hygiene and sanitation practices, was able to develop significantly during the placement and it was thoroughly satisfying to gain invaluable field experience and develop my research techniques before the start of my final year. Moreover, knowing that the work produced could be beneficial to NGOs in Uganda was decidedly humbling and focused my research accordingly.

Conducting interviews in Luweero District

Uganda was chosen for this research primarily for its climatic conditions and its level of development. I was based in Kampala, the capital city, and travelled into rural areas where possible to conduct research. Coming to Uganda as an individual, as opposed to with an organised trip, provided the placement with an intensive learning experience and a

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Latest news

The 'Third Pole': A monitoring and assessment programme to sustain the Hindu Kush Himalayan Region as a global asset

"The best experience of my life": UWE student reflects on his rainwater harvesting research in Uganda

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UWE student reflects on filming his documentary on water pollution in Uganda

The Converging World: The social and environmental impact of convergence

Archives

February 2016

January 2016

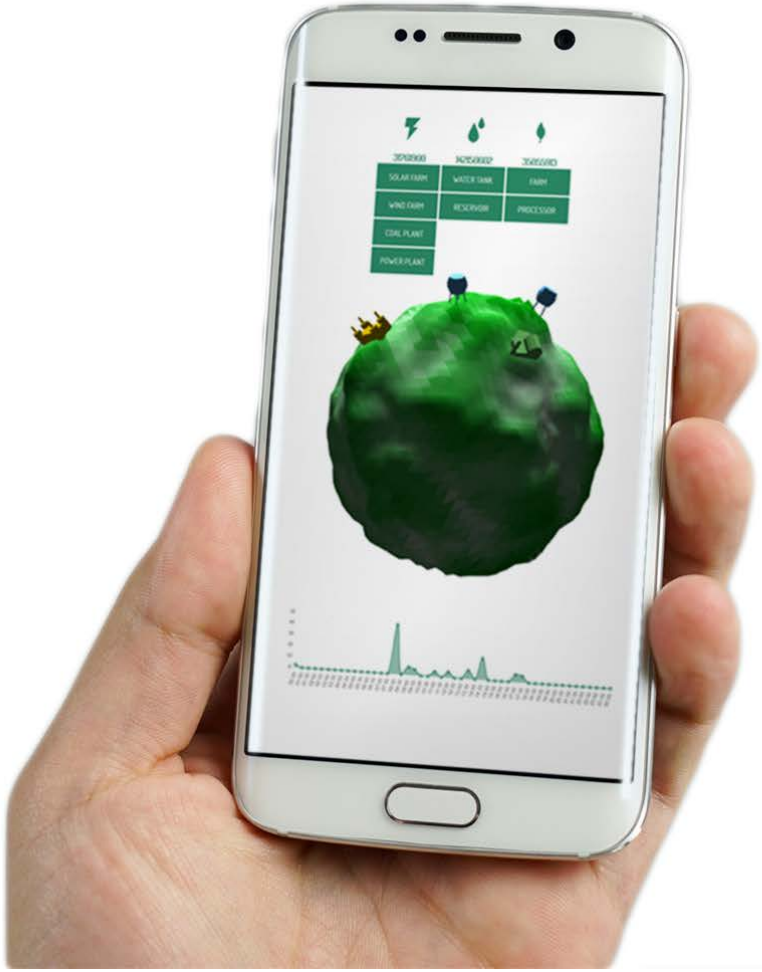
December 2015

November 2015

October 2015

Initiatives for 2015-2016:

- Repeat of earlier tests with qualitative follow-up
- Gamification of water behaviour
- Hot water (=cold water + energy)



#PlanetPocketGame

Pocket Planet

The Wallscourt Village Game

SAVE WATER → PLAY → PROSPER

Play Pocket Planet, save water from your household and become the best planet farmer.

Pocket Planet is the first pilot to measure the effectiveness gamification to change people's behaviour to water usage.

We are looking for focus group participates discuss their thoughts on; **1.Design 2.Usability 3.Gameplay 4.Appeal** free food included.

Visit the **Pocket Planet** website to take part **19th October** to **22nd October** and **26th October** to **29th October**.

http://thinkh2o.co.uk/upload/**pocketplanet**.html

Feel free to email Christopher Light on **chris2.light@uwe.ac.uk** for further questions.

Thanks!

– and please get in touch for more information!

www.watersecuritynetwork.org
www.twitter.com/water_network

The project is funded by Lloyd's Register Foundation, a charitable foundation helping to protect life and property by supporting engineering-related education, public engagement and the application of research.
For more information, see: www.lrfoundation.org.uk

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