WE MUST CONFRONT LOOMING WATER SHORTAGES

MARK HANSFORD
EDITOR

Water regulator Ofwat may not like it, but temporary use bans and drought orders are real and are in the 10 year plans of water companies as they prepare for life without additional resources in the near to medium-term.

This is the strange world of UK infrastructure policy. Much hysteria is generated by high profile projects like High Speed 2 – a project that has always had a challenge demonstrating its value and benefit and is feeling the heat again with news that the first projects to be let are already running more than £1bn over budget (see p6).

Yet almost no heat and no hysteria is being generated by the fact that Southern Water, for example, is telling Ofwat that supplies will remain “at risk” until “sufficient alternative supplies are delivered” and that on the basis of the environmental conditions it expects to encounter before 2027, the people of Hampshire are going to have to get used to temporary use bans. It remains a fascinating yet bizarre fact that the last major public water supply reservoir to be built in the UK was Cawston in 1991.

It is a curious anomaly. The National Infrastructure Commission (NIC) is in the hot seat here. It is poised to publish its long-awaited report setting out the UK’s infrastructure priorities once and for all, and has already indicated that tackling the water resources issue will be high on the list.

Ofwat is sticking to its traditional guns and telling water companies they must redouble their efforts (again) to tackle leakage and reduce demand through metering. But as we report this month already much is being done to tackle leaks – even to the extent of using Snipe the cocker spaniel to sniff them out. And the notion of metering cutting individual water use from roughly 140 litres/day to between 50 and 70 when water remains, frankly, as cheap as chips seems a flight of fantasy.

The NIC certainly thinks so, and said so, in April, when it politely suggested to Ofwat and the water companies that their plans demonstrate “limited ambition for improved long term resilience.”

It pointed out that with current plans there is about a 1 in 4 chance over the next 30 years that large numbers of households will have their water supply cut off for an extended period because of a severe drought. Tackling this in a panic would cost up to £40bn, it calculates.

Instead it suggests a programme of supply infrastructure investment starting in the next regulatory period in 2019 and running through to 2029.

Whether anyone listens – be it the regulator, the government or anyone else – is going to be the first real test of the NIC since its formation in October 2015.

But of course this is not a UK-only issue. We report this month that Cape Town has its own resourcing problems and is, currently, pursuing similarly optimistic demand reduction measures. Around the world, whether it is South East England, Cape Town, California or Singapore, highly developed economies are struggling to plan for the water they need.

And that is the developed economies. As we also report this month, 2.1bn people around the world still lack safely managed drinking water. That is according to professor Stefan Uhlenbrook, director of the Unesco programme office for global water assessment, who spoke at the ICE in May as a precursor to the first Global Engineering Congress, an event being hosted by the ICE together with the World Federation of Engineering Organisations in October 2018.

It has the bold aim of unite engineers around the world in the quest to achieve the United Nations Sustainable Development Goals. As ICE engineering knowledge director Nathan Baker says: civil engineers are “in a unique and privileged position” to help achieve the SDGs. We are and it is time to act here in the UK and around the world.

Mark Hansford is New Civil Engineer’s editor

There is about a 1 in 4 chance over the next 30 years that large numbers of households will have their water supply cut off for an extended period
TIME TO BE STRONG

Regulator Ofwat wants lower water bills but that could come with the risk of drought orders. The National Infrastructure Commission wants water transfer systems to guarantee supply in the next decade, but at a cost. The battle is on for the future of water policy. By Jackie Whitelaw.

Water Resilience

Who thinks standpipes in the street should be a main plank of a water supply strategy in the future? Not many, I’d imagine. Yet temporary use bans and drought orders are some of the solutions being put forward as options by water companies in the water-stressed areas of England’s south and east in order to match too little supply with too much demand. And with drought orders there is always the fear of standpipes.

This is not a risk just for the distant future but for the next decade.

The English water companies are currently in negotiation with regulator Ofwat over pricing for AMP 7 which includes agreeing capital investments for 2020 to 2025, informed by their draft water resource management plans (WRMPs). These look at what is needed to provide secure water supplies to businesses and homes for the next 25 to 50 years. In December, Ofwat will set the final price limits for 2020 to 2025, effectively setting in stone the plans for those five AMP 7 years.

Pressures on supply include climate change, population growth and a reduction in the amount of abstraction from river and ground water sources resulting from new environmental strategies. These include obligations to maintain catchment river flows and habitats along with new abstraction parameters required by the European Union Water Framework Directive after 2027 which, Brexit or not, are expected to be complied with.

Alongside, Ofwat is guiding the water companies to focus on leakage control and demand reduction rather than major infrastructure during the price negotiations. Its aim is to achieve lower bills for customers in the next AMP period. Given the time it takes to build pieces of water civil engineering, AMP 7 funding will also affect what is deliverable in AMP 8 (2025-2030).

As an example of the problem, the companies and consumers in the south and South East are facing, here is what Southern Water has to say about next 10 years in Hampshire in the west of its region. “... our supplies to customers will remain at risk during the AMP7 period and into AMP8 until sufficient alternative supplies are delivered. On the basis of environmental conditions we expect to encounter before 2027, we have forecast that we will need to implement temporary use bans in Hampshire and to apply for drought restrictions.”

We have forecast that we will need to implement temporary use bans in Hampshire and to apply for drought orders (in some areas).

THE STRESSED SOUTH:
EXISTING WATER TRANSFERS

<table>
<thead>
<tr>
<th>Scheme Description</th>
<th>Volume of water (million litres/day)</th>
<th>Estimated date when needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. New reservoir at Alkington and associated transfers</td>
<td>281</td>
<td>2020 to 2025</td>
</tr>
<tr>
<td>2. Water use at Maglar, transfer to Tedington and new abstraction above Tedington Weir</td>
<td>268</td>
<td>2025 to 2030</td>
</tr>
<tr>
<td>3. Water use at Deepsham</td>
<td>45</td>
<td>2025 to 2030</td>
</tr>
<tr>
<td>4. New desalination plant at Bexley</td>
<td>142</td>
<td>2030 to 2035</td>
</tr>
<tr>
<td>5. Expansion of Copper-mills treatment works and extension of London ring main</td>
<td>100</td>
<td>2025 to 2030</td>
</tr>
<tr>
<td>6. Purchase of an existing groundwater source in Medway from a third party</td>
<td>20</td>
<td>2020 to 2025</td>
</tr>
<tr>
<td>7. New reservoir at Haverthorpe and associated transfers</td>
<td>36</td>
<td>2025 to 2030</td>
</tr>
<tr>
<td>8. Affinity Water Complex</td>
<td>18</td>
<td>2020 to 2025</td>
</tr>
</tbody>
</table>

Source: Water Resources South East. From Source to Tap: The ACTION IS NEEDED TO ASSURE LONG TERM SUPPLY: Recommendation – All England

Current resilience – All England

| 4bn litres/day | 52% | Building new supply infrastructure |
| 3bn litres/day | 32% | Leakage reduction |
| Additional capacity per day | 34% | Demand management |

Source: National Infrastructure Commission: Preparing for a dry summer

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orders (in some areas)."

The focus on demand management and leakage reduction planned for AMP7 is all to the good. Reducing demand will play as vital a role in securing future supplies as any new resource infrastructure. "It is essential from the environmental, cost and time perspective," says Mott MacDonald practice lead for water resources management Sally Watson.

Ofwat has set the companies a target of reducing by 15% the 3bn litres/day lost through leakage. It wants increased metering to encourage individual water use to fall from 140litres/day to between 50litres/day and 70litres/day by 2050.

"And there is a lot of interest in making the assets companies already own work better - so they are more efficient, break down less and use telemetry to get more out of what we have got," says Stantec technical discipline lead for water resources Rachel Dewhurst.

"But in terms of much of the major infrastructure needed, under current proposals the next five years will be mainly about the planning."

After that, in AMP 8, the draft WRMPs reveal there will be some "new water" infrastructure works but the bulk of the desalination plants, water reuse and recycling facilities and reservoir work for resilient water supplies are slated for the years after the mid 2040s, pushing the cost of the big ticket items into the future.

Until then, the spectre of drought will always be looming. "There was serious concern in the South East in 2012, if you remember," says Stantec water group director Paul Dally.

"Luckily we then had a wet summer but alarm bells were starting to ring at government level."

Those bells are still ringing and...
This should encourage a more dynamic and transparent market, bringing down costs for customers

them with the much higher costs of emergency response.

The question is whether we plan now to spend $200bn spread sensibly over the long term or do we end up spending $50bn later in panicked spending following an emergency?

The NIC’s central finding was that government should ensure increased drought resilience in England by enhancing the capacity of the water supply system via a twin track combination of demand management and investment in supply infrastructure to increase by a third the 3,000ML/day resilience in the system to 4,000ML/day.

To cope with imminent drought threat, the NIC recommends that Ofwat launch a process to seek solutions by the end of 2019, complementing the price review, so that at least 1,300M litres/day resilience is provided by 2030. Alongside that it wants the water industry to be targeted to halve leakage by 2050 and to introduce compulsory water metering countrywide by the 2030s.

The focus for the solutions for 1300ML litres/day water supply by 2030 should be, the NIC said, water transfers, currently the Cinderella of national water supply.

These currently account for about 4% of total supply capacity and are largely within local boundaries either within those of a water company or in a regional grouping of companies such as Water Resources South East (see graphic).

Transfer systems can move water from areas with surplus to those where it is needed.

"New storage could be provided in a wider range of places, which can reduce costs and increase the likelihood of timely delivery," the NIC says.

"This should encourage a more dynamic and transparent market, allowing a wider range of options to be identified and bringing down costs for customers."

The NIC has estimated that strategic transfers via new pipelines and the canal network could potentially provide about 700ML/day of its required total, with the rest from other supply infrastructure.

It raises the suggestion that English water supply must be planned cohesively rather than in independent fields.

"The scale of this infrastructure goes well beyond that seen in the plans currently proposed by water companies," NIC said in the report. "It is likely to need strengthened regional approaches and perhaps an independent national framework."

Ofwat responded to the WRMPs in mid June. On resilience it said: "some draft plans did not sufficiently convince us that they will meet future drought and non-drought hazards effectively."

The regulator also noted that "Government is currently considering its response to the NIC recommendations. We are also considering the NIC’s analysis and expect companies to reflect on them as they finalise their WRMPs."

Negotiations will be interesting.
TIPPING POINT

It is time for water regulation to switch focus to making the sector a leading player in the circular economy. Jackie Whitelaw reports.

Water Resilience

We are at a tipping point in the direction the water industry chooses to take," says Black & Veatch Water Europe executive managing director Scott Aitken. "Is it lower bills now but the risk of significantly higher prices later to fund the infrastructure we need to guarantee supplies? Or do we spread the cost more fairly over the generations?"

Regulator Ofwat’s focus in the current price review discussions for the next Asset Management Plan spending period between 2020 and 2025 is very much about delivering lower bills. But at the same time the industry and the country need to be considering how to mitigate the impact of population growth and climate change and make sure we have the water resources our children will need, Aitken explains.

He is 100% behind the National Infrastructure Commission’s recent report Preparing for a drier future, which urges Ofwat and the water companies to consider in their near future plans some more long term strategic investment, particularly in water transfer, that would save billions of pounds over the next 50 years (see p34). Investment of £20bn now would be half the £40bn price of doing things later, NIC says.

"I am concerned about the inter-generational risks of making decisions that will pass excessive costs on to the next generation so we can have cheaper bills now," says Aitken. "At the moment regulation is incremental and costs are controlled in an incremental way, with Ofwat signalling it wants lower bills. But for an increase of £10 per household we could invest more strategically in infrastructure and create national and local networks that would mean people would not be laced with drought. I am worried that Ofwat is not thinking like that."

"Reactive spending following a"

For an increase of £10 per household we could invest more strategically in infrastructure.
future drought is always going to be more expensive than considered investment over time.”

Affordability, customer engagement, resilience and innovation are the four pillars of the PR19 price review discussions.

“That’s as it should be,” says Black & Veatch consulting services director Mat Fairfax. “All the future projections say that demand management is as vital as new resource options. But circular economy solutions that involve reuse and transfer – not just within regions but with those who have more than they need – should be just as high a priority.”

There is so much more reuse and recovery work that could be factored into plans for the near future, Aitken says. “Waste water treatment plants are production factories. Yes they are there to treat waste but there are opportunities to produce energy and recover nutrients such as phosphates without which we can’t grow food, as well as recycling water back into the supply side of the system.

“With a basket of measures and strategic planning we wouldn’t have to spend a lot of money later that would mean bills increase sharply in the future,” he says.

Aitken and Fairfax both point to Singapore as an example of what England, and in particular East Anglia and the South East could achieve.

“We talk a lot about drought and scarcity in these regions but in reality we should change the conversation to one about a drying climate. We can learn some good lessons from places, like Singapore, with limited water resources,” says Fairfax.

Black & Veatch has been involved in development of the country’s water supply systems since 1922. Its Singapore office is the company’s global design centre for water and a centre for excellence for desalination.

A severe drought in 1963 pushed the Singapore government to recognise that its future economic success depended on a stable water supply. “A drought in London, where the Underground had shut because it had to cut off its sprinkler system and office towers closed because they had no air conditioning would cost the city’s economy $300M a day, that’s $1.5bn a working week,” Fairfax points out.

In Singapore water supply underpins every government decision. “Every other policy had to bend the knee for water survival,” said prime minister Lee Kuan Yew in 2008, looking back on how the policy had developed.

Most wastewater is now reclaimed and recycled at facilities such as the Jurong Water Treatment reclamation plant designed by Black & Veatch. Latterly desalination has been added to the mix, with the country building the second largest seawater reverse osmosis plant in Asia dealing with 318,500m³/day.

Construction of the Marina Barrage turned Marina Bay into an urban reservoir as well as the centerpiece of a new financial and business district.

And Singapore’s Ulu Pandan wastewater treatment and water reclamation plant is winning global awards for processes that reduce energy use and maximise biogas production for energy generation.

Black & Veatch in partnership with Aecom is consultant for the plant.

“We are at a tipping point, yes,” notes Aitken “but that makes it a very exciting time to be involved in the water sector here.”

INNOVATION

Innovation is the glue that will hold all future developments in water together.

Black & Veatch has been working with Yorkshire Water on its Waterstream 69 lean reliability centred management (LRCM) programme for all its assets. LRCM looks at what a process is intended to do, what factors stop the process from delivering and then works to mitigate those factors, with interventions happening at optimum cost point rather than the higher costs of repairs following a failure.

So far it is proving to be 31% cheaper than reactive maintenance.

The firm is also working with another water company on an app to anticipate pollution risk from storm events and stop storm water pollution outflows into rivers by identifying preventative maintenance and network management regimes. In the last 18 months, since the app has been in use, there have been no stormwater pollution events.

And on a broader industry basis, Black & Veatch’s Innovation Platform is working with water companies, municipal authorities and technical experts to support the circular economy. Technologies for reuse of municipal wastewater, fatberg oil and grease, industrial wastewater and organic municipal waste are being explored.
PLUGGING THE LEAKS

Dogs, drones and smart meters are all being deployed to tackle the enormous amount of water the UK wastes. Fiona McIntyre reports.

Last month the Environment Agency piled pressure on water industry engineers to tackle the 3bn litres of water lost every day through leaking infrastructure.


"We need to change our attitudes to water use. It is the most fundamental thing needed to ensure a healthy environment, but we are taking too much of it and have to work together to manage this precious resource," she says in the report.

"With demand on the rise, water companies must invest more in infrastructure to address leakage instead of relying on abstraction and the natural environment to make up this shortfall."

Water companies are already under
Transient pressure waves will go along and expose that weak point and cause a burst or a leak.

pressure to reduce water waste, as water regulator Ofwat has set them the goal of reducing the amount of water lost to leaks by 15% between 2020 and 2025.

Although a 15% decrease of 2bn litres per day does not sound that impressive, Anglian Water optimisation project engineer Finn Boyle explains that reducing leaks is much harder than it seems due to the country’s ageing pipe network.

“We have pipes in the ground that were installed 100 years ago and are still working fine; we have pipes that were installed 80 years ago and are in terrible condition.”

Thames Water head of water networks Tim McMahon adds that only 2% of leaks in the company’s network are visible while 38%, or 50,000 each year, are underground and difficult to locate.

“It shows we do a lot more practical work on the network which people don’t necessarily see,” says McMahon.

So how are water companies trying to reduce leakage in such challenging conditions?

Anglian Water is the first water firm in the UK to look at using drones to detect leaks using thermal imagery. The company is also using near-real time hydraulic models to help it better respond to leaks and bursts, and to better plan for future bursts.

It is also trying to educate commercial customers to “be a bit more gentle” with their water use to save pipes from bursting: a sudden change in flow of just 10% within a pipe can cause a pressure wave capable of travelling several kilometres in just one second.

“At any of those points which are just about to go due to the age of them, the transient pressure waves will go along and expose that weak point and cause a burst or a leak,” says Boyle.

Thames Water has reduced leakage by a third since 2004, and was recently granted an extra £200m by its board to find and fix more leaks. It has installed 26,000 acoustic loggers mostly in central London, to help pinpoint leaks. These detect noise generated by breaks in cast iron pipes to help engineers locate them much quicker.

Thames Water also has the second biggest smart metering programme in the world, feeding customer usage data back and alerting engineers to anything unusual.

But the quickest solution comes from United Utilities, which serves north west England.

Ex-military dog trainers have taught a Cocker Spaniel named Snipe to sniff out underground leaks in rural water mains. The dog can detect traces of chlorine used to disinfect water supplies, saving engineers time and helping them bring down the amount of water lost to leaking infrastructure.

“The north west of England is a notoriously wet region, and sorting the leaks from the puddles especially out in the fields can be a real challenge,” says United Utilities leakage manager Hannah Wardle.

“Snipe is proving to be an invaluable asset to the team and he’s already finding a lot of leaks for us.”

We have pipes in the ground that were installed 100 years ago and are still working fine; we have pipes that were installed 80 years ago and are in terrible condition.
SMART WORK

Clancy Docwra is combining its 60 years of water industry expertise with the latest technology to transform working practices and tackle leakage.

Water Resilience

Contrators have always known that the operational knowledge and experience of their operatives, built up over time, is as valuable in the field as anything. Now Clancy Docwra has the evidence to prove it.

Northumbrian Water invited the firm to a hackathon — an event which investigates how technology can be used to transform every day practice. In this case, the focus of the day was on predicting leakage.

“We went to the day with IT firm Dootrix with the aim of combining their technology knowledge with our operational understanding of the challenges of leakage management,” says the Clancy Docwra associate director Ronan Clancy.

“We were given the historic data for leak accuracy and asked, what can you do with it?”

Clancy Docwra was the only contractor at the event alongside technology companies.

“With Dootrix crunching the data and our teams’ knowledge of the area along with their understanding of the weather effects in particular spots, we predicted leaks [against actual events] with 95% accuracy. We won the show.”

The contractor has been working with water utilities for 60 years this year, starting with groundworks services, but now, as the sector has evolved, operating as part of a collaborative partnership with its key clients.

That is allowing the contractor to share its knowledge and develop new ways of using it.

The combination of technology and under-the-ground understanding of water company networks is going to be a key part of the five year AMP 7 period from 2020. Ofwat is targeting water conservation during its current price review negotiations — known as PR19 — with the water companies. Reduction in the current 3bn litres a day lost through leakage is inevitably a focus of these talks.

“The future is going to be much more about predictive maintenance, finding leaks before they happen,” says Clancy Docwra chief operating officer Matt Cannon.

“There will be more focus on understanding flow and interpreting information from sensors; less of two people driving around in a van and fixing stuff. We need to be leading that.

“We are trying to focus on more forward thinking: how we can use artificial intelligence and data and align that to our core operation? Can we offer something new and different? We are getting there by working with internet technology companies. It’s very exciting.”

The PR19 focus is also on affordability for customers which means the water companies will be looking to reduce their costs with more efficient working practices.

A typical water region in England and Wales can incur labour costs of up to $10M a year in leakage.
management. But by working with DoItrix, Clancy Docwra predicts that technology has the ability to halve this cost through more efficient use of resources. It has developed a pioneering tool using live, secure, two-way video links between site, experts and clients to get second opinions on investigations and remove the need for clients to visit sites to authorise each job.

Evid, as it is known, was developed first for the company’s work with Southern Water. It is now being trialled on Clancy Docwra’s contract with Anglian Water.

Evidence from the Southern Water work has shown that Evid has delivered £50,000 savings in year one by accelerating decision making and reducing labour costs.

It has saved an average of an hour per job — amounting to 740 working hours already in 2018. The site teams have adopted the tool enthusiastically, creating 150 videos daily and 7,000 since October 2017.

“It has demonstrated a step change in established working methods,” says Clancy.

Clancy Docwra derives around 70% of its £200M annual turnover from water utilities, helped by its share of £1bn of work from the KCD alliance with Kier for Thames Water. It employs 2,500 people directly and another 1,900 through its supply chain.

“We are a family business and we have a lot of families working here – mothers, fathers, sons and daughters,” says Cannon. “Two hundred of our work force have been here over 25 years.

“Founder Michael Clancy died in 1987 but his sons Kevin and Dermot have been running the company for 30 years. The workforce and our clients can see the next generation coming through. We think clients like that we are agile and family run, that they can ring the bosses any time.

“Our challenge is to replicate the family feel as we grow. It is important that it feels like that.

“Our sector has seen huge consolidation but we want to stay family owned. And we don’t want huge borrowings. Our growth will come in a sustainable way.”

As water enters another peak of activity, the Clancy family and their Clancy Docwra business plan to continue their story in the sector.
RUNNING ON EMPTY
What pushes a major city to the brink of running out of water? Jillian Mock explores the lessons learned from approaching Day Zero in Cape Town.

Water Resilience

In early 2018, people around the world prayed for rain in South Africa. Outside Cape Town, the city’s reservoirs were down to 26% capacity. Inside the city, officials begged people to use just 50 litres of water a day – around a third of what the average Briton uses daily. Cape Town’s government said it would have to shut off drinking water to homes across the city. The police worried about riots.

By April, it became clear the city would just about avoid reaching “Day Zero”, the date when Cape Town was forecast to run out of water.

The world breathed a cautious sigh of relief. Cape Town’s predicament received a lot of attention as people across the globe grappled with the idea that a major city could run out of water – and wondered whether they could be next. Experts say the water supplies of Africa’s four largest cities – Cairo, Kinshasa, Lagos and Johannesburg – could all be similarly strained soon, as could Karachi, Lahore, Mumbai and Kathmandu in Asia.

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Number of litres of water per day that Cape Town residents are being asked to restrict themselves to

Delhi is already struggling, and wealthier cities like Beijing and even Los Angeles will also face long-term supply problems if global warming continues to reduce rainfall in their traditional water supply areas.

“Cape Town’s situation really should be a wake-up call for many cities,” said Betsy Otto, director of global water programs at the non-profit World Resources Institute.

“There are things cities can do right now, and should be doing, to prevent and insulate themselves against a similar fate.”

Otto and other experts say cities must carefully consider their water supplies from the demand side – how much water people use and waste – to the supply side – how much water the city physically has access to at any given time. Making water supplies more resilient requires foresight, political willpower and – particularly on the supply side – financial investment.

“If something hasn’t got political capital immediately then it really slips off the political agenda,” says civil engineer Holger Maier, who researches urban infrastructure at Australia’s University of Adelaide.

Maier is concerned about how easy it is for governments to put off big water projects until threatened by crisis.

Two factors will determine how vulnerable cities will be to water scarcity in the future: population growth and climate change.

Today, more than half of the world’s 7.6bn people live in cities, and by 2050, the United Nations predicts this will grow to 9bn people — two-thirds living in cities, with the largest growth expected in Asia and Africa.

Climate change, meanwhile, is expected to shift rainfall patterns, making wet areas wetter and dry areas even drier, according to the

“Cape Town’s situation really should be a wake-up call for many cities

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United Nations Intergovernmental Panel on Climate Change (IPCC). This means relatively dry areas like the southwestern United States, southern Africa, and western Australia will likely see even less rain fill their lakes and rivers. Droughts will probably intensify as well, according to climate scientists in the United States.

“There’s enough water in the world for everyone to have enough to eat and drink,” says Ian Makin, interim deputy director general of the International Water Management Institute, a nonprofit organisation that develops sustainable water use strategies for communities in developing countries.

The problem, he says, is that where and when that water is available “doesn’t match where people want to be”.

Many cities in dry regions rely on snow as well as rain. Snowmelt from the Sierra Nevada mountains in central California, for example, is pumped all the way to Los Angeles. But over the last two decades, the amount of spring snow has generally decreased in the Northern Hemisphere, according to the IPCC.

As a result, the western US is already seeing less snowpack and earlier snow melt in the spring. By the end of the century, scientists predict 40% less snow will accumulate each winter in the western US.

Past-growing megacities in the developing world are likely to have problems first, as urban infrastructure struggles to keep up with booming and “unprecedented” water demand, according to Timothy Williams, director in Africa for the International Water Management Institute.

These extreme water shortages can have damaging ripple effects. In Cape Town, Day Zero would have meant people waiting in long lines to receive daily water rations, which officials worried may have sparked rioting.

The time has come to turn words into action

The ongoing drought in Sri Lanka could be a prelude to severe food shortages. There are major public health concerns, too: if a city cannot deliver water, people may turn to unsafe supplies contaminated with diseases such as cholera, typhoid or dysentery. Sanitation systems could break down and cases of dehydration and heat stroke could soar.

Cities can adapt to these strains, says Maier. The first step is to start using water more efficiently – installing low-flush toilets, low-flow shower heads and fixing leaky pipes, says Allan Frei, a climatologist and deputy director of the Institute for Sustainable Cities at CUNY Hunter College. New York City reduced its water consumption from 8.8bn litres a day to 4.3bn litres a day just by plugging leaks and installing low-flow devices, says Frei. “That’s a huge savings.”

But cutting down on wasted water only goes so far. Cape Town won an award for its water conservation program in 2015.

These efforts, while important, did little to help the city in the face of this year’s extreme drought. At some point, water-stressed cities will have to turn to more expensive supply-side solutions, says Maier.

That means building new water infrastructure like desalination plants and water recycling systems – if they can afford them. A desalination plant in Israel, hailed by MIT Technology Review as the “world’s largest and cheapest”, cost $500M ($374M) to construct.

They can also take a while to come online – the Israeli plant started pumping four years after construction began.

It is hard to find the political motivation and financial capital to act against a threat that is still in the future, says Maier. But if cities fall to act now, they could be left out to dry.

“I think there’ll be more and more cases like Cape Town where there are crises,” Maier says. “People will start to think, ‘How can we prevent this?’”

This feature is provided by Scienceline, a project from New York University’s Science Health and Environmental Reporting Program.

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Engineers are to gather at the ICE-hosted Global Engineering Congress in October to discuss how to meet United Nations targets for increased global access to safe drinking water and sanitation.

Water Resilience

Better management of water resources and more efficient water use are essential to the delivery of universal access to clean water and sanitation, according to professor Stefan Uhlenbrook, director of the Unesco programme office for global water assessment.

According to Uhlenbrook’s research, 2.1bn people around the world still lack safely managed drinking water while 4.5bn lack safely managed sanitation services, presenting a global challenge for civil engineers.

Uhlenbrook delivered the 2018 Gerald Lacey memorial lecture at the ICE in May, presenting findings from his ongoing evidence-based review to establish the global baseline status of United Nations Sustainable Development Goal 6 (UN SDG 6) – ensure availability and sustainable management of water and sanitation.

He was speaking ahead of the first Global Engineering Congress, an event hosted by the ICE together with the World Federation of Engineering Organisations, to agree a worldwide response to deliver the UN SDGs in October 2018.

Uhlenbrook reported that all heads of United Nations member states have now agreed that implementing integrated water resources management (IWRM) is essential to the achievement of SDG 6. This would ensure that water resources are shared effectively among many competing demands, including across country borders. Only 38% of countries reported at least medium-high IWRM implementation in 2017/18.

Other recommended actions that would help progress towards SDG 6 include increasing water-use efficiency by reducing water losses, through measures such as tackling

Engineers are in a unique and privileged position to help achieve the UN SDGs

Millions of people lack safe drinking water within 30m of their homes
In October 2018, the ICE will host the first Global Engineering Congress (GEC) at ICE headquarters, One Great George Street in London.

The flagship event of ICE’s bicentenary brings together the world’s best engineering minds to agree a response to the pressing need for action on climate change, delivering clean water, sustainable energy and a connected world. The United Nations’ Sustainable Development Goals have been set to achieve a better life for those currently without access to these basic human needs.

Over the next two years the ICE wants to build a practical plan that allows the global engineering profession collectively to turn words into action.

Activities will include workshops, roundtable discussions, and exhibitions, as well as allowing networking opportunities and a governmental engagement programme. Wider discussions at the congress will consider how infrastructure and engineering can help alleviate poverty, promote responsible consumption and production, work towards gender equality and encourage worldwide health and wellbeing.

The event represents a unique gathering of the World Federation of Engineering Organisations, the American Society of Civil Engineers, the Canadian Society of Civil Engineers, the European Council of Civil Engineers, the Commonwealth Engineers Council, Engineers Australia and many more. As the world’s oldest professional engineering body, the ICE’s role is to facilitate this global debate.

The GEC offers five full days of multi-streamed content from over 100 speakers, including World Bank vice president - global themes Hartwig Schaefer; Royal Academy of Engineering president Dame Dowling; World Water Council policy and programmes director Danielle Guillard Picher; and Unesco head of gender section Saniye Gulser Corat.

The week-long congress runs from 22 to 26 October.

leakage in municipal distribution networks.

Currently, wastewater treatment uses 20% of the energy used by the water sector but by adopting existing energy-neutral technologies, wastewater treatment could become a source of energy production.

More and better quality data capture related to gender, income and migration status at regional and local level is also needed to deliver effective solutions.

Smart technologies could be particularly helpful in providing data from developing countries, even in regions that lack extensive infrastructure.

ICE engineering knowledge director Nathan Baker says civil engineers are “in a unique and privileged position to help achieve the UN SDGs”.

“The ‘water goal’ is essential for progress on all other SDGs, with sustainable water management enabling social development, such as improving health and reducing poverty, and promoting economic growth across many industries,” he says.

“Civil engineers are in a unique and privileged position and the ICE is committed to doing all it can to help the engineering sector develop practical steps to tackle SDG 6. The time has come to turn words into action,” he says.

Lecture attendees heard that 844M people still lack a basic drinking water service – access to drinking water within 30m of their home while 263M use a limited service. The latest findings from Uhlenbrock’s review also show significant subnational inequalities in basic drinking water services.

Meanwhile, over 2.3bn people lack basic sanitation services and only 27% of the population in the Least Developed Countries (LDCs) has access to soap and water for handwashing on premises. Meanwhile 892M people still practise open defecation and the world is not on track to end open defecation by 2030.

After three years of almost static growth in global CO₂ emissions, 2017 showed a 1.4% rise — bringing emissions to a record high of 32.5 gigatonnes. More carbon in the atmosphere means a more hostile climate, which in turn threatens vulnerable infrastructure. In the United States alone, the annual bill for repairs and recovery following climate-related disasters is estimated at around $300bn ($222bn).

Investors are increasingly aware that their money is at risk. Weeks before the Paris Agreement on carbon emissions reduction was signed in 2015, Bank of England governor Mark Carney outlined how the knock-on effects of climate change, including physical damage to assets and difficulties adjusting to a low-carbon economy, could create financial uncertainty by harming an asset’s value.

Carney also recommended better reporting of climate risks. “With better information as a foundation, we can build a virtuous circle of better understanding of tomorrow’s risks, better pricing for investors, better decisions by policymakers, and a smoother transition to a lower-carbon economy,” he said at the time.

“The more we invest with foresight; the less we will regret in hindsight.”

The financial industry sat up and listened. In 2016 the G20’s Financial Stability Board (FSB) set up the Taskforce on Climate-related Financial Disclosure (TCFD). It aims for voluntary, but consistent, disclosures of climate-related risks to help investors, insurers and others to make more informed decisions.

More than 230 organisations have signed up to the TCFD code. Although it is primarily designed to encourage investors to make climate-conscious decisions, in the long run it means capital will start flowing away from firms which are not contributing to the Paris Agreement’s aim of keeping temperature rises below 2°C.

Infrastructure companies will be particularly affected and water companies are leading the charge.

Anglian Water is already trying to align with the requirements of the TCFD by reducing the carbon used in building its assets by 70% by 2030, from a 2010 baseline. Looking ahead, it wants to be carbon neutral in its operations by 2050.

“Reducing carbon emissions reduces costs; it’s about business efficiency,” explains Anglian Water head of carbon and energy David Riley.

“There is a line of sight to customers at the end of this, that we are making the right decisions, operating the business in the right way.”

The government’s 2013 Infrastructure Carbon Review showed the infrastructure sector has full control of 16% of total UK carbon-based emissions and influence over a further 37%.

If firms do not show how they are contributing to climate change mitigation, as well as adaptation, investors will turn elsewhere says Ariva Investors head of infrastructure debt Darryl Murphy.

“They [large corporates] are going to find increasingly that if they’re not open and they’re not actually addressing these matters, institutional shareholders are going to act with their feet, in terms of not investing,” he says.

Murphy believes climate-related risk reporting will become increasingly important to investors, adding that companies which comply will make themselves more attractive.

Pensions Infrastructure Platform chief executive Mike Weston feels similarly about pension fund managers. “We’re not driving the change as such. What we are trying to do is to maintain the momentum and make sure that the investing pension schemes can get access to the sorts of investment that they want,” he says.

“We don’t want people to retire and take their pension, and not be able to live anywhere because we’ve destroyed the world.”

At the moment, reporting climate-related risks is voluntary, although the European Union high level expert group on sustainable finance has recently recommended mandatory reporting from businesses in the European Union. For Standard & Poors Global Ratings director Miroslav Petkov, the fact that those risks will be reported at all is beneficial.

“It’s going to take time to be really useful and insightful about exposure [to risk], but the other benefit is it in effect forces companies to go through the process of understanding their risks and qualifying their exposure. And this in itself is helpful,” he says.

As Mott MacDonald head of climate resilience Ian Allison explains, the TCFD will help firms understand what actions they must take.

“We won’t be able to fund resilience, particularly we will not be able to fund adaptation, unless we can account for those risks somewhere in our economy. And if we’re going to account for those, we’re going to have to disclose the risk: hence the importance of the TCFD,” says Allison.

“We have to take the disclosure and we have to act on it to lessen the risks we are dealing with.”

Anglian Water also understands that its assets must be resilient to climate change to protect customers, but the risks are different in different areas; a coastal asset will face challenges which might not affect an inland asset.

Riley explains how the firm is planning for the future, building resilience into its assets so they will still be reliable in 2025 and 2065.

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Institutional shareholders are going to act with their feet, in terms of not investing."
"If we look at those different time periods, it not only gives certainty in decision-making, it gives certainty to our supply chain so we can respond in the most appropriate way," he says, adding that although the forecasts might not be correct, taking action now is still incredibly important.

"Those changes in the climate around our region is something that we are responding to, and understanding how those changes are going to occur, when they are going to occur, means that we can put that plan in place as we are investing in our total investment process right now."

But it seems the public and private sectors are experiencing different levels of pressure to report climate risks. As Network Rail weather resilience and climate change adaptation strategy manager Lisa Constable explains, the way it and private investors identify risks is very different.

Network Rail sees risk varying from asset to asset, for example the risks posed to train services of floods and signal failures on a train timetable. An investor on the other hand would see risk in financial terms.

Constable says that as a public sector organisation, Network Rail does not currently experience much pressure to report climate risks.

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