



**Collaborative
working to
reduce
disruption.**

Collaborative working to reduce disruption.

We're passionate about reducing the impact our work can have on customers across our region. So we're working with gas, power and telecommunications providers, as well as Transport for London, the London Borough of Croydon and the Greater London Authority, to see how collaborating on planned streetworks can reduce the impact on the lives of all our customers, local communities and the environment, while still improving our services.

Background.

Over the past year we've been working with Atkins and their digital partner Fluxx, challenging ourselves to make improvements in the way we deliver streetworks to reduce their impact on our customers, and become more efficient by collaborating better.

We know that our essential streetworks can often disrupt our customers' daily lives, especially when a road reopens only to quickly close again for a different project, or for another company to start work.

From talking to our customers, we know that they want us to minimise the inconvenience of roadworks. Our customers see the need for roadworks to maintain and upgrade infrastructure, but they want planning, advance warning, co-ordination with other utilities and highway authorities, and clear information about the roadworks and how long they'll last.

We wanted to identify innovative and more efficient ways of working, so we hosted several workshops with teams across Thames Water, including our delivery alliance eight₂O, to explore how better collaboration might help our projects as well as our customers - including road users, residents, the highways authorities and local councils.

- **Working with others to help reduce the impact of streetworks on our shared customers, the environment and local communities**



Visualising complex data.

During our workshops with teams across Thames Water, we identified numerous benefits of sharing project information at the planning stage - including less frequent streetwork disruptions, less environmental impact, saving money, and better relations with our partners and customers.

However, sharing complicated early stage pre-planning information can be very difficult. This is because the information often isn't finalised yet, it's sometimes out of date as soon as it's published, and it often comes in multiple formats which are time consuming to understand and convert into useful data.

We looked at ideas from other sectors, particularly digital development, to try to devise smarter and more informed ways of working which get the best out of data and technology - making our processes easier while maximising the impact of the final work we do.

We've now identified a useful mapping tool, which we can use to upload data from many different projects and display it all on a single map that's accessible to all our project teams. We've named this tool 'ThamesConnect'.

ThamesConnect tool

This tool enables our teams to easily identify areas where lots of streetworks are planned, without needing lengthy analysis and deciphering complex formats. Our teams can use this map to coordinate projects and reduce disruption. Over six months last year, we saved £8 million through efficiencies including sharing contractors and reducing parking bay suspensions.

'ThamesConnect' now helps us to make better, more efficient decisions for our customers, and may even enable some projects to happen which would otherwise be cancelled due to disruption.

Expanding 'ThamesConnect'

After this success in mapping our planned streetworks, we wondered if it might be possible to extend the benefits beyond Thames Water to other utilities, transport authorities, highways authorities and other departments within London boroughs.

After a successful water mains replacement in Camden in 2016, when we shortened the duration of our streetworks by four months, simply by working more closely with other utility companies and the local authority, we're now testing this idea in the London Borough of Croydon.



We're actively engaging with gas, power and telecommunications providers, such as Southern Gas Networks (SGN), UK Power Networks (UKPN) and BT Openreach, along with Transport for London and the London Borough of Croydon, to test how we can work together more effectively to improve services, reduce impact on the lives of our shared customers, local communities and the environment.

Currently, we're exploring the feasibility of using a single contractor to carry out all planned works in a pilot area. We're trialling this on a six month basis, across water, gas and the council's resurfacing programme.

If this is successful, there could be 20 per cent reduction in the number of days on site. So work that's scheduled to take 50 days might take just 40 - which would massively reduce disruption for all our customers.

A shared future.

By being smarter with data, and working closely with other utility companies, we hope to coordinate our work, plan better, save on resources, and most crucially of all, limit the impact on our customers whenever possible.

We're now looking at rolling out this scheme to other London boroughs, and aim to expand it to cover the whole Thames Valley in the not-too-distant future.





**Delivering our
smart meter
programme.**

Delivering our smart meter programme.

Manging water supplies will only get more difficult as our population grows and our climate changes. Installing smart meters is at the heart of our plan to reduce demand for water. Smart metering provides a wide range of benefits to our customers, but it can see some customers' bill rise significantly. So it's important for us to engage with customers and stakeholders at an early stage in our metering programme.

Background.

A combination of population growth and climate change means we have a shortfall between the water we can supply and the water our customers use. Fitting free smart meters is one of many ways we're working to address the supply and demand gap in the immediate future - because metered customers tend to use an average of 12% less water and can save energy too. Meters also provide greater awareness of where water is used, giving households more control over the water they use and their bills.

Our stakeholder engagement.

We work in partnership with political stakeholders, keeping them informed about our programme, and asking for their support when we're fitting smart meters in their area. Before starting the programme in any area, we engage with MPs and London Assembly Members, explaining our plans, seeking their advocacy and responding to any queries they may have. Local elected leaders and council officers provide us with helpful guidance on the best ways of explaining our plans to local groups.



Engaging with our customers.

We produce a special engagement action plan for each local area, which identifies customers who are likely to need extra assistance and engagement. We may launch an awareness campaign in the area to introduce our smart meter programme, before sending out more detailed letters to our customers.

Throughout the programme, we continue to engage with housing associations, community groups and voluntary organisations like Citizens Advice and Age Concern, to help widen our communications and share our key messages between members of the community. Our Stakeholder Engagement Team also meets with religious groups to make sure we understand any concerns about smart meter devices impacting their religious practices.

We also engage with our customers at local community events, festivals and fun days, giving customers the opportunity to speak to us face to face, and allowing them to better understand the benefits of metering in their area.

Our metering team answers any questions and concerns, building relationships with our customers and stakeholders, and giving them the information they need. We also offer our customers free Smarter Home Visits, in which our team of advisors help them assess how they can save water, energy and money.





**Community
open day at
Mogden
treatment
works.**

Community open day at Mogden sewage treatment works.

Community engagement plays an important part in maintaining relationships with our customers, and helps them to understand all the vital work we do to remove and clean their wastewater before returning it to the environment. In March 2018, we opened the doors of Mogden sewage treatment works, to give our customers and neighbours an opportunity to learn more about the site and meet our operational team.

Background.

Mogden is one of the largest sewage treatment works in Europe, where we carry out the vital service of treating wastewater from over two million people. London's treatment works were originally built well away from people's houses, and weren't designed to minimise smells. But they're now surrounded by residential areas, so the close proximity of new communities can be really challenging when we're trying to prevent unpleasant odours.

No matter how well we manage and operate our sites, some properties can still be affected by smells. We're continuing to reduce odour as much as we can by investing in upgrades at our sites. We also put a lot of effort into maintaining relationships with our neighbours, with regular customer meetings and opportunities to visit our sites and see what we're doing.

Part of the community.

It's important for us to be open in the way we work with our customers and neighbours. Opening our sites for community days is a great way of engaging with our customers, and maintaining relationships with our neighbours, by giving them the chance to visit our treatment processes, and learn more about them and the work we do to minimise disruption. We were able to provide this opportunity and opened Mogden for the community in March 2018.

- Over 400 visitors attended our open day at Mogden to learn more about the site and the work our teams do.
- This is one of the largest treatment works in Europe, treating wastewater from over two million people.



Visiting the site.

Over 400 visitors attended our special open day for a guided tour of Mogden sewage treatment works. Our local operational teams ran bus tours around the site, described our treatment processes from flush to river, and explained all the equipment involved.

There was also a large marquee filled with different stalls and information for visitors to learn about some of our partnerships and projects, including:

- Zoological Society London.
- The Environment Agency.
- Our future plans for wastewater (London 2100) and water resources (WRMP).
- Mogden history and wildlife.
- Apprenticeship opportunities.
- WaterAid.





**Community
open day at
Aylesbury
treatment
works.**

Community open day at Aylesbury sewage treatment works.

We opened the doors of Aylesbury sewage works in June 2017 to show members of the community what goes on behind the scenes. The open day was held to showcase all the improvements we've made since we were fined £19.75 million for pollution incidents between 2012 and 2014.

Background.

Aylesbury sewage treatment works is one of six sites in the Thames Valley where pollution incidents occurred. Since the pollution incidents, we've reviewed our processes and invested heavily in improving the reliability of the sewage works, as well as employing more staff in key operational roles.

The open day was held to show the public the progress we've made in preventing pollution incidents. But there will always be more to do, and we'll continue to challenge ourselves to do even better in the future.

Tour of the site.

Around 30 residents attended the day for a guided tour of the works, and were given talks on how wastewater is treated before being safely returned to the environment. Visitors were guided through the sewage treatment process from start to finish, with operational staff on hand to explain the equipment and processes involved.

Visitors also got to see one of the machines used to remove fatbergs - large masses of congealed fat, oils and greases, as well as other non-flushable items like wet wipes and nappies - which can block pipes and damaging equipment.



Working in the community.

It's important for us to be open in the way we work with customers, our regulators and other stakeholders. As well as opening our sites, we've paid £1.5 million into our Community Investment Fund to improve the river and the surrounding environment at locations affected by pollution.

We also provide funding for the River Thames Conservation Trust and host water quality liaison meetings every 6 months. They focus on how our treatment works are functioning, including any local pollution incidents, and update on any suggested improvements. We have more than 30 treatment works operating in the River Thames catchment, and they're all very important for the area's rivers.



"It has been absolutely fascinating. I didn't realise how big the plant was, and the level of detail that is put into the process, and how natural it all is.

There's no noxious smells, it's all very clean, and I'm really impressed by the education side of it as well, with the 'Bin it – don't block it' campaign. If you can see the mess flushing non-flushable items causes, I think it will make people stop and think."

- Andy Kirkham, resident.





**Our partner
schools.**

Our partner schools.

We're working with specific schools in our area to support the development of future talent to work at Thames Water. The UK faces a skills shortage, and for a company like us, the shortage of people studying and working in the Science, Technology, Engineering and Maths (STEM) fields is really challenging when we want to secure a well-qualified future workforce.

Background.

We've developed strong partnerships with several University Technical Colleges (UTCs) in our area, including Swindon, Oxfordshire, Reading and London.

Our partner UTCs include:

- London Design and Engineering UTC.
- The Leigh UTC.
- Oxon UTC.
- Reading UTC.
- Swindon UTC.

UTCs partner with business and universities to provide a more technical education for 14 - 19 year olds, focused on providing skills that will be more appropriate for the workplace.

Industry led activity.

Last year, with support from volunteers from across the business, our education team delivered a programme of activities, including STEM challenges, mentoring and careers talks, to showcase Thames Water as a future employer at all our partner UTCs across the South East.

- Working with schools in our area to support the development of future talent and address the skills shortage.
- Working with teaching staff and students to develop and deliver real-world curriculum-based projects.



Developing their skills.

Over 600 students from the five UTCs were all involved in careers talks, presentations, work experience opportunities and mentoring programmes - alongside The Network Challenge, our flagship engineering activity which helps budding engineers understand how a water network operates.

We've also worked with teaching staff and students to develop and deliver real-world curriculum-based projects which replicate project management techniques and technical innovation found in the workplace.

Industry led curriculum projects.

Working with Reading UTC, we've been involved in delivering an industry-led project with other partners including Fujitsu and National Grid.

Students had the opportunity to use virtual reality headsets to visualise and address some of the challenges faced by the engineering industry. Our project involved using augmented reality, with a technical specialist remotely guiding a technician through a complex task in the field. This ten-week project formed a core part of the students' practical BTEC course requirements.



**Slough
Education
Centre.**

Slough Education Centre.

Slough Education Centre is located at our Slough sewage treatment works. It's one of five education centres which offer opportunities for schools and community groups to see how our business operates.

Our first education centres were opened nearly six years ago, aiming to offer a more immersive experience for our younger customers. We now have four education centres at our operational sites, and an angling academy at our Walthamstow reservoir complex, enabling schools to take part in site tours and interactive workshops.

Linking with the curriculum.

Many subjects on the national curriculum (such as water distribution, solids, liquids and gases, and renewable energy) are key areas where we can enhance students' learning. We can also add value to students' GCSE studies in science and geography lessons when they're preparing for exams.

Working for all the community.

As well as schools, we also host visits from a wide range of community groups. These range from colleges with students interested in careers at Thames Water, to science clubs and the University of the Third Age (U3A). If members of the community have an interest in our business, we're happy to open our doors and show them what we do.

"We thought the trip was fantastic – it is our second year in a row and the kids loved it. Deena and Liz [are] amazing ladies who know so much and work so well with children. The classroom is set up so well for the children, which makes the trip so easy and stress free for the teachers!"

*- Primary School Teacher,
St Nicolas C of E Combined School.*

Working in partnership.

Many of the visits we host at our education centres are organised directly with schools and community groups, but we also have strong relationships with other organisations which can help us to add value when we're working with schools.

Over the last three years, we've worked closely with the National Citizen Service, a not-for-profit social enterprise. During their summer programme with 16 and 17 year olds, we've enabled the students to engage with us as a local business, and supported them with some key business skills.

We've also been working closely with Enabling Enterprise, a not-for-profit social enterprise which works with schools to support the development of key life skills. We've been pleased to work with them for several years, offering workplace visits to Slough and other operational sites.

- Hosted 52 visits to Slough Education Centre during 2017/18.
- 1193 children visited Slough Education Centre last year.





**Working with
communities.**

Working with communities.

In 2014, we started a new five-year community investment programme worth £6.5m*. This money is being used to fund a series of projects which aim to engage communities through environmental enhancement and educational outreach between 2015 and 2020.

During 2017/18, we allocated funding to 14 exciting projects and two feasibility studies with a total value of more than £840k, all of which were carried out by our community partners. Here are some of the projects we provided funding for during 2017/18:

Pymmes Park education facilities.

At Pymmes Park, a small established wetland in Enfield, we've been working on a project to provide new pathways, steps, fencing and an outdoor classroom. All this will help members of the public to reach the water and learn about the benefits of wetlands. It's due to be completed in June 2018.

Saving our vital nature.

Working with the Canal and Rivers Trust, we created marginal waterside habitat on the Kennet and Avon (K&A) Canal. The River Kennet SSSI is linked to the K&A Canal between Bedwyn and Woolhampton, and it was suffering from high levels of suspended solids and algae, which harm the ecology of the SSSI by smothering the plants and gravel beds needed by fish and invertebrates. This partnership project, completed during 2017/18, was one of the most effective ways to restore the deteriorating canal banks, both upstream of the SSSI and on stretches of the navigation that are also designated SSSI.



WILD Coln.

The Fairford and Healthy WILD Coln project, which runs until November 2020, will allow Fairford Town Council and Fairford Community Voice (a local Friends group) to fulfil their aspiration of benefiting local people by restoring access to the River Coln. It will also improve the environmental quality of the river and its tributaries through Fairford and nearby parishes.

The project will teach people how to identify and restore a healthy river, how to help reduce flood risk, and raise awareness of issues affecting the water environment and how to support sustainably produced food.

Saving Oxford's Wetland Wildlife.

The Oxford Flood Alleviation Scheme is among the largest inland flood alleviation projects in the UK. The new flood channel will run through one of the UK's major freshwater wildlife hotspots, close to the centre of Oxford where 160,000 people live within 5km of the project area.

This project runs until December 2020, and aims to ensure that the full environmental and community benefit of the flood scheme can be realised - helping to create a major new wetland greenspace on the west side of Oxford for people and wildlife.

- **Over £860k committed during 2017/18.**
- **14 projects received funding during 2017/18.**

**This fund was established by the company in 2014 in lieu of a fine for accidental misreporting of sewer flooding data to our regulator Ofwat.*





**Time to Give –
Greenway and
Ridgeway
clean-ups.**

Time to Give – Greenway and Ridgeway clean-ups.

Our Time to Give programme provides all our employees with two days to volunteer for charities that operate in the areas where they work and live. Residents, community groups and businesses from London Borough of Bexley, Royal Borough of Greenwich, London Borough of Newham and Thames Water operational staff took part in two clean-ups on the Greenway and Ridgeway in November 2017.

The Greenway is a footpath and cycleway in East London, constructed on the embankment containing the Northern Outfall Sewer built by Sir Joseph Bazalgette, and the Ridgeway is a footpath in Southeast London on the embankment covering the Southern Outfall Sewer.

Part of the community.

Over two days in November, volunteers put on gloves and picked up litter pickers as part of the latest environment clean-up drive to clear rubbish from popular areas on the Greenway and Ridgeway.

More than 80 volunteers, including Thames Water staff, and 230 school children from the area, collected around 120 bags of rubbish in a single day on the Greenway. A few days later, 74 volunteers, including 40 of our operational staff, collected another 120 bags of rubbish from the Ridgeway.

“I was delighted to join our Mayor and Mayoress in supporting Thames Water’s community investment clean-up event at the newly refurbished Ridgeway path.

We are constantly looking for ways to tackle the litter, so it’s great to see organisations willing to step up.”

*- Cllr Teresa O’Neill OBE,
Leader of Bexley Council.*



Being a good neighbour.

We want to be a good neighbour in the communities where we operate, and litter picks are a great opportunity for us to help local people.

We receive lots of support for our clean-up challenges, and we’re committed in maintaining both the Greenway and Ridgeway as attractive and useful paths for everyone in East London.

Army of volunteers.

We’d like to thank all the other organisations who supported the clean-ups on the Greenway and Ridgeway, and share our commitment to maintaining and enhancing these paths for the public.

These organisations have included:

- Peabody Housing Association.
- The Ridgeway User Group.
- Bywaters.
- The Conservation Volunteer group.
- First Avenue Urban Wilderness Community Garden.
- Kent Partnership.
- Dot Dot Dot.
- Poplar HARCA.
- Friends of Crossness.
- View Tube.
- Eight20.
- Balfour Beatty.





**Managing
invasive
non-native
species.**

Managing invasive non-native species.

The increasing threat of invasive non-native species, particularly in the aquatic environment, is very worrying for us, because they can prevent some of our operational processes working as they should. An invasive, non-native species (INNS) is any non-native animal or plant that has the ability to grow and spread causing damage to the environment, the economy and our health.

Water industry impacts.

INNS have a wide range of implications for water companies, including:

- Fouling, eroding or blocking assets like water pipes and filters.
- Altering water quality and how we can measure it.
- Damaging the status of native species and protected sites.
- Increasing the need for herbicide use within our river catchments.
- Interfering with recreation like angling and sailing.

Preventing the spread.

By law, it's an offence to allow invasive species to escape or spread in the wild. We need to make sure that all activity at our sites is closely controlled to reduce the risk of spreading invasive non-native species. So we've adopted the nationwide 'Check, Clean, Dry' process on our recreational sites and nature reserves:

- **Check** equipment and clothing for live plants or animals, particularly in areas that are hard to inspect.
- **Clean** all equipment, footwear and clothing by washing it thoroughly, and leave any plants or animals at the place where they were found.
- **Dry** all equipment and clothing, as some species can live for many days in moist conditions, and make sure not to transfer water elsewhere.

- **It costs us around £4 million a year to remove invasive mussels.**
- **We've removed the equivalent of over four Olympic-sized swimming pools of mussels from our pipes since 2006.**

Thousands of zebra mussels found inside a connection tunnel.



Although we try to prevent the spread of invasive non-native species as a result of recreational activities on our property, we do unfortunately sometimes find them on our sites or in our infrastructure, and have to remove them.

Invasive mussel species

Last year, thousands of zebra mussels (*Dreissena polymorpha*) were found clinging to the inside of a connection tunnel at Walthamstow Reservoir, in north-east London, by our operational staff carrying out routine inspections. Since 2006, it has cost us around £4 million a year to remove the equivalent of over four Olympic swimming pools of mussels from our pipes.

Removing the zebra mussels from the tunnel had to be done by hand. This meant that we had to take the tunnel out of use, which put a strain on our water treatment works. The dying mussels release hazardous gases, such as ammonia and methane, which makes clearing them a health and safety risk for our people.

The quagga mussel (*Dreissena rostriformis bugensis*), is a highly invasive aquatic species that threatens native wildlife and creates an expensive biofouling nuisance for the water industry. Its first ever recorded appearance in the UK was in September 2014 in the Wraysbury River, a tributary of the River Thames in west London, but it then spread quickly to four of our West London reservoirs.

North American Nuttall's waterweed.

The New River is threatened by North American Nuttall's waterweed, which required a huge clean-up operation after it rapidly covered the river's surface.

This weed was first recorded in Oxfordshire over 50 years ago, but it's now widespread throughout southern England. It prefers nutrient rich lakes and ponds, but can also survive in flowing water.

Last year, our Hampton water works experienced a major issue, with engineers cutting back and removing tonnes of the weed by hand on a daily basis.

The weed clogs waterways and disrupts infrastructure, such as inlet screens, which traditionally filter debris from entering water treatment works.

The New River is an artificial waterway that was opened in 1613 to supply the capital with fresh drinking water taken from the River Lea. If left unchecked, the invasive Nuttall's waterweed threatens to limit the volume of water that we can take out of the river to supply our customers.



Nuttall's waterweed clogging up the New River.



Pigmyweed removal at Kempton.

New Zealand Pigmyweed.

Kempton Nature Reserve is part of our Kempton Park water treatment works in south west London, and it's also a Site of Special Scientific Interest (SSSI) which is designated for its internationally important populations of overwintering waterfowl.

However, in the past 10 years it has suffered from severe and widespread infestations of New Zealand Pigmyweed (*Crassula helmsii*), which we've removed as shown in the image above. The aggressive dominance of this invasive non-native plant has already diminished the botanical diversity of this SSSI, and has severely limited the foraging opportunities for overwintering birds.

"If Nuttall's waterweed is left unchecked, it would drastically reduce the amount of water we could abstract, meaning there would be less water being put into supply throughout the summer at a time when demand is typically higher."

- Claudia Innes, Thames Water Biodiversity Manager.



**'Wild about
Thames' events.**

‘Wild about Thames’ events.

Our Wild about Thames events help to raise awareness about the ecological importance of our sites and the wildlife that can be found on them. These events help educate our people, as well as our customers, about the importance of our work to conserve and enhance biodiversity. Here are some of the events which took place last year:

Wild about Woodlands.

Our volunteers coppiced woodland at Bracknell sewage treatment works (STW). Coppicing is a historic form of woodland management to yield timber. It’s still an important practice to open up shady woodlands and allow ground flora to thrive, such as the emerging bluebells at Bracknell STW (as in the picture below).

Wild about Orchids.

We ran walk and talk events about orchids at Walton water treatment works (WTW). More than 60 of our sites have orchid populations which we conserve with balanced management plans. This includes protecting certain areas on our sites from footfall and reducing summer mowing regimes.



Wild about Wildflowers.

Our people were involved with stripping turf and sowing wildflower seeds at Woking STW. Wildflowers provide vital forage and habitat for our declining pollinator species, so we allow these flowers plenty of time to grow before cutting them, collecting their seeds, and sowing them during autumn.

Wild about Scrub.

Our people also got involved with cutting back scrub around Winchester reservoir. Scrub includes a wide variety of vegetation types, mostly woody plants, which was threatening to encroach on important wildflower-rich grassland.



Bluebells emerging at Bracknell STW.



Man orchid at Epsom Downs Reservoir.



The historic Woking STW behind sowed wildflower beds, spring 2018.

- 14 Wild about Thames events were held in 2017/18.
- 65 Thames Water staff and over 200 of our customers got involved.
- 12 Thames Water sites benefitted from 337 hours of voluntary work.

Wild about Butterflies.

Many of our sites are home to important habitats which are valuable for butterflies, such as chalk grasslands and wildflower meadows. We held an identification workshop followed by a site survey at Winchester Wood. The site was identified as having high potential, but at risk from encroaching surrounding woodland. Our activities keep the site at its chalk grassland status and maintain the habitat for butterflies and other pollinator species.

Last year, we established a partnership with Butterfly Conservation, which has already seen volunteers undertaking extensive work across three of our sites at Chinnor, Winchester Wood and Wendover Dean. Butterfly Conservation provides biodiversity training for our grounds maintenance teams, carries out surveys and food/plant assessments.

Two of our three sites, where Butterfly Conservation has worked so far, have the potential to support the rare Duke of Burgundy butterfly (*Hamearis lucina*), which is only found in England and whose numbers have declined rapidly in recent decades. We hope in the near future we can play a leading role in boosting this species' numbers.



Rare and rapidly declining Duke of Burgundy butterfly (above).



Wild about Birds.

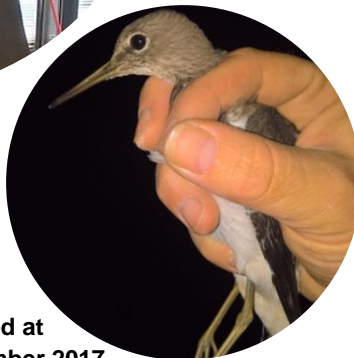
This event was held at Swindon Lagoons, and involved a bird ringing demonstration which gave attendees the rare opportunity to see birds up close and in the hand. Bird-ringing by licenced qualified partners gathers data on health, growth, and breeding success, as well as species abundance and range.

Wild about Owls.

We held this event at our head office in Reading, helping our people to learn about these majestic creatures and other birds of prey at our sites. Many of our people had the opportunity to handle owls and have photos taken with them. We have a number of sites which support nesting barn owls and many other species of top avian predators, from kestrels and sparrowhawks to the fastest animal in the world, the peregrine falcon.



Bringing nature to our people: holding a barn owl.



Green sandpiper caught and ringed at Swindon, September 2017.



**Enhancing our
nature reserves
and operational
sites.**

Enhancing our nature reserves and operational sites.

In 2017/18, we invested around £500,000 on 33 different projects to improve biodiversity and access at our sites. Here are some examples of the work we've been carrying out at our nature reserves and operational sites over the past year:

Long Reach sewage treatment works.

We're working in partnership with the Bumblebee Conservation Trust on the 'Making a Buzz for the Coast' project, which aims to safeguard rare bee populations by creating and restoring habitat, and linking isolated populations by creating flower-rich habitats along the coast.

Our Long Reach sewage treatment works provides a habitat for the rare shrill carder bee. In 2017/18, we changed our grounds maintenance regime to allow pollen and nectar rich wildflowers to flourish, which provide a valuable food source for this struggling bee species and other declining pollinators. We've also installed knee-rail fencing and signage to subtly separate this new wildlife area.



Common Carder bee at Crossness nature reserve.

Beckton Creekside nature reserve.

Last year, we created a 'mini-beast area' where visitors can explore the wildlife and collect insects using a variety of simple techniques and equipment, before returning them to their natural habitats. New paths with seating areas have been created as well, to improve access around the site.

We've also created a new home for a pair of breeding kestrels. The kestrels had previously nested in a vent pipe on Beckton's sludge powered generator. At the end of the breeding season, we sealed the pipe off and provided them with a new dedicated nest box close to the previous nest, which the kestrels accepted and successfully bred in.

Kestrels at Beckton Creekside nature reserve.



- £500,000 invested on 33 projects in 2017/18.
- Improving biodiversity and access to wildlife at our sites.

Mogden sewage treatment works.

Last year trained volunteers caught, monitored and released 588 eels (a critically endangered species) in the fish pass on the Duke of Northumberland River, which runs through Mogden sewage treatment works. This was a joint project with Zoological Society of London (ZSL) and is running again in 2018/19.

Hogsmill nature reserve.

Recent improvements to the lagoons at Hogsmill nature reserve have included creating a new wetland scrape and a brand new community hub.

Wetland scrapes are shallow depressions with gently sloping edges, which hold water. They can provide important feeding areas for breeding wading birds because they support a wide variety of invertebrates.

The new community hub is an important addition to our successful programme of education visits at Hogsmill sewage treatment works. The hub will help us support more and more requests from local school and youth groups for visits, focusing on the natural environment in the wetlands with popular activities like pond-dipping and 'mini-beasting'.

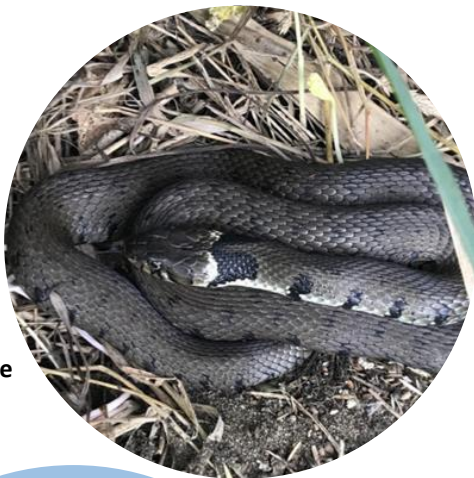


Eel (30cm) caught in the fish pass at Mogden STW.

Kempton nature reserve.

Last year we did lots of work to manage plants at Kempton, including New Zealand Pigmyweed (*Crassula helmsii*) and willow, to prevent them from encroaching on the wetland's islands and discouraging ground-nesting birds.

Regular reptile surveys have been carried out by Friends of the nature reserve for many years, with frequent records of slow worms and grass snakes. The British Trust for Ornithology's Wetland Bird Survey and Bird-Ringing has continued, and we've also started making a bat cave by modifying a redundant inlet tower to turn it into suitable bat hibernacula.



Grass snake at Crossness nature reserve.



Cetti's Warbler at Hogsmill nature reserve.



Bird ringing demonstration at the Beckton Creekside nature reserve.

Sites in the Chilterns.

We've established a partnership with Butterfly Conservation, a charity devoted to saving butterflies, moths and their habitats. The partnership has already seen volunteers undertaking extensive work across three of our sites at Chinnor, Winchester Wood and Wendover Dean. Butterfly Conservation provides biodiversity training for our grounds maintenance teams, carries out surveys and food/plant assessments.

Two of our sites, where Butterfly Conservation has worked so far, may be able to support the rare Duke of Burgundy butterfly (*Hamearis lucina*), which is only found in England and whose numbers have declined rapidly in recent decades. We hope we can play a leading role in boosting this species' numbers.

Maple Lodge nature reserve.

Maple Lodge nature reserve is a 40 acre reserve consisting of lakes, marshland, woodland and hedgerows which we lease to the Maple Lodge Conservation Society. Last year, we created a new two-storey bird hide for visitors to use, as well as a storage facility for the society.

Fobney water treatment works.

In order to improve the hydrology of a wetland area at Fobney, we've dug new ditches and dropped the ground level of existing ditches to help retain water.



Rare and rapidly declining Duke of Burgundy butterfly.



The Environment Agency Thames Catchment team removing willow scrub.

Staines pumping station.

We've re-established a traditional orchard at Staines pumping station in Surrey by planting native apple trees. Traditional orchards are an important and often overlooked habitat, which support a wide range of flora and fauna.

Pinkhill nature reserve.

We've been reintroducing a number of aquatic plant species at Pinkhill nature reserve by creating new ponds. We've also held a number of corporate volunteer task days when employees from other businesses helped actively manage willow scrub.

Ecological monitoring of bats and moths has been undertaken, too. 'Bat nights', which involve evening walks to look and listen for bats, and 'moth mornings', which include identifying species in a moth trap have become regular events at the nature reserve. We've also invested in a people-carrier trailer for open day events at the nature reserve.



**Isle of Dogs
Pumping
Station
heritage.**

Isle of Dogs Pumping Station heritage.

Our iconic Thames Water pumping station on the Isle of Dogs has been declared a Grade II* listed building by Historic England.

An essential asset.

This storm water pumping station in east London has been in operation since it was designed by British architect John Outram and built in the late 1980s.

It becomes active during periods of heavy or prolonged rain, when the main sewer network fills up, and pumps excess storm water to the River Thames to prevent flooding.

However, the building certainly doesn't look like the average pumping station, so it has always attracted attention from passers-by.

“John Outram’s pumping station was one of the most exciting buildings of the 1980s.

Outram exulted in the panache and exuberance of Classicism, and gave this utterly functional structure an exterior which is unforgettable.

It’s vital we keep the List up to date: it’s really exciting that we are starting to see the very best of Post-Modern buildings find their place among England’s finest works of architecture”

- Roger Bowdler, Historic England’s Director of Listing.



New listed status.

Thanks to its unique design by John Outram, the storm water pumping station was given listed status in June 2017.

It’s the first listing to come out of Historic England’s Post-Modernism project, but many other modern buildings look set to follow suit.

The new listed status won’t change the way the site operates, and it will continue to play an important role in managing storm water and reducing the risk of flooding on the Isle of Dogs for many years to come.



Photos by Historic England.



**Royal
celebrations at
Queen Mary
reservoir.**

Royal celebrations at Queen Mary reservoir.

Queen Mary Sailability is based at our Queen Mary reservoir near Heathrow airport. The charity first opened its doors in 1997 and offers hundreds of disabled adults and children the opportunity to enjoy watersports. HRH Princess Anne visited in June to celebrate Sailability's 20th anniversary.

Sailability at Queen Mary Reservoir.

Royal Yachting Association (RYA) Sailability is a charity which offers thousands of disabled children across the country the chance to enjoy watersports like sailing. The charity works out of 178 locations across the country, including Queen Mary Sailing Club.

Sailability caters for those who have physical, sensory and learning disabilities, and meets regularly from April to October. We're delighted to be able to let this charity use our reservoir, helping it thrive and continue its important service.



A Royal visit.

During this 20th anniversary visit, HRH Princess Anne was shown around the reservoir and met some of the charity's volunteers and members.

Talks and demonstrations were held to explain the importance of the charity and the services it offers, and Princess Anne cut a ceremonial birthday cake and unveiled a commemorative plaque.

The Princess Royal is president of the Royal Yachting Association which helps to run Sailability, and she presented a certificate to Janet Horsfield, who finished second in a global race last year. She was also introduced to Paralympians Alexandra Rickham and Mike Browne.

Finally, a naming ceremony was held for 'Zingaroo', the club's new Drascombe Longboat, which has been modified for access by wheelchair users.



- For more information, visit www.queenmary.org.uk

“Twenty years on, RYA Sailability continues to encourage and support people with disabilities to take up sailing and boating.

Many go on to enjoy sailing on a regular basis, and we hope the new boat will help more people, like Alexandra and Mike, to make it to the absolute top level in our sport.”

- Alan Woolford, chairman of the Queen Mary Sailability club.





Walthamstow Wetlands.

Walthamstow Wetlands.

After a ten year, £10.6 million project to transform Walthamstow reservoirs into Europe's largest urban wetland nature reserve, the doors finally opened to the public at the end of October 2017.

First of its kind.

Walthamstow Wetlands are designated as a Site of Special Scientific Interest (SSSI), managed by a first of its kind public, private and charity partnership between Thames Water, Waltham Forest Council and London Wildlife Trust (LWT).

Although this is a Thames Water operational site, LWT are responsible for conserving and enhancing the site's wildlife and heritage. This is an internationally important nature reserve, providing shelter to a wide range of wildlife, including rare and endangered birds

Ten reservoirs make up the 211-hectare wetlands which also comprises the largest recreational fishery in London. The site is owned by Thames Water and supplies 3.5 million Londoners with drinking water every day. This project gives visitors free access to the site's natural, industrial and social heritage.

Opening ceremony.

Steve Robertson was joined by Cllr Claire Coghill (London Borough of Waltham Forest) and David Mooney (LWT). In addition, over 200 guests were invited to celebrate the official opening of the site to the public.

Success since opening.

More than 200,000 people have flocked to Walthamstow Wetlands in the five months since they opened to the public. Despite a very cold, wet and snowy winter, visitors far exceeded initial estimates, but thousands more are expected over the summer to enjoy walks, birdwatching and getting closer to nature.

LWT have continued to deliver education sessions on site, and, with the help of volunteers, have constructed a purpose-built outdoor classroom. Volunteering on site is growing in strength and includes carrying out transitional conservation tasks as well as welcoming visitors and showing them the wildlife around the reservoirs.



Visiting the site.

Visitors are reminded to take safety precautions when visiting the site, including sticking to the designated walking, jogging and cycling paths, not entering the water or feeding the wild birds, and remaining respectful of other visitors and wildlife at all times.

Due to the sensitive and legally protected nature of Walthamstow Wetlands, we're sorry to say we can't allow dogs - even the friendliest and best-behaved dogs frighten the birds and wild animals.

- A 211 hectare, ten reservoir complex owned by Thames Water, transformed into one of the largest urban wetland nature reserves in Europe.
- An internationally important nature reserve, conserving and enhancing the site's wildlife and heritage.

www.walthamstowwetlands.com





**Farmoor
reservoir
fishing.**

Farmoor Reservoir fishing.

With many more big-prize competitions and charity matches booked in for 2018/19, Farmoor's reputation as a friendly, responsible and informative fishery continues to grow.

Competition choice.

In recent times, Farmoor has become a first choice venue for many fly fishing competitions, and a home venue for a number of clubs' fishing leagues, both regional and national.

In 2017, Thames Water hosted the Water Industry Game Fishing Championships at Farmoor, welcoming over 100 hundred anglers and their teams from across the water industry. This event was a huge success, with some of the best recorded match results in the whole history of the competition.

The Ian Barr International Bank Masters championships returned to Farmoor in March 2018 after great success in 2017. Based on an individuals match on the first day and a pairs match on the second, Farmoor saw more than 200 hundred anglers from across Europe competing for the title of Bank Master. Thames Water staff volunteered to assist with marshalling the event, and helped make sure that the day ran smoothly and safely.



Farmoor reservoir fishing.

Farmoor is a man-made reservoir comprising two separate lakes, covering a total of 400 acres in the heart of the Oxfordshire countryside. The reservoir is split by a long causeway, creating two reservoirs to fish in.

Lake one is a 'catch and release' lake, which is most noted for its specimen-sized brown trout, with some very big rainbows present too. Most fishing in lake one is from the bank, but a boat is also available, which requires booking in advance. Lake two is the 'take-out' lake, and Farmoor trout have a reputation being some of the tastiest in the country.

The only coarse fishing that takes place at Farmoor is for pike at selected times of the year. Lake one has a stock of pike up to 30lb+.



- 400 acres of year-round trout and winter predator fishing.
- Encouraging new anglers with a number of instructional sessions each month.

The trout from this reservoir taste exceptionally good.

- Francis Elliot, Chief political Editor, The Times



**The Ridgeway path
improvements.**

The Ridgeway path improvements.

The Ridgeway path runs for three and a half miles across south London from Plumstead station to Crossness pumping station. It is built on top of our Southern Outfall Sewer, engineered by Sir Joseph Bazalgette.

Background.

The Ridgeway path is one of our three key green corridors in London (Ridgeway, Greenway and the New River). It is built on an embankment which covers the Southern Outfall Sewer, designed and built by Sir Joseph Bazalgette in the Victorian era.

What we've achieved.

Our project partners completed improvements to the pathway in 2017, providing pedestrians, cyclists and runners with a safer and more convenient route as well as helping biodiversity to thrive.

There's been a 37% increase in path usage since the improvement project, compared to the same period before the improvements were made.

Working together.

The project is funded by Thames Water and the London Borough of Bexley and the Peabody Trust. Project partners also include the Royal Borough of Greenwich and the North West Kent Countryside Partnership.



Ridgeway improvements.

The new shared use footpath has solar lighting discs installed on the surface to mark the edge of the path. A new access ramp has also been constructed to create a new link to Southmere Park. All the existing gates have been upgraded and new signage has been installed.

We're also working within the local community to help reduce litter on the footpath, as well as a number of other initiatives to be rolled out in 2018.



- Improving access to the Ridgeway and creating a new link to Southmere Park.
- Increasing safety and boosting biodiversity in one of London's green corridors.



**Our WaterAid
campaign.**

Our WaterAid campaign.

This year we've continued to support WaterAid, our principal charity, which was set up by UK water companies over 35 years ago. Our WaterAid steering committee is made up of people from Thames Water. The committee sets our strategy and fundraising targets each year and meets regularly to review progress and recognise achievements.

Right now, we're in the middle of a four year campaign with WaterAid to improve access to safe water and sanitation, and raise awareness about the importance of hygiene in Malawi.

Making change happen.

We believe it's unacceptable that ten million people in Malawi, the world's poorest country, don't have a safe and clean place to go to the toilet, while 1.7 million people don't have access to clean, safe water.

We are supporting WaterAid to raise issues around water, sanitation and hygiene at the highest level in Malawi, to make positive and sustainable change happen. We're also using our peoples' expertise to share skills and help Team Malawi solve technical issues on the ground.

Our fundraising activities.

We've put together a whole calendar of fundraising events, including:

- The 'Big Fat Cheesy Quiz' - which raised £25,000 with the help of our contractors.
- Our 20th annual raft race - around 30 teams battled it out on the River Thames in Reading, raising £30,000 for this great cause.
- Our WaterAid employee lottery, managed by employee volunteers, along with payroll giving, raised £50,345.
- Four of our people participated in WaterAid's Trek Madagascar, raising £17,600.
- Eight of our people also took part in the London Marathon raising £14,000.
- Five teams made up of our graduate intake battled it out with other teams from around the world in WaterAid's Winnovators Scheme, raising £40,000.

Raising money to transform lives.

We'll continue our fundraising and working with WaterAid to transform people's lives in Malawi. In 2017/18, we raised £316,675 with a further £46,344 of income pledged. Over the next two years, we hope to raise more than £1.3 million, so we can continue our programme to improve sanitation, provide safe water, and educate people on the importance of hygiene in two towns in Malawi: Kasungu and Mponela.



Thames Malawi

To date we've reached:

- 4,062 people with clean water.
- 9,485 with sanitation.
- 6,621 with hygiene messaging.





Looking for
invisible
flaws in our
water
mains.

Looking for invisible flaws in our water mains.

Trunk mains are the backbone of our water network, carrying drinking water from our treatment works over long distances. Bursts on these pipes are relatively rare, but when they do happen they can cause major and unacceptable impacts like flood damage, widespread interruption to water supplies, and even risk to life.

We know that trunk main bursts are a concern to our customers and the public. This means we're constantly trying to learn more about what causes these bursts, and where they have the worst effects, so we can work out the best ways to invest in these important pipes.

Ageing wonder material.

Much of our 3,600km trunk main network is made from cast iron dating back up to 200 years, with diameters as great as 1.5m. Although cast iron was a wonder material of its day, it was put in the ground with little protection from corrosion. Many of these pipes have decades of service left, but we know that in some places they've become badly corroded. During the current five-year period we've already invested £240m in improving our trunk mains, and this project will further enhance our understanding for the future.

Three-year programme.

Our three-year programme started in 2017, and over the next two years we'll continue to invest £4.5 million in research and technology trials for trunk mains. We're continuing to inspect the outside of pipes whenever we dig them up to work on them, since this provides useful information about the network as a whole. We're going to build on this experience and our previous research to let us inspect hundreds of metres of pipe at a time without digging up entire roads. To achieve this, we need a method that will work from inside the pipe.



In-pipe scanning technology.

The oil industry has been inspecting pipes from the inside for years, using sophisticated scanners, but we can't just copy them. We need technology that will work on thick cast iron, which is much more difficult for scanners to penetrate than the steel used in oil pipelines. We also need to avoid damaging our pipes or affecting the quality of the water that flows through them. To achieve this we're working with technology companies to test and improve their in-pipe scanners.

- £4.5m three-year project to trial new ways of testing trunk mains.
- Innovative trial to detect defects in these important pipes.

Innovative trial.

In August 2017, we carried out the first ever 'in-situ' trunk main survey in the UK using a pipe scanning technology not previously used with cast iron mains of this size. The 24 inch trunk main was out of service following a burst in Lee High Road in December 2016, providing an opportune test location for this trial. The aim of the trial was to measure the success of this new scanning technology by detecting defects along a 1200m length of the pipe.

For this trial, we manually machined different shaped defects, including holes of various sizes, into a section of the trunk main (which we'd already scheduled to remove and replace after testing was complete). Then we cut a special hatch into the main, and lowered a torpedo-shaped scanning device into the pipe. The device used acoustic resonance technology to measure the condition of the trunk main wall – a technique which had never been used before in cast iron mains of this size.

In the end, although the scanner couldn't detect our deliberate test defects, we still learned important lessons from this trial. The scanner was able to travel a significant distance along the pipe, but we now believe that such thick metal trunk main walls (up to 25mm) are beyond the limit of this scanning technology. The scanner's data analytics and hardware are now being further developed by the supplier, and future tests of any modified version will be possible at our new dedicated trunk main testing facility.

Unique testing facilities.

We're building a dedicated facility for testing trunk mains at one of our sites. This will give us a testing ground for a variety of trunk main technologies, including in-pipe scanners, while simulating many of the challenges of the real water network without disrupting traffic or water supplies to customers. We're also collaborating with other water companies to share technology testing, and demonstrate a wider market for new technologies.

Scanning real trunk mains.

Only the most promising in-pipe scanners will get the opportunity to be used in real trunk mains in our network. By 2020 we aim to have identified technology that can be used more routinely. But this will still be expensive work, so we'll need to target our inspections carefully.



Making sense of it all.

Alongside the technology trials, we'll be working with experts from universities and industry on analytical tools to translate this scanning data into insight, to help us invest money where it's needed most.

We've already been working closely with the University of Surrey for a number of years to understand how corrosion affects the strength of cast iron pipes. Further postgraduate research into the corrosion and deterioration of trunk mains is also being funded by this programme.

Our future vision.

Ultimately we hope that by scanning the highest-risk trunk mains, we'll be able to work out which sections really need to be replaced, and which sections are safe to carry on using. Being able to target our investment better will help us avoid replacing pipes needlessly, which will benefit everyone in the end.





**Algal filters -
increasing
resilience to
climate change.**

Algal filters - increasing resilience to climate change.

Algal blooms are a natural phenomenon, but when they happen they can block processes in our water treatment plants. This is already a regular occurrence, and it's set to get more common with future climate change. We're exploring an innovative way to remove algae and reduce the impact on our treatment processes, by adapting a filter that's already widely used in cleaning treated wastewater effluent.

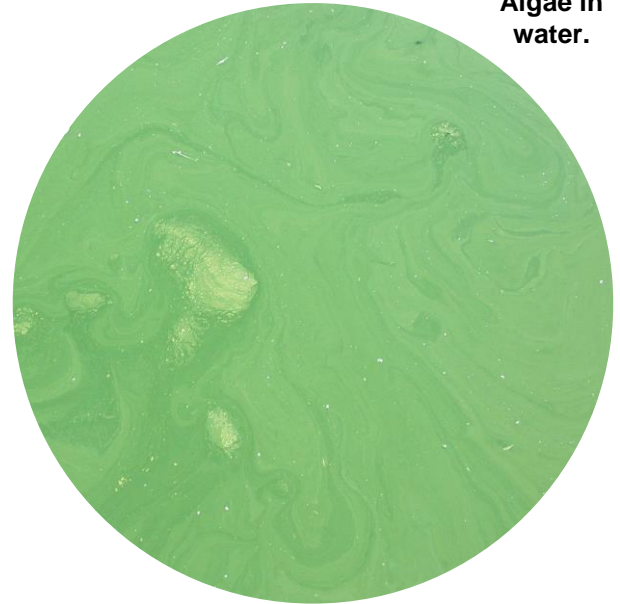
Background.

Algae are microscopic plants which live in water. Because plant nutrients are plentiful in the Thames Water area, we experience extreme algal population growth, called 'blooms', in our reservoirs several times a year between spring and autumn. Each bloom results in a large number of algal cells needing to be removed from the water to make it fit to drink. This increase in algae can block our filters more quickly, which requires more wash water, and sometimes limits production capacity.

To provide water to our customers, we operate a network of over 20 large storage reservoirs which are fed from the River Thames and River Lea. These reservoirs supply nine water treatment works, where we use a sequence of treatment steps to remove particles and other impurities from the water to make it fit to drink.

Every day, under normal weather conditions, we pump river water into our storage reservoirs and take some out for treatment. This makes sure we have enough water stored to supply our customers for approximately three months if the river flows get too low. Storing the water also helps to start purifying it naturally.

Algae in water.



- Novel use of established filter technology.
- Future-proofing our treatment works against climate change.

Challenge.

Our current approach to controlling algae involves mixing water in our deepest reservoirs. This moves algae to deep water, out of the sunlight, which restricts its growth. We then try to select water from the most treatable reservoirs.

However, climate change may result in warmer temperatures, as well as longer, dryer and sunnier periods, and more intense storms. If this occurs, we anticipate that reservoir water will become more difficult to treat. Our filters could be overloaded by algal blooms and too many microscopic particles – and our current algae control strategy of mixing water won't work if there's not enough water to keep the reservoirs full to allow mixing.

**The filter cloth
half immersed
in reservoir
water.**



An innovative solution.

We're currently investigating whether adding an extra stage of filtration ahead of our normal water treatment processes could protect our existing equipment and make sure it remains capable of doing the job.

Although this method of filtration is widely used to treat wastewater, using it to treat raw water is an innovative new application. The filter is made of cloth, which is fixed onto a frame, and allows water to pass through. To keep the cloth clean, a device periodically pushes water back through the cloth to remove debris including algae.

We installed these compact Mecana filters at two of our operational treatment works, and operated them over a two year period – testing how effectively they could filter a range of algae of different shapes and sizes which grow naturally in our reservoirs.



**Compact filter
at one of our
sites.**

Promising results.

Our tests so far have shown that Mecana filters can efficiently remove the kind of algae we find in west London reservoirs – taking out around 80 per cent of it. In east London the filters removed around 80 per cent of algae during summer and autumn, and around 50 per cent of the very fine algae present during spring. The results have been extremely encouraging, and demonstrate that this technology will be able to offer the protection we need for our water treatment works against some of the anticipated future challenges of climate change. In turn, this will enable us to keep on providing clean, safe drinking water for our customers.

Future testing.

The filters are now being moved to our research and development centre at Kempton, where we have special tanks for growing algae in test settings. We'll put the technology through its paces in more extreme conditions, and investigate whether the filters are effective against algae in excess of what our reservoirs usually produce.

The water from these tests can then be pumped to our pilot-scale water treatment works to demonstrate the protection this extra filtration step will give to our security of supply. Then, in the next five years, we're planning to build two demonstration sites to test this technology at full scale.





**Advances in
slow sand filter
skimming.**

Advances in slow sand filter skimming.

Slow sand filters are at the heart of London's largest treatment works, supplying 70 per cent of our water each day. These sustainable biological filters clean raw water using low amounts of energy, but they need to be drained and cleaned every few weeks to keep them productive. We're working on an underwater skimming machine that cuts the time the filters are being drained and cleaned by around 80 per cent.

Daily filter skims.

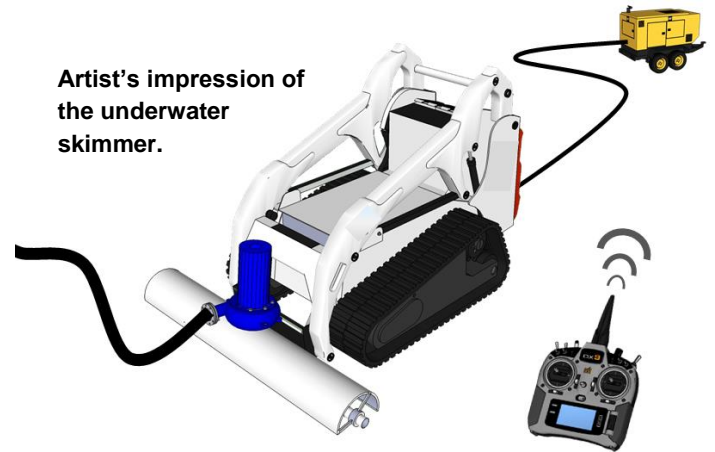
We operate 102 slow sand filters in London to treat raw water biologically, with a total area of more than 3000m² for each filter. Almost every day, one of these filters needs us to remove around 250 tonnes of sand to be cleaned and recycled.

After a few weeks of filtering raw water, a green biological layer forms on the surface of the sand, and blocks the filter. This means we have to drain it, to allow purpose-built skimming machines and dumper trucks to remove the top layer of sand for cleaning and recycling.

The filter is then slowly refilled and brought back into use, giving the microbiological community at the core of the treatment process time to re-establish. Each cleaning and refilling process takes four days, but we'd like to reduce this to half a day.



Current process: skimmer with dumper truck following behind.



Artist's impression of the underwater skimmer.

New skimmer design.

Now, we're planning to build an innovative new skimming machine which combines standard equipment in a unique and novel way.

Our new design of skimmer will travel underwater, collecting the surface layer of sand to be pumped out of the filter for cleaning and recycling. It would be operated remotely by a technician in a mobile control centre, using a laser guided control system, underwater cameras and GPS location equipment.

The machine will use a commercially available tracked excavator which has been stripped down to remove unwanted parts. A conventional cutting head from an existing skimmer will be fitted, together with a submersible slurry pump which will be mounted. The new skimmer will be serviced with food grade oils and powered remotely by a hydraulic power unit on the side of the filter.

Being able to clean slow sand filters while they're still operating will increase water production, minimise the disruption to the biology of the filter, and reduce health and safety risks for our people.

- We operate 102 slow sand filters in London to treat water.
- We're planning to build an innovative new underwater skimming machine.

The project plan.

Last year, we conducted a market review which confirmed that no machine of this kind was commercially available at a scale that would let us clean our filters at the speed we require. So we decided to design and build our own innovative underwater skimmer.

Using a mathematical model, we demonstrated that a fleet of these new skimmers, working across London, could let us produce an extra 60 to 90 million litres of drinking water a day, compared to current skimming methods.

Over the next year, we'll be constructing a working prototype. Our research and development team will build and test the machine, using pilot filter studies to establish how the slow sand filter should be operated while the underwater skimmer is in use.

After these tests, we'll put the new skimmer to work on full scale filters, to monitor water quality and the performance of the skimmer. The full-scale sand filters will be close to our sand cleaning plant, to allow the sand and water slurry to be pumped to the plant directly from the skimmer.

Alongside the tests of the skimmer machine, we'll be working with a supplier of solid and liquid separation technologies to develop a sand dewatering solution, to avoid pumping sand slurries over long distances.

- **Our innovative new underwater skimming machine could cut the time taken to clean our filters.**
- **It could also help our people stay safe, and make our maintenance more efficient and productive.**



The project team.

The working prototype will be built by a team led by a Thames Water research and development Principal Research Engineer, in collaboration with Affinity Water who are providing an experienced mechanical and electrical craftsman. The team will also include two of our slow sand filter technicians who will eventually be using the new machine.

A promising future.

As one of the world's major users of slow sand filters we appreciate their benefits, but recognise that we need to do more with our existing assets. Our innovative approach should ensure that this technology remains at the heart of meeting our customers' needs well into the future.

This exciting new machine could save time for the whole skimming process – as well as helping our people stay safe, and make our maintenance work more efficient and productive.





**Sustainable
drainage
systems
planning tool.**

Sustainable drainage systems (SuDS) planning tool.

London has a combined sewer system, which means it carries both rainwater and foul water. A combination of climate change, population growth and urban creep is putting pressure on the capacity of our sewer network, and increases the risk of sewer flooding. Sustainable drainage systems (SuDS) can be designed in a variety of ways to manage rainwater, reducing the speed and volume of rainwater flowing into combined sewers, and reducing the risk of sewer flooding.

Background.

Some of our sewerage network is more than 150 years old and was designed to serve a much smaller population than London supports today. At the same time as population growth, more green and natural areas are being paved over, which means rainwater can't soak away into the ground. Instead it flows into our sewers, where it can increase the risk of sewer flooding and spills into the environment from combined sewer overflows. Climate change is also increasing the risk of more intense rainfall.

We've now developed a SuDS planning tool which can identify areas of Greater London with the highest risk of sewer flooding and pollution events, based on current sewer capacity levels. This can help us identify what we need to do to reduce these risks.

- **Identifying areas at risk of sewer flooding, and the most effective and sustainable solutions.**
- **Shortlisted for the Data Project of the Year Award by the Water Industry Achievement Awards '18.**

Collaborative working.

We're working with lead local flooding authorities, stakeholders and charities to identify areas where interventions are needed, and make sure that the most efficient opportunities are implemented.

By developing this SuDS planning tool, we've also have been able to identify suitable partnership projects with third parties to support the London Sustainable Drainage Action Plan.



SuDS planning tool.

Our SuDS planning tool for the Greater London area now allows us to identify, target and improve the available capacity of our sewers in a more sustainable way, without having to physically increase the size of our network.

This planning tool uses a sewer capacity model to highlight zones in Greater London where sewer capacity is already a challenge, and where that capacity will deteriorate over time.

A number of different parameters such as climate change, urban creep, population growth, physical asset data, rainfall depth and modelled infiltration can be incorporated into the model.

This data is displayed on a dashboard, so that areas which need our attention can easily be identified. The model can also suggest types of intervention, and where they may be needed to reduce risks in specific areas.

The dashboard system is interactive, letting our teams filter data parameters including cost effectiveness and location. This quickly allows us to compare the potential cost of the chosen intervention against how well it reduces risk.

Our dashboard data can be uploaded and shared online as a web application, and flexibly accessed through devices like laptops, tablets and smart phones.



**Smart bugs to
revolutionise
nutrient removal
and recovery.**

Smart bugs to revolutionise nutrient removal and recovery.

We're currently trialling several 'smart bug' bacteria in our labs, pilot plants and even at full scale, which have the potential to revolutionise nutrient removal and recovery in the wastewater treatment process.

Background.

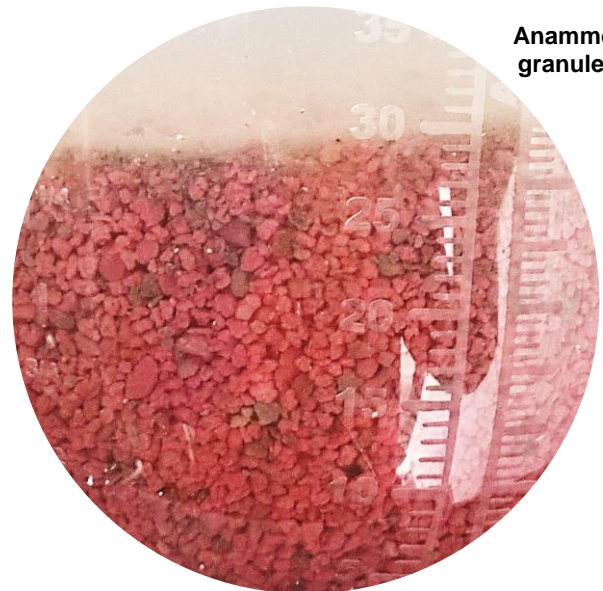
These smart bugs come in different shapes and forms, but they've all been selected for further investigation because they could help us to intensify our treatment process, while reducing the need for chemicals and energy intensive aeration.

Using smart bugs also reduces the space needed for wastewater treatment. With population growth putting increasing pressure on our sewage treatment works to process more wastewater, and urbanisation reducing the available space to expand our sites, smart bugs are a cheaper and more sustainable way to accommodate increased flows of wastewater.

Anammox

Ammonia can be hazardous to the environment as a result of its toxic impacts on fish and other species. Sewage treatment works are a major source of ammonia in rivers, so we need to remove ammonia to prevent any impact on local watercourses and comply with our strict environmental consents set by the Environment Agency.

- **Smart bugs can significantly reduce the amounts of energy and chemicals needed to treat wastewater.**
- **Smart bugs will help to reduce our carbon footprint and make the business more sustainable.**



Anammox granules.

We currently use a two-step process called biological nitrification to remove ammonia in our sewage treatment works. This involves two different types of bacteria: one which converts ammonia to nitrite, and another which turns nitrite to nitrate. A large amount of energy is used to provide oxygen for each step, and chemicals are sometimes also needed to remove nitrate by converting it to nitrogen gas.

We're testing a recently-discovered bacteria called Anammox which has the potential to revolutionise ammonia removal in wastewater treatment. Anammox (Anaerobic ammonium oxidation) bacteria have the unique ability to convert ammonium directly to nitrogen gas. This shortcut to ammonia removal halves the amount of oxygen, and therefore the energy needed during the treatment process. It doesn't require extra chemicals, and it has a smaller footprint in comparison to traditional processes.

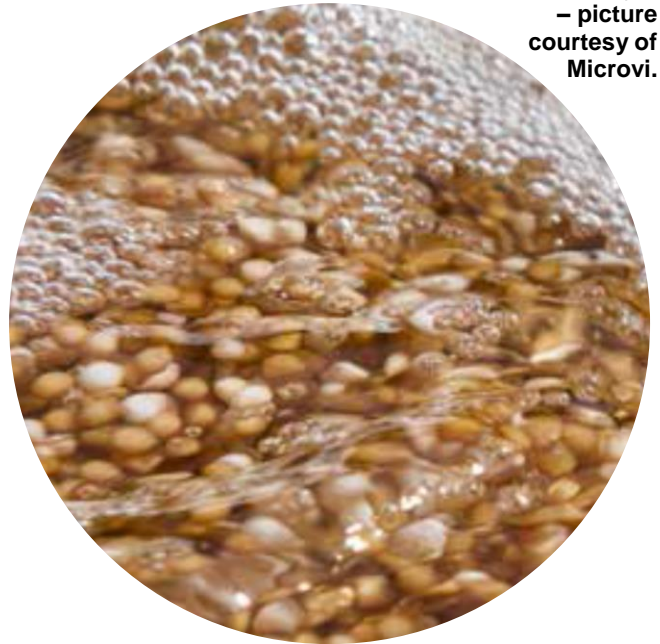
There are several different ways of using Anammox, and we're currently trialling them in pilot plants at one of our sewage treatment works. Once we've identified the most suitable technique, we'll aim to roll it out at full scale.

Granular activated sludge.

Our conventional activated sludge process in our wastewater treatment process uses billions of bacteria and other tiny organisms in a soup like mixture called activated sludge. During treatment, these bacteria are mixed in tanks with wastewater and air. Following this, the bacteria are separated from the treated wastewater in sedimentation tanks, before being returned via a pump to be used again to treat more wastewater.

We're currently trialing the granular activated sludge process in the first UK full scale plant of this type at Highworth sewage treatment works. We're testing a process using granular activated sludge. Bacteria communities are grown which eventually form granules. These are heavier and faster to settle which avoids the need for large sedimentation tanks compared to conventional activated sludge processes. Less air is used in the granular activated sludge process, significantly reducing energy consumption and its associated greenhouse gas emissions. The process also reduces the amount of equipment needed to treat the sewage.

Biocatalyst
– picture
courtesy of
Microvi.



Aeration lanes and settlement tanks used for conventional activated sludge process.

Biocatalysts

Instead of working with mixed cultures of bacteria which naturally grow in presence of wastewater, we can select the most efficient microorganisms that target specific organic matter and nutrients found in wastewater and embed them in a capsule. As the content of wastewater varies at different sewage treatment works, this provides the opportunity to choose the most appropriate bacteria for each of our sites.

With biocatalysts, there's no need to separate bacteria from the treated wastewater in settlement tanks at the end of the process and pump it back to treat more. This reduces the amount of energy used and associated greenhouse gas emissions, and the footprint of the treatment process on our sites such as the tanks and equipment needed.

We're currently trialling the biocatalyst at laboratory scale to better understand the set of limits and conditions in which it can operate, and we're piloting biocatalysts at one of our rural sites to compare this with existing processes.



**Managing sludge
with Advanced
Energy Recovery.**

Managing sludge with Advanced Energy Recovery.

Sewage sludge is the essential solid by-product of the wastewater treatment process, but it's a valuable resource too. We treat sludge safely, and recycle it to land sustainably as biosolids. We also use sludge as a fuel to produce biogas to generate renewable electricity and reduce our reliance on energy imported from the grid. We're continuing to look for ways to increase our renewable energy generation, and for more sustainable and resilient ways to dispose of sludge.



Background.

A primary component of our activities around wastewater involves disposing of sludge in effective and sustainable ways.

Historically we've treated sludge to high standards using anaerobic digestion (AD). This produces biogas which can be used as a fuel in our combined heat and power (CHP) engines to generate renewable energy. This renewable energy is then used to run our largest sites, offsetting the need to import electricity and natural gas from the grid, and reducing carbon emissions.

- **Generated a record 289GWh of renewable electricity from sludge.**
- **Full scale pilot Advanced Energy Recovery plant to treat sewage from around 250,000 people.**
- **Predicted to extract over 80 per cent of available energy in sewage.**
- **Residual product is 84 per cent less than the volume of sludge entering the process.**

Increased generation from sludge.

A key change in the way we manage our sludge during the current AMP has been to move towards advanced digestion using the Thermal Hydrolysis Process (THP). Using THP before anaerobic digestion helps break down the organic matter in the sludge into more accessible (digestible) compounds for the microbes in the anaerobic digesters to utilise. The microbes use these compounds more efficiently, which results in more biogas production.

This has allowed us to make more efficient use of sludge by increasing the amount of biogas produced, and therefore increasing the amount of renewable electricity and heat generated. In addition to the renewable energy benefits of pre-treating sewage sludge with THP, it also reduces the amount of treated sludge which needs to be recycled to land.

Last year we renewably generated over 20 per cent of our overall electricity from sludge and biogas, but there's more we can do. As well as expanding our use of advanced digestion and THP, we're also piloting a full scale advanced energy recovery (AER) plant to treat sludge by means of pyrolysis. In addition to fuel gas, this produces a carbon-based and mineral-rich material as its final product.

Advanced Energy Recovery.

Located at our Crossness sewage treatment works, the full scale pilot AER plant will treat sewage from around 250,000 people. The AER plant uses pyrolysis and involves processing sludge at temperatures of up to around 800 degrees Celsius in close to atmospheric pressure, without any oxygen, to produce fuel gas that can be used in engines to produce electricity.

While pyrolysis isn't a new idea, the amount of energy needed to dry sewage sludge to prepare for the process used to be prohibitive. Now, as a result of innovative thinking, we've adapted Bucher press technology from the cider industry, to squeeze more water out of sewage sludge.

By combining pyrolysis with drying the sludge at low temperatures, the Bucher press and existing processes – anaerobic digestion, combined heat and power engines and thermal hydrolysis – it's likely that we can cut carbon emissions even further by using more heat from the CHP engines to dry sludge at the start of the process.

AER is still in its infancy, but we predict that when it's maximised to its full potential, we'll be able to extract around 80 per cent of the available energy that's left in sewage after conventional processes. We can then use this to power our operations.

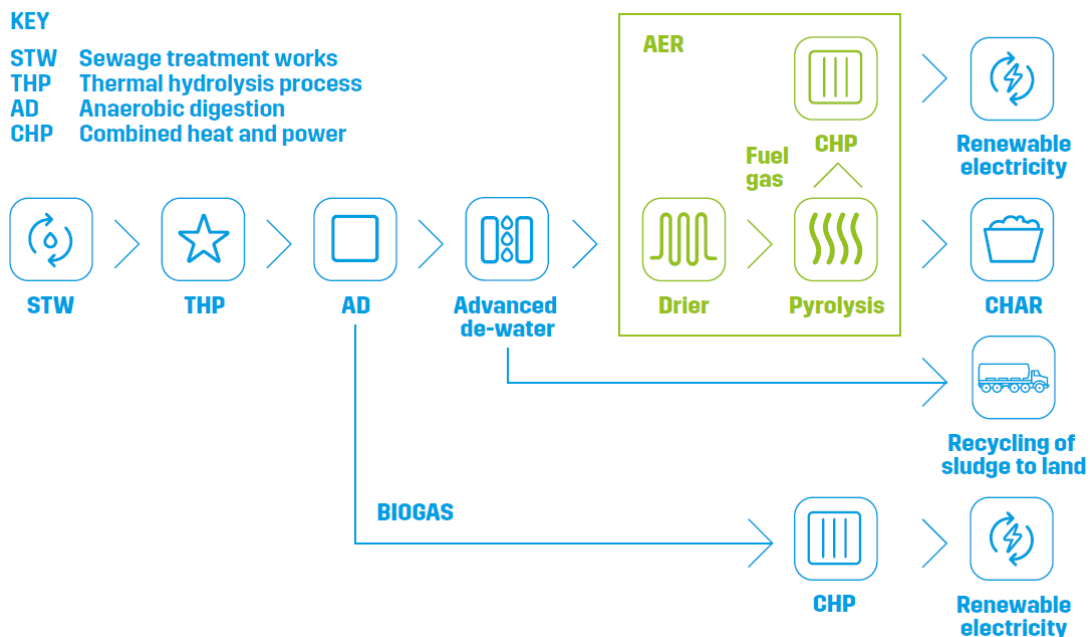


Circular economy benefits.

By using this technology effectively, the volume of residue (called char) is also 84 per cent less than the volume of sludge entering the process.

Char is a carbon-based and mineral-rich material, and we hope we'll be able to recover even more nutrients, precious metals and carbon to contribute further to the circular economy.

Our ambition is to make AER technically and economically viable, and unlock many potential benefits for customers, the environment and the wastewater industry.





**Our social media
customer service.**

Our social media customer service.

Communicating with our customers is very important to us and we've made significant investments to help us communicate through our social media channels. Our social media customer service is available 24/7/365 to reflect our 'round-the-clock' operations and make sure we're always 'here for customers' when they need us - whether it's a billing query, media enquiry, a complaint, or providing us with positive feedback.

Facebook and Twitter.

Lots of people get in touch with us via Facebook and Twitter, where we communicate both publicly and privately in accordance with our customers' preference and data protection requirements. The types of contacts vary daily, and cover a range of topics including revenue, operations, media enquiries, positive feedback and complaints, through to other more unusual requests and queries.

To help interact with our customers, we've invested in a more intelligent and resilient platform, as well as new research tools to give us the know-how to act when and how our customers need us to. Our new platform helps us to respond in a timely manner to customers, and proactively keep them up to date during situations like burst water mains.

Expanding our team.

We've also increased our number of dedicated social media agents to ensure we're there for our customers when they need us. Our business is a 24/7 operation, so our social media presence needs to reflect this. We receive contacts throughout the night for various reasons - for example relating to operational work such as overnight emergency repairs, leak detection or supply issues.

- **271,858 messages received via social media.**
- **203 per cent increase in contact volumes, compared with 2016/17.**

(1 April 2017 – 31 March 2018)



Telling our story.

With a growing social media audience of over 56,000 followers across Twitter and Facebook, we now have an opportunity to tell the wider stories around our business.

We're using these channels to highlight our partnerships with schools through our education programme, as well as local events we'll be attending where anyone can come and speak to us.

We also use social media to promote benefits like our priority services and our online account facilities, as well as providing advice and support about other aspects of our business.

Social media advertising.

Social media can be an effective way to reach a large audience, so we use our channels to educate our customers on our three key programmes, 'Bin It - Don't Block It', water efficiency, and metering.

However, we'll always make sure we use it alongside other forms of communication like letters and drop-in sessions, for those who prefer to use other services or don't have access to social media.

The infamous Whitechapel fatberg.



The Whitechapel fatberg.

In September 2017, our engineers started a nine-week battle against a giant 250 metre long fatberg. The Whitechapel fatberg was one of the largest ever found, with the rock-solid mass of wet wipes, nappies, fat and oil weighing a staggering 130 tonnes. It was blocking a stretch of Victorian sewer more than twice the length of two Wembley football pitches.

It attracted attention from around the globe, with stories about it running across the world's media. This provided us with a great opportunity to promote and reinforce our 'Bin It Don't block it' campaign, with our message that the three P's – pee, poo and [toilet] paper – are the only things that should ever be flushed down the toilet. Cooking fat, oils and grease (FOG) and wet wipes, sanitary products and nappies should never go down the drain or toilet.

We also promoted a unique exhibit called 'Fatberg!' at the Museum of London which opened to the public in February. It showcases not only what fatbergs are, but how they form and how they're removed from London's sewer network by our specialist teams.

The Beast from the East.

A prolonged period of sub-zero temperatures, followed by an extremely rapid thaw, caused water pipes to burst which resulted in a dramatic loss of water for customers across England and Wales in March 2018. We saw a huge increase in the number of customers contacting us during the 'Beast from the East' storm, with a 12-fold increase in those contacting us through social media.

In anticipation of the cold weather in March, we offered tips and advice on what our customers could do to prepare and protect their water pipes. When the cold weather arrived we updated our customers on what we were doing to proactively manage our treatment sites, and shared more information on what customers could do at home. We used social media to update our customers of how our engineers were working round the clock to fix burst pipes, and provided details of the bottled water site locations for customers who had lost water supply due to bursts.

Although we've seen improvements in our customer communications, the impact of the 'Beast from the East' highlighted gaps in our ability to communicate with all our customers during widespread and extended incidents. Our incident management, communications with our customers, and how we distribute bottled water, are all areas where we can improve.

Thames Water @thameswater · 6m
Update from our team working with @LondonFire and @NetworkRailEUS on the burst water main today



Video update and positive feedback during the Euston water main burst.

Proactive and informative posts during the Beast from the East.



The Euston water main burst.

On 27 October 2017 a 16-inch water main burst in the early hours of the morning near London's Euston train station. Our dedicated incident management team was quickly mobilised and coordinated our response to limit damage to property, look after customers, and make the necessary repairs as quickly and as safely as possible to minimise disruption.

We posted regular information on social media, including videos to provide real-time visual updates. We received positive feedback of our collaborative, coordinated response with local stakeholders, including the station and the London Fire Brigade. We've replicated this approach for other events to ensure our customers receive detailed real-time updates to keep them informed.





**Lead in
drinking water.**

Lead in drinking water.

We've been working to eliminate the risk of lead in drinking water for many years, but it's a significant challenge. We estimate that around half of the pipes that connect individual properties to our network of mains are made from lead. This is approximately 1.24 million pipes, and it's even more complicated because the pipework is made up of two parts: the communication pipe which is our responsibility; and the supply pipe which is the responsibility of the property owner.

Background.

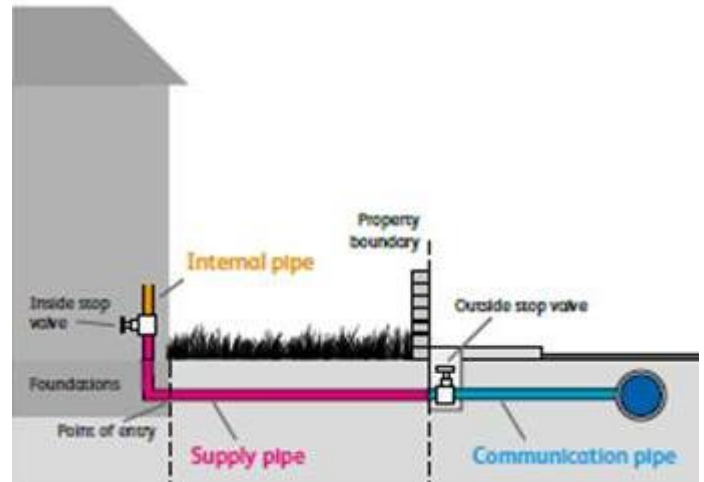
We supply drinking water to more than 9 million customers across London and the Thames Valley, and we aim to provide best-in-class customer service. The long-term interests of the communities we serve are central to our work, and protecting public health is at the very heart of this. Everything we do must be responsible and deliver sustainable solutions at an affordable cost for our customers.

There's a wealth of evidence that lead affects people's wellbeing, so it's been removed from many day-to-day products like petrol and paint. In drinking water systems, installing lead pipework was banned in 1970, and lead solder was banned in the following decade.

Lead pipework isn't used in our network of mains, but before 1970 it may have been used to connect individual properties to that network. If drinking water is allowed to stand in contact with lead pipework for a period of time (for example, overnight), lead may dissolve into the water.

We've been working hard over many years to mitigate the potential risk to public health from the presence of lead pipework, and the possibility of lead in drinking water.

- We're working to eliminate the risk of lead in drinking water.
- The number of samples above the drinking water standard has fallen from 10% in 2001 to less than 1.5% in 2017.



Arrangement of pipework, made up of two parts

Protecting public health.

The government has set the maximum level of lead in drinking water as 10 micrograms per litre (10 parts per billion). This standard is based on advice from the World Health Organisation and is used across Europe.

We've introduced specific initiatives and programmes, agreed with our customers and approved by our regulators, which have been highly successful, significantly reducing the levels of lead in drinking water. The number of samples above the standard has fallen from 10% in 2001 to less than 1.5% in 2017.

Reducing lead levels.

We know there's still more to do to achieve our objective of completely removing the risk of lead in drinking water. This will require a long-term approach to ensure the best outcome for public health, our customers, and future generations.

To reduce lead levels further, we're working on a number of initiatives which we'll explain on the next page. These include:

- Installing specific water treatment processes to reduce lead risk.
- A substantial proactive programme of lead communication pipe replacement.
- A programme targeted at primary schools and nurseries in London and Thames Valley.
- Communicating with our customers and stakeholders.

Installing specific water treatment processes to reduce lead risk.

Since 2003, we've been adding very low levels of phosphate to the drinking water we supply, which has the beneficial effect of reducing the risk of lead dissolving from pipework. Phosphate produces a protective layer on the inside of the pipe which prevents water coming into contact with the lead. More than 90% of the drinking water we provide is now treated in this way.

A substantial proactive programme of lead communication pipe replacement.

For a number of years, we've operated a risk based programme, targeting lead pipe replacement in areas of our network where our monitoring has shown the highest levels of lead. When we find lead pipes as part of any other mains renewal programmes, we remove them then, too. By 2020, we'll have replaced at least 36,500 lead pipes.

A programme targeted at primary schools and nurseries in London and Thames Valley.

We recognise that primary-aged children are particularly vulnerable to lead because of its effect on neural development – so we've been actively targeting primary schools in London to see if they have lead pipework. When they do, we replace our lead communication pipes, and work with the local authority to ensure replacement of any lead supply pipes. We'll be investigating over 750 schools across our region by 2020, as well as exploring how we might offer financial assistance to schools and nurseries via charitable donations.



Examples of lead pipework.

Communicating with our customers and stakeholders.

Our customers have a part to play in reducing the amount of lead that gets into drinking water from pipes they own, so raising awareness of the possible risks of lead pipework is another important part of our work. We've been doing this in a number of ways:

1. Offering public health information about the potential risk from lead pipes.
2. Giving advice on recognising and checking for lead pipework in a property.
3. Providing guidance on who is responsible for the pipework at a property.
4. Establishing of a scheme where customers can request free replacement of their lead communication pipe if sampling confirms an issue.
5. Maintaining a list of approved plumbers who can replace lead supply pipes and internal pipework.
6. Engaging with householders in areas where we're delivering a programme of lead communication pipe replacement. If we find a lead supply pipe, we inform the householder, and provide health advice and information about replacing the pipe.

We're also working with our colleagues in the local authorities, Public Health England, Regulators and DEFRA to raise awareness of the risk of lead in general. Clearly, removing lead communications pipes won't eliminate the risk of lead in drinking water completely. So we'll continue to explore what else we can do to encourage replacement of lead supply pipes, to find the best solution for our customers. Options may include:

- Transferring responsibility for all supply pipes to water companies.
- Providing grants to property owners for replacing their pipework.
- Requiring all lead pipework to be removed before a property is put on the market, or leased to new tenants.
- Devising innovative new technical and funding approaches to improve the range of solutions we can offer our customers.

Our holistic approach.

We believe that all these elements of our approach, when they're taken together, will provide clear public health protection benefits for our customers, as well as all the future generations who will live in our region.





**Payment for
Ecosystem
Services
project.**

Payment for Ecosystem Services project – River Tillingbourne.

We're using catchment management approaches to work with farmers, land managers and the wider pesticide industry to prevent metaldehyde reaching watercourses. One of these approaches is called Payment for Ecosystem Services (PES).

Metaldehyde, the active ingredient in many slug pellets, is commonly used in agriculture to protect crops against slug damage, particularly winter cereal crops and oilseed rape. Slug pellets are applied in autumn when the soil is wet and rainfall is highly likely.

The challenge.

When it rains, metaldehyde can be washed off the land and enter rivers at concentrations higher than the Drinking Water Standard (DWS) of 0.1µg/l. Unfortunately, even advanced water treatment processes can't easily remove metaldehyde, so other approaches are needed to maintain compliance with drinking water standards.

The Tillingbourne is a tributary of the River Wey, and both rivers are used to provide drinking water. Metaldehyde concentrations in these rivers can exceed the DWS during the high risk season, between September and December. For this reason, this catchment was chosen to pilot our first PES project in autumn 2015.

- Metaldehyde concentrations frequently exceed the Drinking Water Standard (DWS) of 0.1µg/l in some rivers.
- Metaldehyde can't be easily removed during the water treatment process
- Farmers have been rewarded for keeping metaldehyde concentrations below DWS for two consecutive years.



Payment for Ecosystem Services.

PES schemes involve payments to the managers of land or other natural resources in exchange for providing specified ecosystem services over and above what would otherwise be provided even if payments weren't made.

Ecosystem services are the benefits we derive from the natural environment. For example, these include the provision of food and water (provisioning services), regulation of climate and flood risk (regulating services), opportunities for recreation and education (cultural services), and underlying functions such as nutrient cycles and crop pollination (supporting services).

Maintaining and enhancing ecosystem services (and restoring them if they've been lost or degraded) is increasingly recognised as essential for sustainable economic growth, prosperous communities and promoting everyone's wellbeing.

The project.

Our PES project recognises the contribution of farmers in keeping metaldehyde concentrations below the DWS, producing 'clean' water, and rewards them for this.

Three key farmers in the catchment were identified as metaldehyde users. These farmers volunteered to get involved in the project in both autumn 2015 and 2016.

The PES approach is designed to be flexible and outcome focused, giving farmers the opportunity to select from a variety of land management practices to keep metaldehyde out of rivers, including:

- Using ferric phosphate slug pellets as an alternative to metaldehyde.
- Using cultural control methods to create a less favourable environment for slugs.
- Using integrated pest management to control slug populations.

To determine the success of the project, metaldehyde concentrations were monitored at the downstream end of the catchment. Farmers received payment if metaldehyde concentrations remained below the DWS throughout the high risk season.

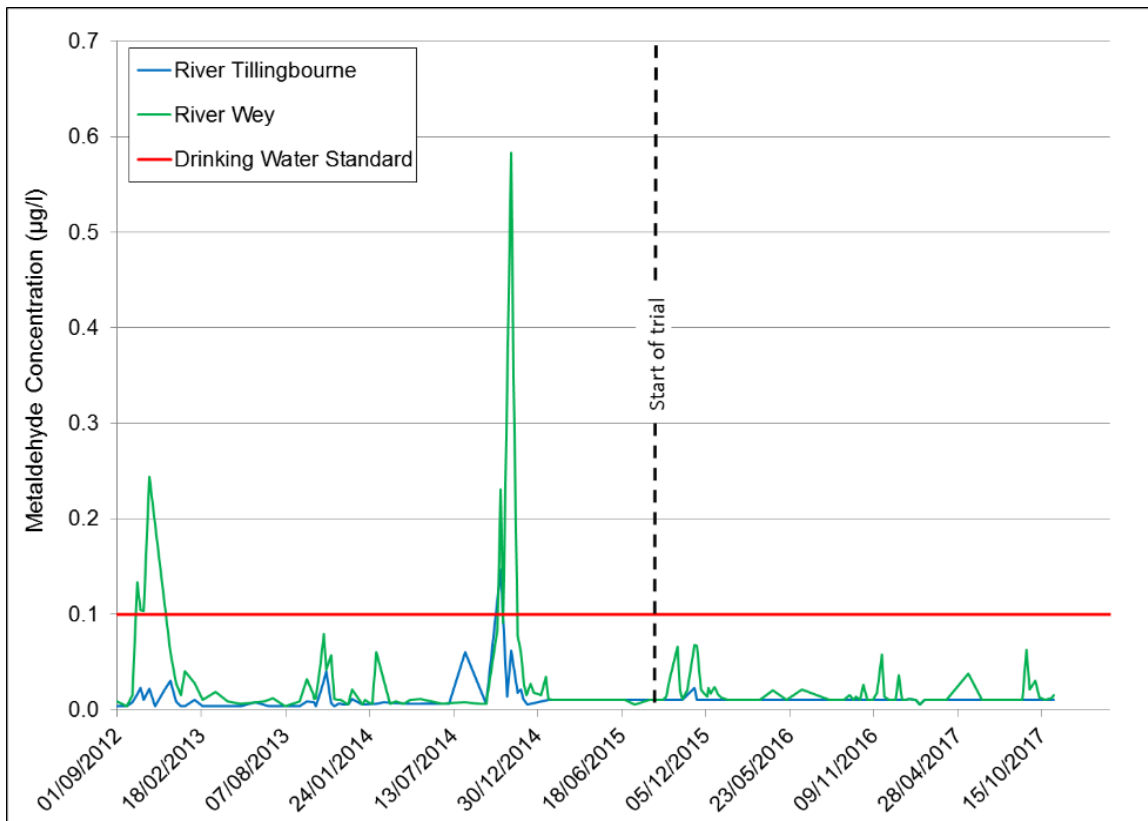
What we've seen.

Before the project, a metaldehyde peak of 0.15µg/l was recorded in the River Tillingbourne in mid-October 2014. At this time a higher concentration of 0.23µg/l was recorded in the River Wey, followed by a peak five times higher than the DWS in early November.

Since the project began, it's been successful in keeping metaldehyde concentrations in the River Tillingbourne below the DWS. During the high risk season, 'clean water' from the River Tillingbourne is blended with water from the River Wey which is typically higher in metaldehyde. The farmers have received payment for providing this clean water, and are eager to continue working with us in the future.

What next?

The Tillingbourne PES project involved a small number of farmers who were willing to work voluntarily with Thames Water to improve local water quality. This approach requires a high level of engagement and involvement by farmers currently using metaldehyde. Building on this success, we've now begun the challenge of scaling up our approach across larger catchments with more farmers.





**Metaldehyde
product
substitution
project.**

Metaldehyde product substitution project.

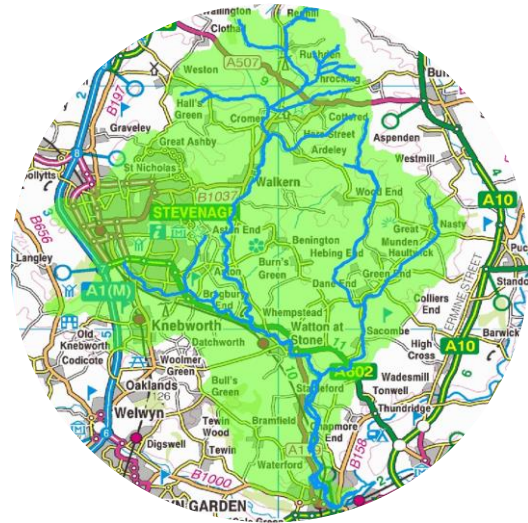
Even advanced treatment processes can't easily remove metaldehyde from water, so we're working with farmers, land managers and the wider pesticide industry on catchment management approaches to prevent metaldehyde reaching watercourses. One approach includes product substitution.

The challenge.

Metaldehyde is the active ingredient in many slug pellets, and it's commonly used in agriculture to protect crops against slug damage. The pellets are usually applied in autumn when the soil is wet and rainfall is highly likely.

When it rains, metaldehyde can be washed off the land and enter rivers at concentrations exceeding the Drinking Water Standard (DWS) of 0.1µg/l. Unfortunately, metaldehyde can't be easily removed through, even with advanced water treatment processes, so other approaches are needed to maintain compliance with drinking water standards.

The River Beane is a tributary of the River Lee, and provides drinking water to north London. Metaldehyde concentrations in these rivers can exceed the DWS during the high risk season (September to December). As a result, we started a slug pellet product substitution project in the Beane catchment in autumn 2016.



The River Beane flows from north to south, with tributaries joining from the east and west.

Product substitution approach.

The product substitution approach aims to encourage farmers to use slug pellets that contain ferric phosphate instead of metaldehyde. Arable farmers are offered a subsidy of £1/kg for ferric phosphate slug pellets to be applied on autumn-sown crops.

Ferric phosphate pellets have been found to be just as effective at protecting crops as metaldehyde, but don't affect water quality.

When ferric phosphate is used, slugs stop feeding almost immediately after ingesting the pellets and retreat underground to die. Unlike metaldehyde, there are no visible slime trails or dead slugs, so the treatment's effectiveness may be questioned by farmers. Regular field walks and inspecting the crop are the best ways to judge how well the product is working.

- We're offering arable farmers a subsidy of £1/kg to use ferric phosphate slug pellets instead of metaldehyde.
- Metaldehyde can't be easily removed during the water treatment process.
- In some rivers, metaldehyde concentrations frequently exceed the Drinking Water Standard of 0.1µg/l

Beane catchment project.

The aim of the project was to prevent concentrations of metaldehyde frequently exceeding the DWS in the River Beane, and to show farmers that ferric phosphate works just as well as metaldehyde despite the lack of dead slugs on the surface of the soil.

We identified 26 arable farmers in the Beane catchment as users of metaldehyde. By offering them a subsidy of £1/kg for ferric phosphate slug pellets, 25 farmers agreed to work with us.

In the past, metaldehyde concentrations in the River Beane had frequently exceeded the DWS, as shown in the graph below.

In November 2012, the levels of metaldehyde reached almost 25 times the DWS (around 2.5µg/l). This was due to more metaldehyde being needed to control a boom in the slug population, combined with extremely wet weather. The DWS had been exceeded every autumn since 2012.

In the first year of the project, metaldehyde concentrations remained below the DWS of 0.1µg/l at the Beane sampling point during the entire high risk autumn / winter period, with the highest concentration recorded at 0.04µg/l.

During autumn 2017, the second year of the project, one sample only just exceeded the DWS in mid-September, after very heavy rainfall. Concentrations then stayed below the DWS for the rest of the season.

“I’ve been involved with this project for two years, and product substitution has been problem-free in terms of application, slug control and ease of claiming back product subsidy.

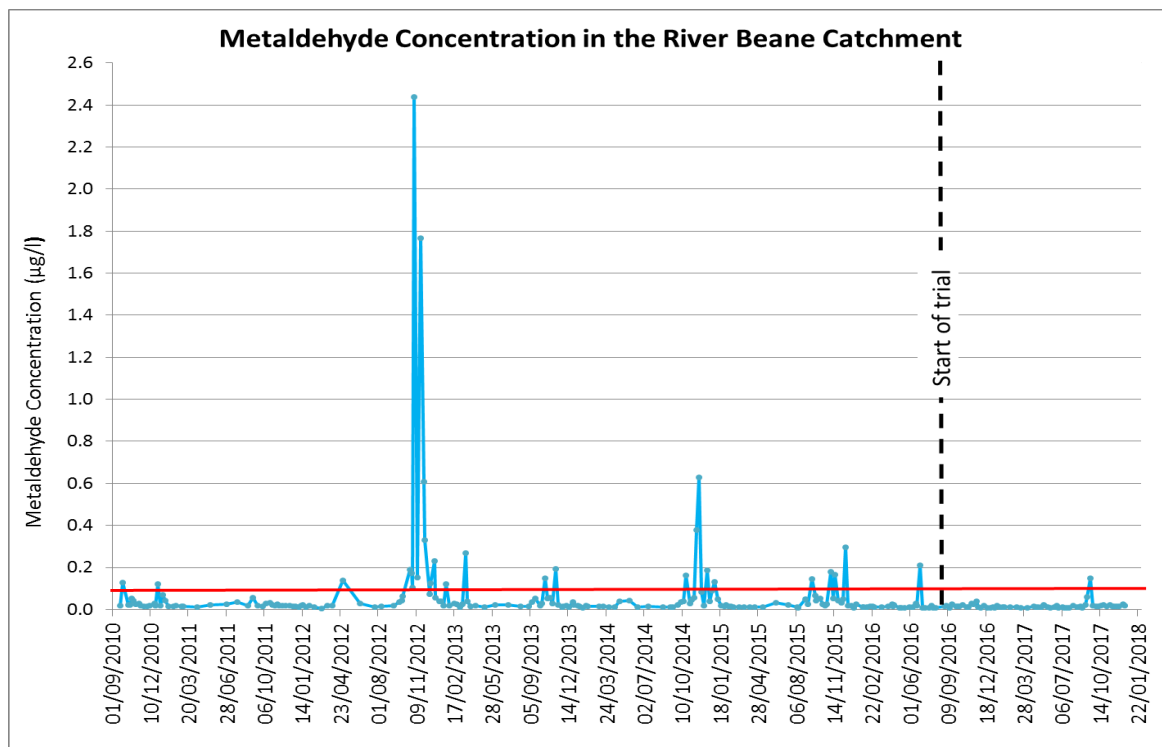
It’s also good to get monthly feedback of metaldehyde levels in the catchment area during the autumn.”

- Mr. Livings, local farmer.

Our next steps.

The Beane catchment product substitution project has shown that a group of farmers working together with a common aim can help improve local river water quality. But there was one point in the two years when metaldehyde exceeded the DWS, despite almost every farmer taking part.

For this type of catchment management approach to succeed, all farmers need to be engaged. This may be challenging in the future as we continue to scale up water quality improvement projects to larger catchment areas.





**River Crane:
urban catchment
management.**

River Crane: urban catchment management.

Catchment management is most often associated with rural, upland areas, and often focuses on tackling single issues like pesticides, phosphorus or nitrate. The River Crane catchment in west London is an example of a densely-populated urban catchment which presents a different kind of challenge, with a wide range of issues to address.

Background.

London's rapid growth is quickly catching up with the extra capacity that was created by a major programme of improvements at the capital's largest sewage works in 2015. The challenge is greatest at our Mogden site in Twickenham, west London.

Wrongly connected household drains are a key source of problems in the Crane and wider Mogden sewage works catchments. These 'misconnections' send household waste into surface water drains, causing pollution in local rivers. In other cases they channel rainwater from domestic properties into sewers, using up valuable treatment capacity at our works.

With population growth of more than 15% expected in the sewage works' catchment area over the next 20 years, and very little space for changes within the boundary of the site, it's essential for us to find a solution elsewhere in the catchment.

The project focus.

The huge amount of rainwater that flows into our pipes is the main issue we need to address. A more conventional approach to upgrading Mogden sewage works would cost around £250 million, with relatively high operating costs because of significant energy requirements. But this still wouldn't solve the underlying problems at source.

Instead, we're aiming to reduce the need for new infrastructure at the works at all. This project focuses on how an integrated upstream approach could address the wider issues in the River Crane catchment, and how it could reduce or defer the need for hard, end-of pipe solutions.



Our programme of activities.

This project will work through the local catchment partnership to identify and deliver a programme of activities, many in collaboration with customers and NGOs, including:

- Detailed catchment modelling.
- Improvements to the public sewer network, which could include restoring surface water outfalls, recommissioning redundant outfalls and creating new sections of foul sewer.
- Property-level improvements, potentially including tackling misconnected drains, and installing water butts and planters.
- Increased use of SuDS to manage surface water, including at schools.
- Education and engagement, targeting the 60 schools in the catchment.
- Extending the successful citizen science programme which is already underway.

- **Densely populated urban catchment affected by a wide range of issues.**
- **Putting community engagement at the heart of catchment management.**

Citizen Crane project.

Citizen Crane is a citizen science project to investigate the causes of pollution in the River Crane, and to identify and put in place measures to improve the condition of the river.

The project is now in its fourth year, and has provided a continuous dataset of water quality data for the catchment – by putting citizen science and community engagement at the heart of catchment management.

The project steering group includes members of the Crane Valley Partnership with Green Corridor (host of the partnership), Thames Water, the Environment Agency, Zoological Society of London, Friends of River Crane Environment and frog environmental all contributing.

Outfall Safari.

One of the most important elements of the project has been Outfall Safari. Citizen Crane volunteers surveyed all the outfalls along 34 km of the main river corridor in the catchment, locating, photographing and assessing a total of 227 outfalls, using a methodology previously developed by Thames Water. Details of all polluting outfalls were passed to our Environmental Protection Team to follow up and take action.

Since creating the Outfall Safari methodology, 112 volunteers have been trained, and this approach has now been rolled out to more than 140 km of river corridors across Greater London.

More than 1,100 outfalls have been assessed and their details passed on to our team, the Environment Agency and the relevant catchment partnerships to take action by tackling the pollution that volunteers find - often from wrongly connected household drains.

Outfall Safari has improved public awareness of the risk of wrongly connecting drains, which has historically had little public visibility. This should help to cut the number of new misconnections, and more effective work to resolve existing problems when they're discovered.

Thanks to the success of this project, we're now supporting similar schemes on the River Cray in Bromley and Bexley, and the River Beam in Barking, Dagenham and Havering.

Polluted surface water outfall.



Trained volunteers gathering data.



**River Evenlode:
rural catchment
management.**

River Evenlode: rural catchment management.

One of the main influences on water quality in the River Evenlode is phosphorus, but it can be very expensive to reduce the high levels of phosphorus in lowland rivers to meet the standards needed to reach 'good' ecological status under the Water Framework Directive.

Now, phosphorus standards are set to become even more rigorous – so it's more important than ever for us to be able to test whether we can provide value for money for our customers through a catchment approach.

Background.

The Evenlode is a headwater of the River Thames, flowing from Moreton-in-Marsh in Gloucestershire to Eynsham in Oxfordshire for more than 75km. It drains an area of nearly 30,000 hectares, and is managed as a number of river 'waterbodies'.

The main sources of phosphorus in the Evenlode are agricultural fertilisers, manure, industrial effluent and the discharges from our 14 sewage treatment works in the area.

Phosphorus is essential for plant life, but too much of it can damage the environment - for instance, by encouraging excessive weed growth and causing algal blooms. For this reason, limits for phosphorus concentrations in our natural waters have been set to protect the environment and everyone who uses it.

Water companies have historically relied on wastewater treatment to reduce concentrations of phosphorus before it reaches rivers. However, this can be expensive and resource intensive, as well as generating waste.

- Reducing phosphorus in wastewater treatment can be costly and resource intensive.
- Trialing a catchment based approach to reduce phosphorus in the River Evenlode



Trees being planted to slow farmland run-off.

What we're doing.

We're working with farmers and other local stakeholders to encourage water sensitive farming and reduce phosphorus loss from farms and fields into local watercourses. Our Smarter Catchments Project around the Evenlode is already underway with a phosphorus reduction trial. There are four elements to this project:

1. Catchment fund.

The Catchment Fund provides grants for new infrastructure and changes in farm management practices to reduce phosphorus loss from fields and farmyards to watercourses.

The Fund makes annual payments at a rate high enough to support specific changes in operational practices on farms. These can be made for up to three years, subject to annual farm checks, and include a broad range of measures, from arable reversion to grassland, to installing and maintaining buffer strips to intercept nutrients.

It also provides grants for one-off, capital investment improvements to farm infrastructure, including 30 measures ranging from concrete yard and drainage renewal, to additional gates to keep stock away from watercourses.

The Fund also includes an 'innovation' measure, designed to encourage applications from farmers who have ideas in addition to the measures we've listed and costed, which could provide alternative approaches.

2. Advice service.

Our advice service helps farmers take advantage of existing agri-environment schemes, as well as assistance with completing applications for our Catchment Fund. Delivered through a subcontracted Catchment Sensitive Farming Officer, it includes free farm visits to help design farm activities that reduce phosphorus loss and deliver additional benefits.

3. No till and cover crops.

We're running a trial to explore the effectiveness of no till and cover crops in reducing the loss of soil and phosphorus to watercourses, and improving soil health. Just as importantly, we need to understand their impact on the profitability and efficiency of farms.

This approach involves keeping stubble in fields after the harvest, and planting new crops directly into it (as shown in the pictures). It can represent a big change in approach, but can also yield major benefits for farmers, and we're encouraging them to use it by providing access to or funding for alternative equipment and seed.

Farmers decide what they'd like to try, as well as how, when and where. Our role is to support the trial financially, so that risks to participants over the five years of the trial are minimised.

We've organised a series of farm visits and talks by people with experience of no till and cover crop farming, open to all farmers around the Evenlode, to explore the challenges and benefits of this farming system, and to help design trials. The trial itself commences in August/September 2018.

4. Partnership working.

We'll be working with the Evenlode Catchment Partnership (ECP) and other local organisations to support projects that provide additional benefits within the catchment. This includes the Natural Flood Management scheme being delivered with funding from the Environment Agency.

This scheme, running from 2017 to 2022, uses a range of interventions, from planting riverside trees, to building woody dams to naturally slow the flow of water through the catchment. Some of these have already been installed, and the next phase of the project will involve monitoring their effectiveness.

Next steps.

The Evenlode Smarter Water Catchments project is still at an early stage, with results being gathered and analysed. But initial feedback from our partner organisations is positive, with enthusiasm for the prospect of scaling up our current work.

Once we've assessed the effectiveness of the different interventions, we'll be looking to expand the project in collaboration with the ECP. This will continue the partnership work already underway, which involves monitoring and sharing data across the organisations, as well as further investment in additional equipment and modelling.

Above all, the project will help by measuring how effective this approach is in reducing levels of diffuse phosphorus pollution, as well as quantifying the cost per kilogramme of phosphorus removed from the environment, and fully understanding the relative cost effectiveness of financially supporting landowners compared to an end of pipe approach with additional treatment at sewage works. We believe this project can deliver many other benefits too, including better biodiversity and opportunities for recreation.



Right - a winter wheat crop emerging through the stubble.



Left - no till drill sowing a crop within the stubble cover.



**Hampton eel
screens.**

Hampton eel screens.

We've installed a series of screens to stop eels being sucked into the Thames Lee Tunnel at our Hampton water intake. This will protect the eels and help the recovery of this endangered species.

Background.

We worked closely with our suppliers, Intralox Bridges and Steelway, to create protective eel screens for our intake at Hampton. These moving band screens are designed to stop eels getting into the transfer tunnel and allow them to continue their migration up and down the river.

The screens' small mesh prevents the eels from passing through, while an auto-wash feature enables the screens to self-clean without hampering the flow of water into the tunnel. The design is modular, so that all four screens and frames could be easily installed from a floating pontoon without impacting water abstraction during construction.

Working offsite.

The modules were constructed at Bridges' factory in Midsomer Norton, providing the benefits of a controlled working environment, free from the risk of delays and potential hazards which are often present on a construction site.

The steelwork was designed to fix directly onto the existing concrete structure in the water in front of the Hampton intake channel. This removed the need for structural works, such as piling, and minimised potential health and safety risks and possible delays to the project.



Elvers – young eels.

Screens to protect endangered eel populations.



Our construction team visited the factory to see a demonstration of the installation process. This meant that as soon as the components reached the site, they knew how to install them correctly.

The frames were brought on site and fixed by divers into the concrete structure under the water. Most of the following work could be done from the bank or from the pontoon.

Benefits of the scheme.

The new screens have reduced embodied carbon, operational carbon and energy demand to less than 30 per cent of what was originally proposed in our business plan. The screens are also cutting operational carbon by an average of 9.6 tCO₂e per year, and they're saving 35 MWh per year of electricity compared to our business plan.

What's next?

There are another eight sites where we need to install eel screens at the intakes. Now we've successfully proven the effectiveness of this modular approach at Walton and Hampton, we can repeat the process at our other sites.

- Protecting endangered eel populations.
- Saving 9.6 tCO₂e/year and 35 MWh/year of electricity.
- Innovative engineering design helping to minimise disruption.



**Innovating to
boost reservoir
levels.**

Innovating to boost reservoir levels.

Using an interactive map developed by our innovation team, which displays real-time data from the Environment Agency (EA), we've been maximising how much water is pumped from rivers to fill our large London reservoirs while ensuring the environment is protected.

Background.

We work closely with the EA to set and manage abstraction rates, which determine the amount of water that can be pumped from rivers. The EA has live data to show precise depth levels of rivers, showing how much water can be abstracted without damaging the environment. Here at Thames Water, our data tells us how much water we need to take from the rivers to keep our customers supplied with clean and safe drinking water. We share this information with the EA on the phone every day to agree abstraction rates.

After a drier than average year in 2017, water resources were down – for example, a reservoir in north east London, used to supply water to 3.5 million people, was only 39% full. So, during a period of heavy rain in early 2018, we responded quickly to devise a new interactive map to maximise the use of real-time data from the EA to fill our large London reservoirs.

This tool uses data from both Thames Water and the EA to help us better monitor river levels and identify opportunities to abstract more water and boost reservoir levels when rivers are full, but also slow abstraction down when river levels are low. This new system also means that less information needs to be passed over the phone, streamlining and increasing efficiency in the process.

Protecting water supplies.

We're always looking into innovative new ways to be more efficient, and this new tool has streamlined the abstraction process, optimised how we work, and helped us to fill our reservoirs rapidly at the right times, protecting water supplies for our customers for the immediate future after a very dry year.

The biggest spike in water levels was at the William Girling reservoir in north east London, where we can store 16,511 million litres of water, and supply 3.5 million people via the nearby Coppermills water works. This reservoir was down to 39 per cent of its capacity in mid-November, but after carefully timed abstraction from the river, we returned it to nearly 90 per cent full again.

It was a similar story at the large reservoirs near Heathrow, which supply the majority of Londoners. The Queen Mother, Queen Elizabeth II, Queen Mary and Wraysbury reservoirs were severely depleted at the start of December, but we managed to increase levels again to more than 95 per cent full.



Wraysbury reservoir earlier this year after abstraction (inset, how it looked in October).

Developing the innovative tool.

Our innovation team worked with colleagues in the EA and a number of teams across the business, including our water resources and operational control teams, to explore what data we'd need for the interactive tool, and how we could display it in the most practical and useful way.

We identified and introduced a form of technology that allows our computers to ask the EA's computers for details of flows and levels of rivers across the UK. We then developed web pages to present this data back to us in a useful format.

We created colour coded maps of rivers which displayed water levels using thresholds we've agreed with the EA. Rivers were shown as red if river levels were too low to abstract, and orange or green as availability increased.

We also added a feature which allows us to see the recent history of river water levels along key stretches of the river. This enabled a more complete catchment management approach, by allowing us to anticipate when water will become available as it flows down the river.



Queen Mary Reservoir earlier this year after abstraction (inset, how it looked in October).



**Identifying and
fixing leaks with
smart meters.**

Identifying and fixing leaks with smart meters.

Engineer installing a smart meter.

A huge leak which was losing 50,000 litres of water a day and could have cost a customer over £38,000 a year has been identified and repaired by engineers thanks to smart meters.

Background.

The leak, which is the largest one discovered by a smart meter, was spotted during routine monitoring of hourly data from the device. The customer was informed and a team of engineers were tasked to repair it. Two leaks on the same stretch of pipe were ultimately identified, one in the garden and one in the basement.

If the leak had not been identified and fixed by our engineers for free, it would have cost the homeowner over £38,000 per year and would have lost 50,000 litres of precious resource.

The meter was installed on a customer's property in Greenwich as part of our water saving smart meter programme. The customer is currently on a trial period for the smart meters, and the money saving is the difference between what they would have paid if they hadn't installed the device.

Smart metering programme.

Our industry-leading programme is currently being rolled out across London and gives customers two years to take control of their metered usage before switching to a metered bill.

The aim of the smart metering programme is to reduce overall water use and improve leakage detection, due to the pressures on water resources from population growth and climate change.

- **Smart meter helped save 50,000 litres per day and a bill of over £38,000 per year due to a leak**
- **We have installed over 243,000 free smart meters across London through our progressive metering programme**



Meters will help achieve this aim, by giving residents access to their water use information, online or over the phone, allowing them to see how efficient their home is and track how simple water-saving efforts – like four minute showers and turning the tap off while brushing your teeth – can reduce bills. Metering also means that our customers' bills reflect the amount of water they use, making it a fairer way to pay.

We have installed over 243,000 free smart meters through our progressive metering programme across fourteen London Boroughs - Bexley, Brent, Bromley, Camden, Croydon, Enfield, Greenwich, Hackney, Haringey, Islington, Lewisham, Newham, Redbridge and Waltham Forest.

If we're not yet fitting meters in an area as part of our progressive metering programme, customers can request a meter through our optant metering programme at any time.

We also offer award-winning free smarter home visits to check how water efficient a house is and provide and install free water-saving gadgets.



**Cracking
down on
illegal
standpipes.**

Cracking down on illegal standpipes.

We're cracking down on those who illegally connect and steal water from our vast network of pipes using unauthorised standpipes. Over the last six years, illegal connections have sky-rocketed from 33 in 2011 to 734 in 2017. Water theft accounts for around seven per cent of our leakage figure, and it also increases the risk of water contamination and supply issues.

Background

We have many hydrants across our network that extend from our water supply and are most often used to connect a standpipe which creates a temporary water source from our mains. They can be used by commercial customers with a licence for building, road cleaning and landscaping as well by firefighters.

Any customer that wants to use a standpipe on our network must apply for a licence and an authorised standpipe which comes with a meter and valve to stop dirt from entering the water supply. All of the authorised standpipes to be used on our network are blue with a yellow tag.

It's really important to keep track of who and what is being connected to our network for several reasons:

- If a connection is made without the correct valve, our water supply can end up being contaminated with dirt which can affect the quality of our water or it could affect water pressure in the surrounding area.
- If a standpipe is attached without being metered, the water being used isn't accounted for and is therefore classed as leakage.
- If people who aren't properly trained connect a standpipe to our network, it can cause damage to our assets.

- **Water thefts account for around seven per cent of the total water lost through leaks.**
- **Illegal connections can affect the quality of drinking water and affect local water pressure.**



Thames Water authorised standpipes (above) and an illegal connection (left)



Water theft crackdown.

Reports of illegal standpipes have increased rapidly in recent years, and this has been possible by raising awareness and helping people understand the risks of unauthorised standpipe use.

Since we established our investigation team in 2016, we've received over 470 reported incidents of illegal standpipes being set up, and have sent out 750 warning letters. Last year, 61 illegal charges and four prosecutions were brought against people for illegal use and around 59 people without licences were converted to authorised connections.

In the past year, a cleaning firm pleaded guilty to 18 offences in Croydon and Reading under the Water Industry Act (WIA) 1991 after illegally connecting standpipes to the network. The company was ordered to pay fines and costs totalling almost £15,000.

Another street cleaning firm admitted to 12 offences under the WIA and was ordered to pay more than £5,000 in fines and costs. They were seen on four occasions connecting an unlicensed standpipe to a fire hydrant in Battersea, and using thousands of litres to clean the streets.

It's vitally important we find and stop people illegally connecting into our network, to stop thousands of litres of drinking water being lost every day and help protect water supplies now and for future generations. To report any water network abuse, email illegalconnections@thameswater.co.uk or call our customer services on 0800 980 8800.



**Metering –
securing future
water supplies.**

Metering - securing future water supplies.

Metering is at the heart of our government-approved plan to reduce demand for water. Customers with a meter use less water, and smart metering technology allows us to quickly and accurately identify leaks on customers' supply pipes.

Background.

Our region has been classified as seriously water stressed – meaning that demand for water is higher than the amount available. London and the Thames Valley is already one of the most densely populated parts of the country, and managing water supplies will only get more difficult as the population grows and our climate changes. By 2045, we forecast that there will be a shortfall of water equivalent to the amount needed by over two million people.

Every day, on average, we supply 2.7 billion litres of drinking water to our customers across London and the Thames Valley. Data from meters helps to improve our understanding of where our water goes once it leaves our water treatment works – directly to our customers, or where it's being lost through leaking pipes. This allows us to find and fix leaks faster. It also helps our customers to understand and control their household water use, and ultimately their bills.

- In 2017/18 water meters helped us to save over 14.8 million litres of water every day, by fixing leaks and reducing usage.
- We're metering our water network in a range of different ways to help us manage our projected shortfall in supply.

How are we metering?

We're fitting smart water meters for all our customers through our progressive metering programme. This roll-out started in London in 2015/16, and we've now fitted 243,000 smart water meters across fourteen London boroughs.

If we're not yet fitting meters in an area as part of our progressive metering programme, any customer can opt to have a water meter sooner if they wish.

We're also continually replacing old, broken and missing meters, and will fit large non-billable meters on pipes which feed large buildings, to help us find leaks as part of our bulk metering programme.



Water.

Metered customers use around 12 per cent less water.



Energy.

Using less hot water reduces your energy bill too.



Money.

Meters are the fairest way to pay because you only pay for what you use.



Control.

You can go online or call us to understand how much water you're using.



Progressive metering.

Customers who get a smart meter through our progressive metering programme enjoy an adjustment period before being switched to a metered bill. During this period, we give them regular information to help our customers understand the comparison between their current charges and what they'll pay when they switch to a metered bill. Households who find that they'll be better off on a metered tariff can opt to switch early.

For households who find that their metered bill would be higher than their current bill, we'll provide support and practical advice to help save water, energy and money, including our free smarter home visits where the latest water saving devices are fitted in the home for free. We want to make sure that we fully support our customers who are finding it hard to pay their bill.

How are we doing?

Here's the progress we've made in 2017/18:

- Installed over 114,500 new water meters.
- Replaced over 19,600 existing meters.
- Fitted over 550 bulk meters.
- Saved over 14.8 million litres of water per day by finding and fixing leaks and reducing usage

Helping our customers save.

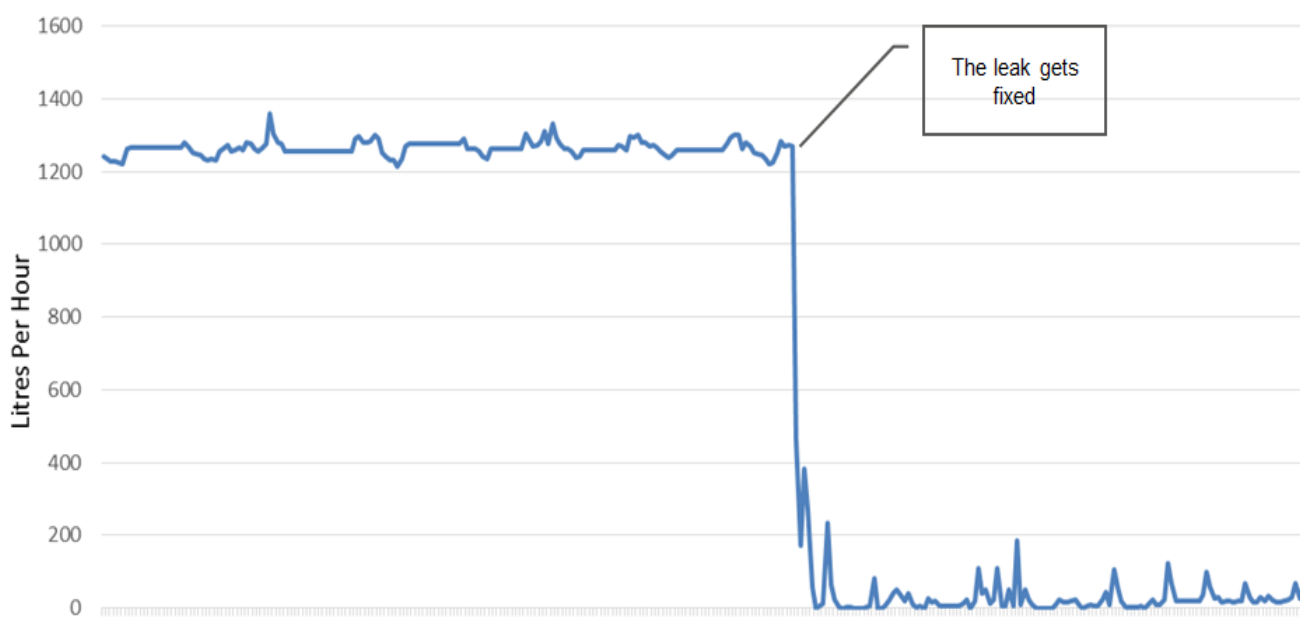
As well as fitting meters, we're offering a free Smarter Home Visit to all customers who've had a meter fitted. Our team of advisors can help customers save water, energy and money by fitting the latest water-saving devices in their homes, and providing expert advice on how to cut water use and bills.

In 2017/18 we delivered over 60,000 Smarter Homes Visits in London and the Thames Valley, and installed over 174,000 water and energy saving devices through these activities.

Smart meters finding leaks.

Smart water meters, which we're now fitting across London, show us where there's water continuously flowing through a meter for a sustained period. This helps us to find leaks on customers' supply pipes or within their homes more quickly and accurately than ever before.

This graph shows how we can identify and repair leaks using hourly smart meter data. Without a smart meter, this leak on a customer's supply pipe could have wasted over 10 million litres of water a year, and generated a bill of over £21,000. Instead we were able to find it, and fix it for free.





**Smarter Home
Visits.**

Smarter Home Visits.

Our Smarter Home Visits (SHV) initiative is the largest water efficiency programme ever seen in the history of the UK water sector.

The background.

Our SHV scheme involves retrofitting water saving devices, and providing individually tailored water saving advice, to households across London and the Thames Valley.

The scheme is run by our partner Groundwork – which delivers wider sustainability and green space projects and trains local people to carry out the visits and retrofit our range of water and energy saving devices.

In 2017/18 we delivered over 69,000 SHVs in London and the Thames Valley, and installed over 174,000 water and energy saving devices through our activities. The majority of our SHVs were provided to households that recently had a smart water meter installed.

During these visits we also fix leaky loos, and offer selected customers free benefit entitlement checks and debt advice. An average of £2,791 per year has been identified for each family eligible for financial assistance.



- Over 69,000 smarter home visits in London and the Thames Valley in 2017/18.
- Fitting over 174,000 free water saving devices last year.
- Fixing leaky loos and other internal leaks for free.

Water saving in action.

We've seen more and more of our customers take up our SHVs because they're keen to learn how they can reduce the amount of water they use, and save money on their water and energy bills.

During each visit, our Smarter Home Advisers show each customer how they could be saving money using our specialist water and energy saving app. Our app has been developed in conjunction with the Energy Saving Trust (EST), and it includes both water and energy savings for each customer's household.

By using the app to talk the customer through each of the ways they use water, and asking a number of simple questions about how they use water and energy, our advisers can show a 'live view' of where savings could be made, and produce a bespoke water savings plan for every customer.

To maximise these water savings, we've also offered customers a wide range of water saving devices and fixes including:

- Showerheads and shower saves.
- Shower timers.
- EcoBETAs (toilet dual flush retrofit device).
- Toilet cistern displacement devices.
- Tap aerators.
- Kitchen swivel taps.
- One-off free leaky loo fixes.





**Smarter Business
Visits.**

Smarter Business Visits.

During 2017/18 we've continued to run a Smarter Business Visit (SBV) trial in London to make businesses more water efficient. This trial delivered a total of 527 SBVs, mainly in south east London.

Background.

Although we've left the non-household retail market for water, we still have our wholesale non-household water efficiency target to reduce demand and increase security of supply.

Alongside our Smarter Home Visit (SHV) programme, our SBVs involve a qualified plumber visiting business premises to review their kitchen and bathroom facilities.

Our plumbers then recommend the best solutions for the business and fit suitable water saving devices. The visit and the installations are free - helping to save water for the business, and protecting the environment too.

In addition to these installations, our SBV team also find and fix visible internal leaks, most commonly leaky loos or leaky urinals.



Installing free water saving devices.

The free water saving devices we offer to install include:

- Cistern displacement devices.
- Tap inserts.
- ecoBETAs.
- Shower heads.
- Urinal controls.

During our 527 SBVs in 2017/18, we managed to save each business over 2,000 litres of water every day on average.



- Visited 527 business customers
- Fixed 715 visible leaks.
- Saved over 2,000 litres of water a day on average.



**Leaky loos and
internal leaks.**

Leaky loos and internal leaks.

Leaky loos are one of the most common causes of unexpectedly high water use in households and businesses, but they aren't always easy to spot, so they often go unnoticed. We estimate that up to five per cent of toilets leak, wasting from 100 to 2,500 litres every day.

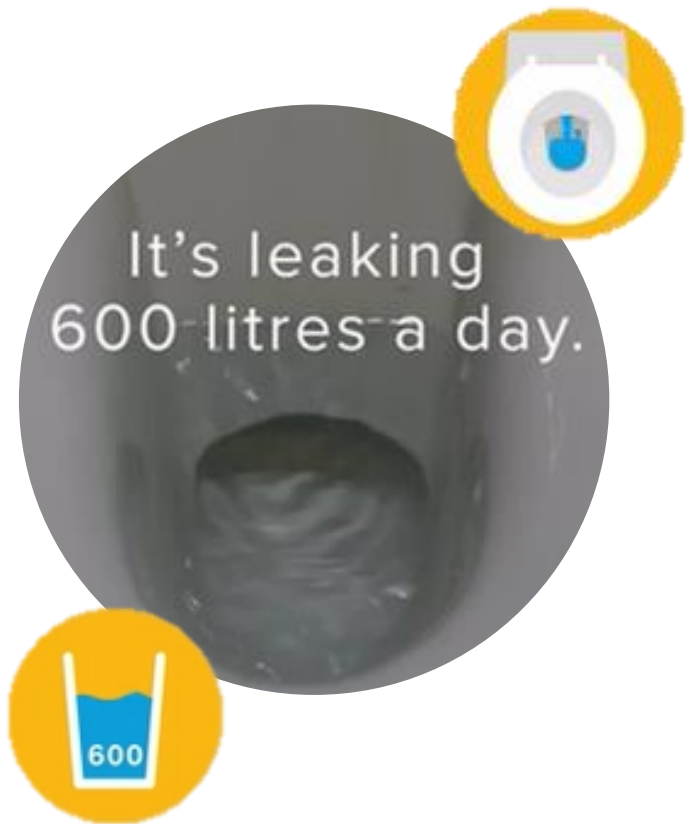
Fixing leaky loos.

Following a successful trial in 4,000 households, we've made fixing leaky loos and other internal leaks part of our core business, with every Smarter Home Visit customer eligible for one free repair.

Now that fixing leaky loos and tackling internal leakage has become core business for us, we've increased our capacity to provide these fixes, and we've been rewarded with significant savings.

With an average leaky loo doubling a metered household's annual water bill, our efforts to raise customers' awareness, and fix these leaks, will deliver savings that directly benefit metered customers' bills.

- **Leaky loos can double a metered household's annual water bill.**
- **Over 6,000 internal leak repairs carried out in 2017/18.**
- **3.2m litres of water saved per day thanks to Smarter Home Visits.**



Smarter Home savings.

During 2017/18 we completed over 6,000 internal leak fixes as part of our Smarter Home Visit programme. This produced savings of 3.2 million litres of water per day.

When the cost of a fix is accounted for, it represents extremely good value for money. But the benefits for customers who've received a Smarter Home Visit and retrofit don't end here, and everyone has something to gain from wider awareness of water saving issues:

- Average saving per fix of over 300 litres a day.
- Saving money for customers.
- Reducing in-home leakage.



**Water efficiency
incentive
scheme pilot.**

Water efficiency incentive scheme pilot.

In partnership with Green Redeem, we've developed an incentive pilot scheme based on the concept of rewarding customers for reducing their water usage. We've made a commitment as part of our AMP6 Business Plan to test whether innovative tariffs or incentives could help reduce household water demand.

Our original pilot has been running in Reading and has been made available to 3,000 households, using smart meter technology which provides regular data on how much water they consume.

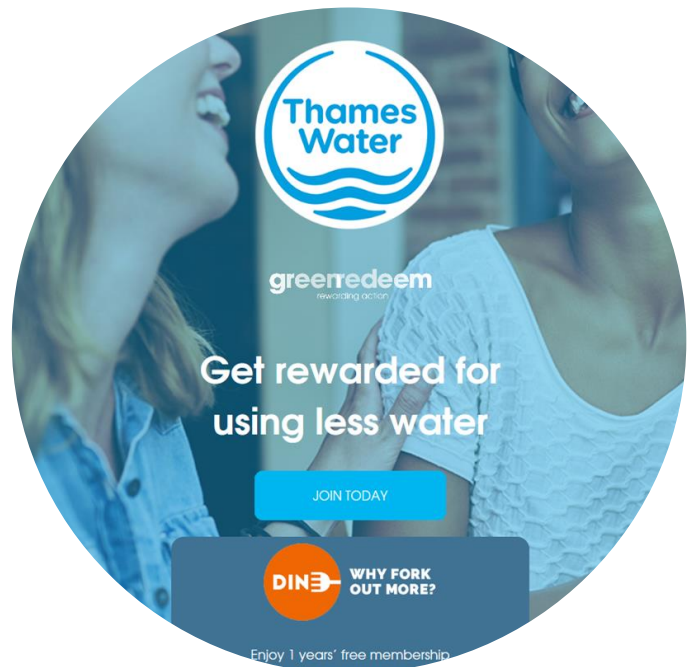
In 2017/18, as a result of our successful pilot in Reading which tested how our customers could be rewarded for reducing household water use, we expanded this trial to include over 140,000 smart metered households in London.

How it works.

We establish a baseline water consumption value for each household taking part in the pilot, by calculating their average water use over the previous three months from meter readings.

Each week the participating households are awarded points through their online portal or app, if that week's water use was lower than their baseline.

- Rewarding customers for saving water through an innovative pilot incentive scheme.
- First ever scheme to combine smart water meter data with non-financial rewards.



Rewarding water efficiency.

Customers can spend their points on a selection of rewards such as offers at local businesses, shopping vouchers, free coffees and more. Points can also be exchanged for entry into a monthly prize draw or monetary awards that are donated to charity.

The platform for the incentive scheme also allows 'bonus points' to be awarded for taking quizzes about water efficiency and pledging to undertake sustainable actions. All this helps to increase awareness and education amongst participating customers.

Pilot scheme results.

The households which signed up to the original pilot scheme in Reading indicated water savings between 0.5 and 2 per cent against their baseline.

We've recruited 1,675 customers for the pilot scheme across both Reading and areas of London. We'll continue to add more households to the incentive scheme pilot, monitoring any reduction in water consumption, and measuring customer engagement with the app and reward offers.





**Helping housing
association
residents save
water and
energy.**

Helping housing association residents save water and energy.

We're working with housing providers to deliver in-home visits for their residents to help them save energy, water and money. We've partnered with ZapCarbon to combine both energy and water advice through EnergySave Plus Water.

Background.

The EnergySave programme was developed by ZapCarbon, who are award winning experts in delivering behaviour change programmes, with the aim of helping residents of the housing provider London and Quadrant (L&Q) to save money in times of financial hardship.

EnergySave Plus Water.

Through tailored in-home visits and on-going behavioural coaching, the EnergySave programme helps residents to gradually reduce how much they spend on energy.

On average, EnergySave households have saved £208 each year through pure energy savings. With this new expanded programme, they can cut their water bills by an additional £60 a year, making a combined household saving of over £268 a year.

Water efficiency was added to the Energy Save Scheme because energy and water efficiency are directly linked. For instance, hot water is a major source of energy use, accounting for around 20% of how much gas or electricity an average household uses. Reducing the amount of hot water they use can directly cut residents' energy and metered water bills.

As part of this programme, residents receive water and energy saving advice that's tailored for them and their household. They can also get a wide range of our water-saving devices installed, as well as useful information about our affordability and extra care services.

- **3,578 energy and water visits carried out in 2017/18.**
- **Residents can save around £268 every year.**
- **A visit could help save around 80 litres of water a day.**



How it works.

The EnergySave plus water programme is delivered by ZapCarbon and funded by L&Q and Thames Water. ZapCarbon manage and deliver the visit programme with their team of highly-trained field agents. They also use a range of coaching technology tools to help residents after each home visit.

Benefits.

- Saving residents energy, water and money.
- Tailored household advice.
- Increasing residents' and customers' satisfaction.
- Improving the efficiency of homes.
- Tackling fuel poverty.
- Reducing CO₂ emissions.
- Identifying vulnerable residents.
- Telling residents about other kinds of help.

Feedback from residents.

"If they hadn't sent anyone round I would not have known how much I could save on my bills."

An overwhelming 97% of residents said they would "recommend the service to friends and family". Encouragingly, 83% of residents said that they were doing more to monitor their consumption following the visit, and 79% of residents believed that the changes made as a result of the scheme would be lasting.

Looking to the future.

Encouraging water efficiency alongside energy efficiency has proven to be highly effective, both in the benefits delivered for residents and in the cost of delivery. We're planning to roll this project out to more housing associations and local authorities in 2018/19.



**Water Efficiency
Schools
Programme.**

Water Efficiency Schools Programme.

Our Water Efficiency Schools Programme (WESP) is an industry leading behaviour change and school engagement project, and it's a central component of our wider water efficiency programme. During 2017/18, we visited 40 schools, where over 5,000 students took part in this programme. Being able to engage with a whole school community like this ensures our messages endure in the minds of this key group.

Winning formula.

We offer each participating school a comprehensive programme of practical and educational activities, including a multi-visit programme of interactive engagement workshops, a free and comprehensive water audit for the school, a focus on free fixes for leaking taps and loos, and free urinal controls.

This programme is innovative in the way it sets out to involve the whole school community – from pupils to caretakers to families – and produce lasting behaviour change alongside real water savings. The project uses peer-to-peer influencing to widen its reach and make sure that our key messages aren't quickly forgotten.

Our interactive engagement workshops help students to understand water efficiency issues, as well as encouraging them to spread this knowledge through the school and at home. The workshops have included creating an 'eco team' within their school. Teams were taught how to run an interactive game using water and energy saving messages with their peers, and then encouraged to invite other school classes to take part.

In secondary schools, teams were asked to create and develop a water efficiency campaign. Support was provided to help them select key messages and methods of delivery, but the teams themselves came up with their own ideas on the campaign itself.

Alongside the workshops and campaigns, each school receives a free and comprehensive water audit, in which we focus on identifying and fixing leaky loos and taps. We also install urinal controls where appropriate, providing the school with even more savings.

- Engaged with around 40,000 pupils.
- Free school water audits and fixes.
- Shortlisted for Global Good Awards 2018.



Wide reach, successful delivery.

Since this programme started in 2014, we've engaged with 210 school communities. We've provided real water savings for schools as part of an innovative engagement and education programme, reaching thousands of pupils and their families. We've also:

- Delivered nearly 500 workshops in schools since 2014.
- Engaged approximately 40,000 pupils.
- Saved over 8 million litres of water each year.

Building on the relationship.

After our successful school visits, we held a celebration and awards event for eight of the schools which took part.

This event was held at City Hall in central London, where students were given the opportunity to present their water efficiency campaigns in the prestigious main Assembly Chamber, with their work being judged by a panel. The presentations included the changes they'd made in their school and local community, as well as findings from the project.

The winning school was rewarded with a fun trip to Walthamstow reservoir to see one of our sites of special scientific interest (SSSI).

Longer term outcomes.

The benefits of our Water Efficiency Schools Programme go far beyond water savings and the number of people we've engaged with. By fully evaluating this project, using before and after surveys, we've been able to measure how the students' and communities' behaviours and attitudes to water use have changed. Overall, we've seen a positive shift in attitudes, showing how successful the programme has been.



**Using
wastewater to
support water
resources.**

Using wastewater to support water resources: a step toward water resilience.

The combination of population growth and climate change is putting more and more pressure on our precious water resources. If we don't take action, there's predicted to be a shortfall of around 360 million litres of water a day by 2045, which is the equivalent of 2 million customers' needs. We're investigating three options for using wastewater to support water resources and help tackle the shortage of water. These include 'planned indirect potable reuse', 'non-potable reuse' and 'environmental flow augmentation'. If we implemented these options, we'd have more water for our customers.

The challenge.

With 70% of the world covered in water, and the UK being perceived to have a lot of rain, it can be difficult to understand the need to be careful with water. But our heavily populated region is classified as 'seriously water stressed' by the Environment Agency. With the additional impacts of population growth and climate change, this situation is likely to get worse.

A shortfall - when demand for water is higher than the amount available – is projected to be around 360 million litres of water a day by 2045. With each customer using, on average, 146 litres of water a day, that's the equivalent of 2 million customers' needs.

In water stressed areas like the Thames catchment area, most of the available water resources for drinking water supply have already been used. We want to ensure resilient water resources for future generations. So, as part of our Water Resources Management Plan (WRMP19) process, we assessed many options for reducing the shortfall, and submitted our preferred plan to our regulator. This plan, which we also put out for consultation, included options to reuse wastewater as a water resource.



Queen Elizabeth reservoir.

Current processes in Oxford and London.

We already reuse wastewater in a process which is called unplanned indirect potable reuse (IPR). This occurs when treated wastewater from sewage treatment works is returned to a watercourse or river, re-entering the hydrological cycle. This water blends with river water and is further diluted and purified as it flows downstream, where it is then abstracted and treated to produce drinking water. 'Indirect' indicates that the treated wastewater flows through a natural watercourse before being reused.

An example of this is the relationship between Oxford and London. Oxford is located upstream of London, with drinking water taken from the River Thames. The city's wastewater is treated at sewage treatment works before being returned into the Thames or one of its tributaries. Even further downstream, water is abstracted from the Thames near London, where it's treated and put into Londoners' water supply.

- London will face a shortfall of around 360 million litres of water per day by 2045.
- We've found three options which use wastewater to support water resources and included them in our WRMP19.

Our proposed options.

We've assessed the feasibility of three different options in which wastewater could play a role in supporting water resources and reducing the predicted water shortfall. These options are:

- Planned indirect potable reuse.
- Non-potable reuse.
- Environmental flow augmentation.

Planned indirect potable reuse (IPR).

Planned IPR is when treated wastewater is intentionally returned to the river upstream in a catchment where water is abstracted for drinking water treatment (Figure 1).

Non-potable reuse (NPR).

Some of the water we use at home and in offices doesn't need to be treated to the same high standard as drinking water. This includes water for flushing toilets and watering plants. Non-potable water supply can be provided by recycling greywater (the water from bathroom sinks, baths or showers) and blackwater (municipal and industrial wastewater).

Using these alternative non-potable options, in combination with rainwater harvesting, could significantly reduce water demand at local scale. This is particularly relevant to new housing and commercial developments. Potable water demand could be reduced by up to 33 MI/d by implementing non-potable water supplies in new developments across London's 38 opportunity areas (as defined in the London Plan published by the Greater London Authority).

Environmental flow augmentation.

In this option, treated wastewater is returned to the river downstream of the drinking water catchment to offset abstraction for drinking water treatment further upstream, to ensure there is sufficient water left in the environment for fish, insects, birds, plants and animals.

Our research platform.

The Old Ford water recycling plant on the Olympic Park in east London is the UK's largest wastewater recycling facility of its kind. It was jointly funded with the Olympic Delivery Authority to cut potable water consumption across the Olympic Park, which helped to reduce reliance on tap water during the Olympics and the 2012 drought.

We've been operating and maintaining Old Ford and its associated assets since February 2012, supplying on average 70 million litres a year of recycled, non-potable water for flushing toilets and irrigation on the Olympic Park.

We've also been using Old Ford as a research platform to assess the feasibility of both non-potable reuse (NPR) and planned indirect potable reuse (IPR). Since December 2016, we've been operating a pilot plant to evaluate two advanced treatment processes for planned IPR:

- Reverse osmosis followed by Advanced Oxidation Process (AOP)
- Granular activated carbon followed by AOP

AOP involves treating water with hydrogen peroxide (H_2O_2) before passing it through an ultra-violet (UV) reactor. These advanced treatment processes are outlined in Figure 2.

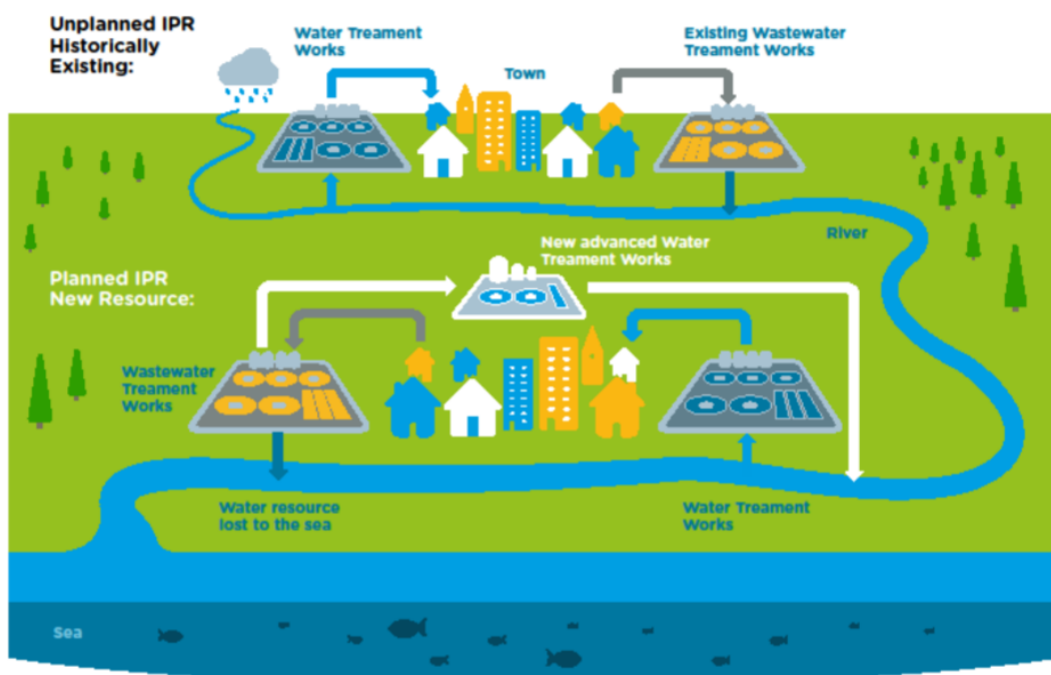


Figure 1: Planned indirect potable reuse.



Our research platform (continued).

We've focused our research at Old Ford on the following areas:

- Understanding our options' effects on society and the environment.
- Making sure we'll comply with regulations like the Water Framework Directive and the Water Supply (Water Quality) Regulations, by developing risk assessment methodologies.
- Assessing how any risks could be mitigated by various technological solutions.
- Understanding governance and how our stakeholders perceive planned IPR and NPR.
- Developing and applying a multi-stage methodology to assess the potential for reusing non-potable water in London.



Old Ford water recycling plant.

Options in WRMP19.

We've also included our research on reusing water as part of our wider WRMP19 process. This sets out how we'll maintain a sustainable balance between water supplies and demand over the next 25 years, as a minimum. It's critically important for us to plan for the long term, because the decisions and investments we make now will determine the level of service that we can provide to our customers into the future. More information on water reuse options and other water resources in our WRMP19 can be found on our [website](#).

We'll publish a report setting out the comments we received during the WRMP19 consultation and explaining how we have taken these into account in revising our draft Plan.

What's next?

If our preferred WRMP is accepted, we'll continue our research to make sure we put the very best solutions into practice.

For both planned IPR and NPR, we'll create a risk management framework for reusing water, which will address the risks associated with water quality compliance and technological performance. We'll also develop our communication and engagement approach with regulators, stakeholders and the public.

We're aiming to develop a sustainable operating model to ensure that NPR schemes are beneficial for our customers, Thames Water and other operators. We'll achieve this by considering the performance of our water supply network, and by effectively managing any potential cross-connections between potable and non-potable water supplies.

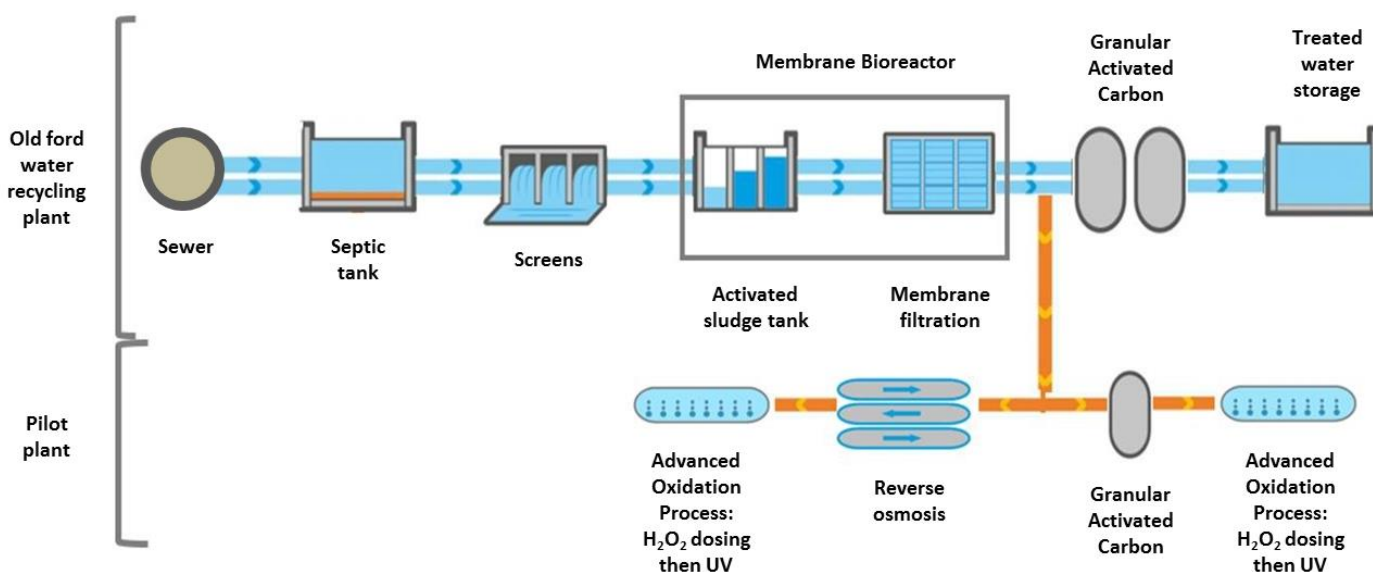


Figure 2: OFWRP and IPR pilot plant advanced treatment processes.





**Innovative pipe
pushing machine.**

Innovative pipe pushing machine.

We've installed a new water main in Baker Street as part of a £2.1 million project to make the network more resilient now and for future generations. To minimise disruption to traffic and the community, we used a process called slip-lining, which means inserting a new plastic pipe inside the old iron one.

Background.

We're using cutting edge techniques to replace our ageing water mains and reduce congestion on London's busiest roads.

We're doing this by using an innovative method called slip-lining to replace old pipes, a process when a durable plastic pipe is inserted into the old cast iron pipe. This involves welding sections of pipes together and using a special machine to push it through the pipe, with a winch at the other end to pull it through.

In this case, the plastic pipe measured 450mm in diameter, and was inserted into the 300 metre stretch of pipe which runs underneath Baker Street, Marylebone Road and Park Road.

Effective and beneficial.

This method is proving incredibly effective by replacing hundreds of metres of pipes without having to close and dig up entire roads and replace the pipe completely. This significantly reduces the time and disruption it traditionally takes to replace and strengthen old Victorian pipes, which benefits both residents and commuters.

- Innovative method called slip-lining inserts new plastic pipes into old Victorian cast iron pipes.
- Significantly reducing project time and disruption for residents and commuters.



A pipe pushing machine on a similar project.

Keeping everything moving.

This project is the latest success story in our mains replacement programme, in which we're targeting pipes in poor condition across the capital and replacing them, to reduce the risk of bursts.

We're planning to roll this method out across the rest of our mains replacement programme, including our £600,000 work near Banbury, and other repair work next year.

As well as slip lining water mains, we're trialling a range of new technologies to detect potential failures on our pipes, including smart meters which have already saved around 4.7 million litres of water.



Our project team with Lord Mayor Cllr Ian Adams.



**Being a good
neighbour at our
Acton storm
tanks.**

Being a good neighbour at our Acton storm tanks.

Collecting rain water and sewage in Acton's six storm tanks is a crucial part of making sure our sewer network can cope with heavy rainfall and prevent sewer flooding. But local residents have raised concerns about the storm tanks' odour and visual impact.

The time it takes to drain and clean the tanks after rain water and sewage had been collected was causing concerns for residents, including those who had recently moved to the area in newly built high-rise flats which overlooked the site.

Engaging with the community.

In 2015 and 2016, we held a series of meetings for residents, the chair of the residents' association, councillors and local MPs, Andy Slaughter and Rupa Huq, to share and update them on our proposals for reducing the smell and visual impact of the storm tanks, and get their feedback.

Before our upgrade work started, we delivered letters to local residents, businesses and councillors informing them of our work and inviting them to two public drop-in sessions.

While the upgrades were happening, we kept residents informed with a monthly newsletter delivered to homes. We also published updates on a dedicated webpage for the works.

- Acton storm tanks help our network to cope with heavy rain and prevent sewer flooding.
- Upgrading the site to reduce odour and concerns about visual impact.
- Engaging and working closely with the local community.



Upgrading the site

To complement the cleaning regime our teams already performed on the storm tanks, our upgrades included changes to operational practices – like altering the way the tanks fill up, so that the middle two fill first during periods of heavy and prolonged rainfall.

We've also installed covers over these middle tanks, with an odour control unit to treat any smelly air under the covers. This has helped to reduce the local community's concerns.



Part of the community.

We recognise that we play a key role at the heart of the community, and we want to be a responsible neighbour.

We've worked closely with the community around our storm tanks at Acton. As well as the improvements at our site, we've upgraded the facilities at the local scout hut which plays a central role in bringing the community together.

A number of volunteers from across Thames Water gave this community hub a new coat of paint. Our people also replanted and landscaped the garden, and installed a new kitchen too.

The community was so impressed with Thames Water's efforts to go above and beyond that we were presented with an award in 2017 for our efforts to help and engage with local people.

The site's future.

Thanks to the Thames Tideway Tunnel, we'll eventually be able to remove two of the six storm tanks at Acton, because excess storm flows at the site will be discharged directly into the purpose built 'super sewer' instead.

The remaining four tanks will still provide us with additional capacity and resilience, but they won't be filled as often when the new Tideway Tunnel has started working.

As part of the Tideway Tunnel team's ongoing engagement programme, we'll continue to be involved in community meetings to make sure we address any concerns about our operations as quickly and fully as possible.





**How we
manage carbon
emissions and
sludge.**

How we manage carbon emissions and sludge.

We're committed to becoming a more sustainable business, at the same time as keeping our customers' bills as low as possible. A big part of our work around wastewater involves disposing of sludge more the effectively and more sustainably. Historically we've treated sludge to high standards using anaerobic digestion (AD), producing biogas that can be used as a fuel in our combined heat and power (CHP) engines. This generates renewable energy which we use to run our largest sites, offsetting the need to import electricity from the national grid with its associated carbon emissions.

Background.

We're committed to reducing our contribution to climate change, and we aim to reduce our carbon emissions in line with the Climate Change Act 2008. Compared to our levels of 845.8 kTCO₂e in 1990, we've achieved a 67 per cent net reduction in our emissions including the purchase of renewable grid electricity.

Until recently, the main focus of our efforts to reduce our carbon emissions centred around reducing our consumption of grid electricity – by increasing our own supply of renewable energy and increasing energy efficiency across our operations.

This was because emissions associated with grid electricity have traditionally made up the largest component of our overall footprint, typically around two thirds. However, from October 2016 we started to purchase 100% REGO accredited renewable grid electricity, and we can now turn our attention to emissions from other non-grid related sources.

- **GHG emissions 67 per cent below 1990 levels.**
- **Purchasing 100% REGO accredited renewable grid electricity.**
- **Generated a record 289GWh of renewable electricity from sludge.**
- **Reduced distance sludge travelled via tankers by around 335,000km.**



We can expect to be able to reduce our carbon emissions even further by better understanding where our overall emissions come from, and the way our operations contribute towards them.

The significance of emissions generated through managing and disposing of sludge will continue to rise for us, due to population growth and therefore the increased amount of sludge we'll need to treat, manage and dispose of in the future.

By better understanding the carbon related and wider environmental benefits of the way we manage our sludge, we can identify new ways to increase these benefits - helping us work towards our goal of becoming a more sustainable business.

We're taking this very seriously, not just because protecting the environment is the right thing to do, but also because meeting the challenges of population growth will help us provide value for money for our customers.

Emissions from digestion.

A key change in the way we manage our sludge during the current AMP has been to move towards advanced digestion using Thermal Hydrolysis Plant (THP) technology. Using THP before anaerobic digestion helps break down the organic matter in the sludge into compounds which the microbes in the anaerobic digesters find it easier to use. The microbes digest these compounds more efficiently, which results in more biogas production.

This has allowed us to make more efficient use of sludge by increasing amount of biogas we're producing, so increasing the amount of renewable electricity and heat we can generate. We've increased the volume of biogas we produce from 76 million m³ in 2013/14 to 122 million m³ in 2017/18.

Although THP requires the addition of a small amount of energy, this increase in biogas and the resulting renewable energy outweighs this. Compared to traditional digestion alone, we've seen an overall reduction in greenhouse gas emissions of 9 KtCO₂e when we've been using THP.

Generating more electricity from sludge.

We generated a record 289GWh of renewable electricity from sewage sludge in 2017/18. This represents a 90 per cent increase in generation compared to 156GWh in 2013/14 - reducing our reliance on grid electricity and making even better use of sludge.

Our green tariff renewable grid electricity has allowed us to offset a significant cost associated with the price of the grid electricity that would otherwise have to be procured. This saving allowed us to invest even more in developing our renewable energy generation capacity, and in environmental improvements elsewhere in our operations.

Less tankering.

Moving towards advanced digestion has provided us with big additional environmental benefits – including less sludge that needs to be transported by tanker to other sites for treatment, and less treated sludge, known as biosolids, being taken to farmland.

Improving how we manage sludge transportation in our region has also reduced our tankers' mileage by around 335,000 kilometres in 2017/18 compared to the previous year. This has allowed us to save 1KtCO₂e in greenhouse gas emissions, while improving local air quality, reducing disturbance for local communities, and the risk of health and safety incidents at our sites and on the roads.

Continuing our journey.

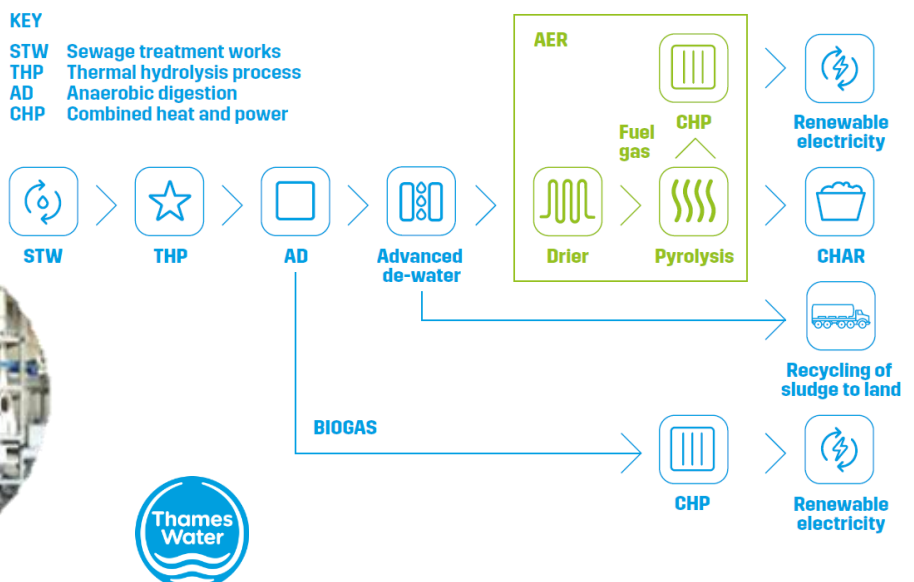
As well as expanding our use of the advanced digestion and THP, we're also piloting a full scale advanced energy recovery (AER) to treat sewage from around 250,000 people.

The AER plant uses pyrolysis and involves processing sewage sludge at temperatures of up to 800 degrees Celsius, in close to atmospheric pressure without oxygen, to produce fuel gas that can be used in engines to produce electricity. AER is still in its infancy, but when its full potential is reached, it's predicted to extract over 80% of the available energy that's left in sewage after conventional processes. We can then use this energy to power our operations.

The residual product (called char) is a carbon-based and mineral-rich material. We hope to be able to recover nutrients, precious metals and carbon from char, contributing even more to the circular economy. Extra cuts in carbon emissions are also likely as a result of using more biogas for heating and drying sludge before anaerobic digestion and pyrolysis. We're hoping to make AER economically viable, which will unlock potential benefits for customers, the environment and wastewater industry.



THP (above) and pyrolysis plant (right).





**Becoming a
more energy
aware business.**

Becoming a more energy aware business.

We're committed to becoming a more sustainable business, at the same time as keeping our customers' bills as low as possible. Our energy performance team are contributing to this by helping our business to use less energy, pay less for the energy we do use, and make more of our own renewable energy – 'use less, pay less, make more'. We're trying to increase energy awareness across our whole business to build a culture where being energy efficient is part of our daily working lives.

Background.

Energy prices are set to rise, which could take our company's annual cost of energy from around £100 million to £145 million a year by 2025 if we don't take action. Using less energy, making more of our own renewable energy and finding ways to pay less for it, (for example, by reducing how much we use during peak tariff periods from 4.00pm to 7.30pm each day, when energy costs can double) will ultimately help us keep our energy costs down.

No matter how big or small these savings may be, everyone across our business can contribute. To help this happen, we're communicating our energy saving messages to all our people, who work at hundreds of sites across London and the Thames Valley.

Communications and engagement.

To help make energy saving part of our everyday thinking, we regularly engage with all our people:

- **Digital engagement:** stories on our internal portal, articles in our monthly company magazine, email bulletins, and posts on our internal social media platform called Yammer.
- **Energy saving tips:** we tailor and provide tips for our people in offices and on operational sites alike, so they can maximise energy savings.
- **Employee engagement emails:** we encourage our employees to contribute energy saving ideas by sending them to our Energy Performance Team's 'thinkenergy' mailbox. Suitable ideas are taken forward and supported by the Energy Team.



Every Watt Counts

Using less. Paying less. Making more.

Insights from sub-metering.

We've fitted more than 900 sub-meters across 25 of our largest sites, where around 60 per cent of our total energy is used.

Sub-metering allows us to better understand the energy consumed by equipment or processes on our operational sites.

Our site managers receive the data from the meters, and can use these insights to identify opportunities for improvement with their operations teams. In 2017/18 this data insight helped us save more than £400,000.

- Our top 100 operational sites consume 80 per cent of the total energy used by our business.
- 60 per cent of the electricity used at a typical sewage treatment works is powering aeration to treat customers' sewage.
- Over 80 per cent of the electricity used at a water treatment works is powering the pumps that provide customers' water supply.

Energy awareness workshops.

Our Energy Performance Team has hosted many workshops across the business, including areas like wastewater treatment, water production, and operational control, to make sure as many of our sites are as energy efficient as possible. These workshops particularly focused on the top 100 energy-consuming sites that don't have sub-meters fitted, which account for approximately 20 per cent of the energy consumed by the company.

The workshops have emphasised the 'use less, pay less' principles to our operational teams. They've also introduced them to new technology, improved their awareness and understanding of energy across the business, and explored how they can positively contribute to helping reduce our carbon footprint. To help our teams to identify energy saving opportunities, we've developed a checklist of energy-saving suggestions. Running these workshops has enabled a closer working relationship between our Energy Performance and operations teams.



Detailed energy reports.

We produce a wide variety of reports to inform our operational teams - helping them to better understand how when and where they use energy, and to identify where they could reduce consumption and cost.

For example, our 'time of day' reports help site teams understand costs associated with importing grid electricity during peak tariff periods, when electricity is much more expensive. By knowing where and when our processes use electricity, our teams can look for opportunities to alter consumption and reduce costs, without affecting our customers and the environment. This lets us free up budget to improve our operational performance even further.

Another example is our 'energy doughnut report' which allows operational managers to take a more dynamic view of energy performance across the sites they manage. As a consequence, operational issues like higher energy use in parts of the process, indicating potential problems, can be identified earlier and proactively resolved.

Benefits of awareness.

Effective engagement with our people on the subject of energy is an important part of making our business more energy efficient, and more sustainable as a result. By increasing awareness and understanding of how we use energy, it's helping us to proactively identify and prevent potential operational issues, and stop them affecting the service we provide for our customers.



**Bringing skills into
our industry.**

Bringing skills into our industry.

The Skills Accord is an energy and utilities skills initiative aimed at using procurement to promote sustained investment in the skills that our sector needs most. This is vital because one fifth of the energy and utilities sector's skilled workers are approaching retirement age, and 36% of vacancies are currently proving harder to fill than in any other UK sector. The Accord was piloted in October 2016 by Thames Water, Amey, National Grid, SSE, and UK Power Networks. Since then, the number of leading supply chain company signatories has grown to 38.

Background.

The 2015 National Infrastructure Plan for Skills identified a number of challenges across sectors, regions and skills groups, to keep productivity high, costs affordable and ensure the delivery of the infrastructure pipeline to 2020 and beyond.

One of the key challenges was to find a mechanism to incentivise skills investment through procurement and engagement approaches that would provide appropriate incentives to retrain and up-skill the workforce to meet future skills demands. The Skills Accord was developed by five leading companies in the energy and utilities sector: Thames Water, Amey, National Grid, SSE and UK Power Networks. The initiative now has 38 signatories.

Skills through the supply chain.

The Accord has set five robust and challenging commitments to make sure companies use responsible procurement practices to promote investment in skills through the supply chain. All the companies involved have agreed to:

- Address sector-wide skills gaps and shortages.
- Promote signing up to the Accord through their supply chain.
- Promote relevant skills development across the supply chain through procurement.
- Continuously improve performance.
- Monitor and report relevant performance.

- **An important new initiative to tackle the energy and utility sector's skills gap.**
- **Using responsible procurement practices to promote investment in skills through the supply chain.**



Thames Water receiving an Achievement Award in recognition of our commitment to the Procurement Skills Accord.

During the Accord's first year, we're delighted that it has stimulated a number of improvements, with encouraging results for our sector:

- 28 of the eligible companies, including Thames Water, met their commitments and received an award for promoting investment in skills and training.
- There has been an increase in the percentage of the eligible workforce accessing training.
- 15% increase in the percentage of the eligible workforce (c.39,000) were given access to technical and operational training during the last year – up from 9.5% to 11%.
- 86% of signatories demonstrated a commitment to continuous improvement through sustainable workforce practices.
- Nearly 70% of signatories with a relevant supply chain took on at least one new supplier.

A future sustainable workforce.

The energy and utilities sector is now poised to deliver its commitment to skills through the supply chain for many years to come – giving us a more sustainable workforce in the future. We're proud to be a leading partner on this important initiative, and to drive investment in the skills that our sector needs most. We're committed to tackling the skills gap by collaborating with our supply chain and through our procurement practices.



**Managing sludge
with Advanced
Energy Recovery.**

Managing sludge with Advanced Energy Recovery.

Sewage sludge is the essential solid by-product of the wastewater treatment process, but it's a valuable resource too. We treat sludge safely, and recycle it to land sustainably as biosolids. We also use sludge as a fuel to produce biogas to generate renewable electricity and reduce our reliance on energy imported from the grid. We're continuing to look for ways to increase our renewable energy generation, and for more sustainable and resilient ways to dispose of sludge.



Background.

A primary component of our activities around wastewater involves disposing of sludge in effective and sustainable ways.

Historically we've treated sludge to high standards using anaerobic digestion (AD). This produces biogas which can be used as a fuel in our combined heat and power (CHP) engines to generate renewable energy. This renewable energy is then used to run our largest sites, offsetting the need to import electricity and natural gas from the grid, and reducing carbon emissions.

- **Generated a record 289GWh of renewable electricity from sludge.**
- **Full scale pilot Advanced Energy Recovery plant to treat sewage from around 250,000 people.**
- **Predicted to extract over 80 per cent of available energy in sewage.**
- **Residual product is 84 per cent less than the volume of sludge entering the process.**

Increased generation from sludge.

A key change in the way we manage our sludge during the current AMP has been to move towards advanced digestion using the Thermal Hydrolysis Process (THP). Using THP before anaerobic digestion helps break down the organic matter in the sludge into more accessible (digestible) compounds for the microbes in the anaerobic digesters to utilise. The microbes use these compounds more efficiently, which results in more biogas production.

This has allowed us to make more efficient use of sludge by increasing the amount of biogas produced, and therefore increasing the amount of renewable electricity and heat generated. In addition to the renewable energy benefits of pre-treating sewage sludge with THP, it also reduces the amount of treated sludge which needs to be recycled to land.

Last year we renewably generated over 20 per cent of our overall electricity from sludge and biogas, but there's more we can do. As well as expanding our use of advanced digestion and THP, we're also piloting a full scale advanced energy recovery (AER) plant to treat sludge by means of pyrolysis. In addition to fuel gas, this produces a carbon-based and mineral-rich material as its final product.

Advanced Energy Recovery.

Located at our Crossness sewage treatment works, the full scale pilot AER plant will treat sewage from around 250,000 people. The AER plant uses pyrolysis and involves processing sludge at temperatures of up to around 800 degrees Celsius in close to atmospheric pressure, without any oxygen, to produce fuel gas that can be used in engines to produce electricity.

While pyrolysis isn't a new idea, the amount of energy needed to dry sewage sludge to prepare for the process used to be prohibitive. Now, as a result of innovative thinking, we've adapted Bucher press technology from the cider industry, to squeeze more water out of sewage sludge.

By combining pyrolysis with drying the sludge at low temperatures, the Bucher press and existing processes – anaerobic digestion, combined heat and power engines and thermal hydrolysis – it's likely that we can cut carbon emissions even further by using more heat from the CHP engines to dry sludge at the start of the process.

AER is still in its infancy, but we predict that when it's maximised to its full potential, we'll be able to extract around 80 per cent of the available energy that's left in sewage after conventional processes. We can then use this to power our operations.

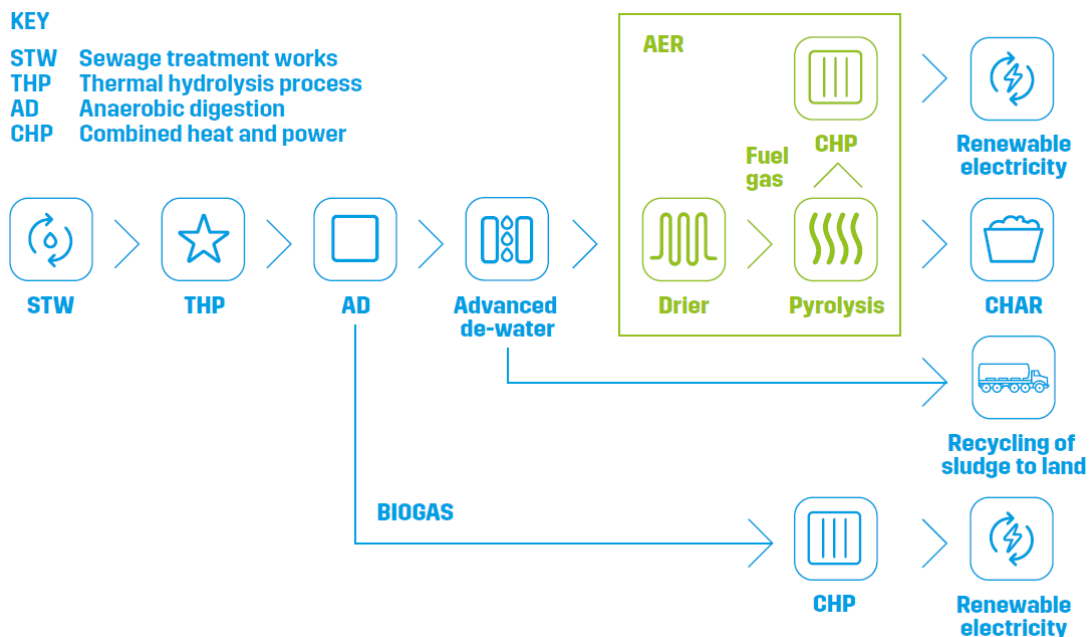


Circular economy benefits.

By using this technology effectively, the volume of residue (called char) is also 84 per cent less than the volume of sludge entering the process.

Char is a carbon-based and mineral-rich material, and we hope we'll be able to recover even more nutrients, precious metals and carbon to contribute further to the circular economy.

Our ambition is to make AER technically and economically viable, and unlock many potential benefits for customers, the environment and the wastewater industry.





**Stabilising
the sewer
above Baker
Street
underground
station.**

Stabilising the sewer above Baker Street underground station.

We've inserted a state of the art stainless steel structure, which supports a glass fibre reinforced polymer liner, inside a sagging sewer above Baker Street underground station. This way, we've avoided the need for large-scale engineering works, which could have caused significant disruption to people and traffic on the roads above, and to trains in the tunnel below.

Background.

The large Kings Scholar Pond Sewer, which crosses the top of the Tube tunnel at Baker Street station, was sagging and needed to be repaired.

Instead of large-scale engineering works, involving digging up Marylebone Road and causing huge disruption to people and traffic on the roads above as well as to the underground train network, we designed a novel structure which could be inserted through manholes and then assembled inside the sewer to strengthen it.

Working offsite.

The steel structure and liner were manufactured and assembled off-site using a detailed modelling system. This allowed the construction teams to visualise building the structure before production. The steel structure has been designed so it doesn't require maintenance for the duration of its service life, which is approximately 120 years. The liner, which has a lifespan of 50 years, has been designed so that individual panels can be removed to allow the sewer bricks to be inspected in future.

- Saving 26,443 tCO₂e .
- Designed to last 120 years.
- Avoiding significant disruption to road and rail commuters .



Keeping things moving.

Best of all, this solution has allowed the sewer to remain in operation. To keep our teams safe, flows were carefully managed during construction, and there was a system of cameras and alarms upstream in the sewer to alert teams to evacuate if rainfall increased the flow.

Materials were only taken into the sewer to assemble as they were required. This ensured that no parts would be lost or damaged if work had to be temporarily stopped.

Further project benefits.

As well as avoiding significant disruption to road and rail users in this very busy part of London, eliminating the need for large scale excavation has saved 26,443 tonnes of embodied carbon and approximately £23 million, not accounting for the cost of disruption to road and rail networks.



**Using recycled
aggregate.**

Using recycled aggregate.

A state-of-the-art mobile recycling unit that processes excavated material, such as sand and gravel, into recycled aggregate is helping our business become more sustainable - contributing to our target of not sending any excavated material to landfill and reducing our carbon footprint.

We excavate and use large quantities of materials in the projects we deliver as part of our capital programme. In 2017/18 we used almost 50,000 tonnes of aggregate in different applications, such as bedding for pipes, in concrete, and as hardstanding for vehicles. We aim to recycle excavated material as aggregate wherever possible, instead of extracting, processing and transporting new material.

Recycled aggregate standards.

We already have Asset Standards that our design and construction teams all need to follow. These set out the performance requirements, particle size and chemical compatibility of materials. Before switching to alternative materials such as recycled aggregate, we need to be sure that they meet the standards that are required in each situation. As with regular aggregate, it's important that the appropriate material specifications are used to choose a material that's suitable for how it will be used.

On-site recycling.

The recycling unit is proving crucial in our ongoing programme of repairing and restoring water mains.

Instead of excavating material, disposing of it to landfill and using new aggregate to fill the trenches, the recycling unit processes excavated material by crushing it and sieving it, before combining it with other substances like cement additives to help make it stronger. This recycled material was used to help fill the trench after we'd repaired the pipe.



Benefits of using recycled aggregate.

By recycling and reusing the excavated material, we've cut our costs and carbon, as well as our reliance on extracting, processing and transporting new material.

During one of our mains rehabilitation projects last year, we saved 9 tonnes CO₂e in transport emissions. Fewer vehicle movements reduces health and safety risk on sites and roads, and also means less traffic, dust and noise disruption for local communities.

Over the last year, more than 50 per cent of aggregates were obtained from either on-site recycling or other recycled sources. In the future, we aim to use 90 per cent recycled aggregate.

- Over 50 per cent of all our aggregates are from recycled sources.
- Minimising traffic, road and noise impacts on our customers.



**Protecting the
environment at
Lockwood
reservoir.**

Protecting the environment at Lockwood reservoir.

We've been working on a soft engineering solution to stabilise and prevent further erosion on a stretch of the embankment at Lockwood reservoir in north London. This reservoir is part of the Walthamstow Wetlands Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA). We worked closely with Natural England, Walthamstow Wetlands Trust, Waltham Forest Council and the fisheries throughout the project.

Soft engineering solution.

We've combined environmentally sensitive design with innovative, robust natural engineering solutions in this project to enhance the SSSI and SPA. We installed wire cages filled with large stones, called rock mattresses, on the embankment. These mattresses will protect the embankment and help prevent erosion by letting fine sediments build up in the gaps between the rocks, where vegetation will grow. We also used geotextile reinforcement matting underneath the rock mattresses to provide further protection from erosion. Both of these design approaches, which incorporate environmentally sensitive materials, enhance biodiversity as well as being safer, quicker, less intrusive and more cost effective to install than conventional solutions.

Effective communication.

We used our digital channels to share information and photographs of the project's progress to keep the public and stakeholders informed. The Walthamstow fisheries and wetlands have thousands of Facebook and Twitter followers, so our messages reached a wide audience.

- **Rock mattresses promote biodiversity and provide a cost effective way to protect the embankment, saving around £194 per m²**
- **Our design for a new access road reduced around 3,200 tonnes of excavated waste, 110 tonnes of carbon and a total cost saving of £660,000.**



Providing site access.

The site is situated amongst the Walthamstow reservoirs and has public access for anglers and other visitors.

We built a 7.8km road around the reservoir to provide access for pedestrians and reservoir maintenance vehicles. We've minimised impacts on the SSSI and SPA by designing the narrowest possible road for our purposes.

By building on suitable existing ground, we were able to reduce the amount of excavated material, minimise the use of new material, and keep embodied carbon and costs as low as possible. As well as providing access, the road protects the western embankment from wind and wave erosion. These works have improved both safety and access to the reservoir for the future.

Innovative drone survey.

We conducted innovative pre and post-work surveys using unmanned aerial vehicles (UAVs, also known as drones) to assess the impact of the project on birds from surrounding works at Walthamstow Wetlands, and to monitor habitat changes at the reservoir over time. We've shared this data, which included thermal imagery, with Natural England, who are keen to explore how they can use drones as part of their regulatory activities.



**Protecting our
network from
fats, oils and
grease (FOG).**

Protecting our network from fats, oils and grease (FOG).

The residual fats, oils and grease (FOG) from preparing, cooking and cleaning up food cause major problems for our business. When they reach our sewers, they combine with wet wipes and other unflushables to form fatbergs, which can damage our pipes, lead to blockages and sometimes cause flooding and pollution to homes, businesses and the environment. Our dedicated Network Protection Team visits food businesses in fatberg hotspots to investigate their current grease management and proactively engage with them about responsibly managing and disposing of waste FOG to help reduce blockages and flooding.

The FOG problem.

With 15 million customers and over 43,000 food businesses within our area, significant amounts of FOG is being washed down the drains. Once it's in our sewers, FOG can form hard deposits and block part, or all, of the pipes. In September 2017, our engineers started a nine-week battle to remove the infamous Whitechapel fatberg, one of the largest ever found. This rock-solid mass of wet wipes, nappies, fat and oil weighed a staggering 130 tonnes!

FOG blockages can directly affect businesses like restaurants, with a wide range of impacts:

- Sewage backing up and flooding the business.
- Being forced to close while a blockage is cleared.
- Loss of sales and reputational damage due to environmental damage.
- Rodents attracted because of bad smells.
- Road closures creating disruption for customers.

We've found that many of our customers don't know about the problem they're causing when FOG is washed down the drain. Most are also unaware of equipment that can be installed in commercial kitchens to reduce the amount of FOG entering our sewers.

- **Customers located within 50 meters of one food business are five times more likely to be flooded with sewage...**
- **... while customers located within 50 meters of two or more food businesses are eight times more likely to be flooded.**



FOG blocking our sewer pipes which can lead to flooding and pollution to homes, businesses and the environment.

What we do.

There's a clear link between our fatberg hotspots and high concentrations of food outlets. Our initial findings indicated that 90 per cent of food businesses did not have appropriate grease management in place.

Using sewer blockage data, our Network Protection Team identifies target areas in our region, and visits the food outlets in these fatberg hotspots to investigate their current grease management and inform them about responsibly disposing of waste FOG to help reduce blockages and flooding.

During the visits, food outlet owners and managers are provided with leaflets and posters explaining how they can dispose of FOG safely. We also remind them of their legal obligations to avoid putting the wrong things down the drain. Under section 111 of the Water Industry Act 1991, the law states that it's an offence to discharge anything into a sewer which may interfere with it flowing freely.

Our approach is to inform and educate businesses to help tackle sewer misuse to reduce blockages, sewer flooding and pollution. Over three visits, we take our food outlet customers on a journey to encourage them improve their grease management practices to control the discharge of FOG. If this is unsuccessful, we'll consider cost recovery and prosecution in extreme cases as a last resort.

Grease management equipment.

Installing and maintaining grease management equipment properly will reduce the likelihood of our customers being affected by problems caused by FOG. Some easy solutions include:

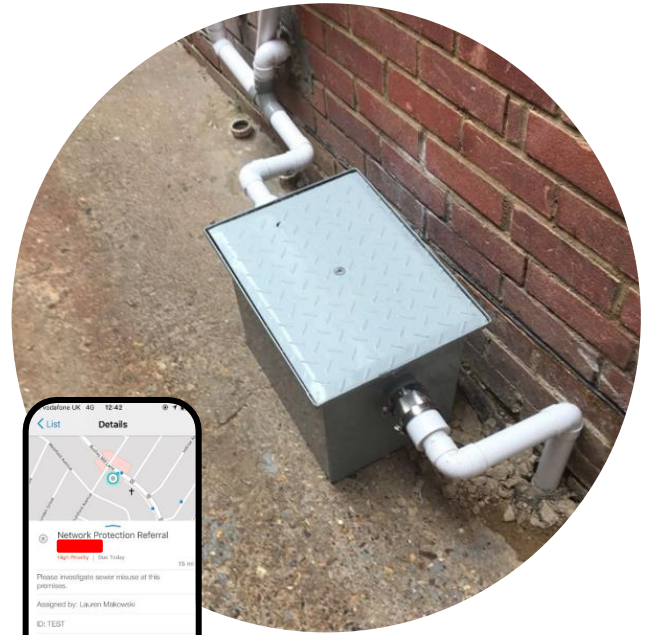
- **Grease removal units** - fitted to kitchen appliances like sinks and work stations. They use heat and electricity to remove FOG from wastewater and keep it in a container to be emptied.
- **Grease separators** - placed in drain pipes, allowing the FOG to float to the top, separating it from the wastewater. They must be cleaned out manually on a regular basis.

Our wider engagement.

Kitchens are found in a wide variety of premises such as restaurants, takeaway cafés, hospitals, schools and work canteens. As well as face to face visits to individual food outlet owners and managers, we also engage directly with large businesses and institutions in order to encourage change across entire estates.



Leaflets and posters explaining how to dispose of FOG safely.



Grease separator installed at a food outlet and our mobile app to refer cases of sewer misuse.

Smarter working.

Real-time cases of sewer misuse are reported to our team through an internal referral system, and are managed through the use of a mobile app and GIS. This way, we can easily identify customers who may need more engagement and help.

What are the benefits?

Our proactive strategy has helped us to build relationships and educate our customers about FOG. We've seen numerous benefits at a local level, with fewer repeat blockages in areas where grease management systems have been installed and maintained.

Future developments.

Building on our Network Protection Team's success, we've tripled the size of the team to 12 people. This means the team can now visit and engage with over 4,000 premises each year.

Proactive engagement is our preferred approach, but we'll still take enforcement action if these visits don't produce positive outcomes. Expanding our team will also help us tackle other forms of sewer abuse like wet wipes and clinical waste.





**Outfall safari and
tackling
misconnections.**

Outfall safari and tackling misconnections.

Misconnections happen when wastewater or sewage pipes are mistakenly connected into surface water drains. This is usually accidental, but it's causing pollution in watercourses across the country. In the past, reports of polluting outfalls have often come from members of the public who happen to spot pollution entering our rivers. 'Outfall Safari' was created for volunteers to survey outfalls along rivers, and pass the details to our Environmental Protection Team to follow up and take action.

Background.

Foul sewers collect wastewater from toilets, sinks and appliances like washing machines and dishwashers, and take it to the nearest sewage works to be treated.

Surface water drains are separate - collecting rainwater that runs off roads and roofs. This water is then diverted to a local river or stream to prevent your home from flooding, while also boosting water levels in the environment.

The environmental impact.

If a property is misconnected, the wastewater will go straight into the river. Untreated sewage kills wildlife, damages the natural environment and puts our health at risk.

Are misconnections illegal?

Under Section 109 of the Water Industry Act 1991, it's unlawful to discharge foul water into a sewer provided for surface water when separate public sewers are provided for foul water and surface water. It's also an offence to put raw sewage into rivers and streams. Property owners could face the risk of an expensive bill to put this right. They could even be prosecuted and fined up to £50,000 if they don't do anything about it.

- **Misconnections are unlawful.**
- **We estimate as many as 60,000 properties are misconnected in our region.**
- **Volunteers can help us find and fix more misconnections.**



Volunteers on an outfall safari.

Outfall Safari.

Outfall Safari was developed and first run by the Citizen Crane project in the Crane Valley catchment. Volunteers surveyed all the outfalls along 34 km of the main river corridor in the catchment; locating, photographing and assessing a total of 227 outfalls, using a methodology previously developed by Thames Water. Details of all polluting outfalls were passed to our Environmental Protection Team to follow up and take action.

Since the Outfall Safari methodology was created, 112 volunteers have been trained, and the approach has been used on more than 140 km of river corridors across Greater London.

More than 1,100 outfalls have been assessed and their details passed on to our team, the Environment Agency and the relevant catchment partnerships to take action, by tackling the pollution found by volunteers - often from wrongly connected household drains.

Outfall Safari has improved public awareness of the risk of wrongly connecting drains, which has historically had little public visibility. This should mean fewer new misconnections in the future, and more effective work to resolve them when they do appear.

Following the success of the project, we're now supporting similar schemes on the River Cray in Bromley and Bexley, and the River Beam in Barking, Dagenham and Havering.

Our catchment investigations.

Once a contaminated outfall has been discovered (in other words, when foul water is going where it shouldn't), we can trace the pollution back to its source.

During these investigations we can also identify other issues that cause pollution in local watercourses. In addition to misconnections, this can include private blockages and illegal fly tipping of trade waste.

We have a specialist pollution tracing contractor who investigates our sewer network to identify misconnected properties. We use a range of techniques including:

- Visual assessments.
- Dye tracing.
- CCTV.
- Wire caging.
- Water quality sampling.

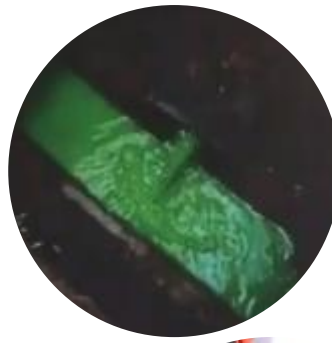
Visual assessments.

Identifying the type of pollution in the local watercourse can give us an indication of where it's coming from. For instance, an outfall polluted mainly with grease and fat suggests that it could be from a local restaurant. Pollution often results in the growth of sewage fungus, a mass of filamentous bacteria that grows in response to excessive nutrients in the water.

We may also be able to spot misconnections by looking at the outside of properties. For example, we check all roof drainpipes and guttering for any additional connections. Sinks and washing machines should never be plumbed into drainpipes.



Polluted surface water outfall.



Dye tracing, sewage fungus and wire caging.

Dye tracing.

This involves putting a teaspoon of colourful, fluorescent dye down sinks, toilets, appliances and drainage gullies so we can follow where it goes. The bright dye shows where wastewater is flowing, and helps us check that properties are properly connected. The dye isn't permanent, and doesn't cause any staining.

CCTV.

We can use crawler CCTV systems to follow our network of sewers, and identify any misconnections where wastewater enters the surface water drains.

Wire caging.

We hang wire cages inside the drainage network to catch toilet and kitchen waste, and other evidence of pollution as it's flushed out of toilets and sinks, and flows down to the watercourse. This can also help identify problem areas in our catchments.

Water quality sampling.

Misconnections and the pollutions they cause are often difficult to detect, due to their intermittent nature and the fact they may not always be visible. However, the wide range of possible pollutants can all be sampled and checked for, monitored and used as indicators for the source of the pollution.

What can you do?

Taking the time to make the right connection can have huge implications for your local watercourses. Make sure your property is connected right first time - visit www.connectright.org.uk for more information and to find an accredited plumber.

**connect
right** ✓
Stop pollution





**Tideway - a
cleaner, healthier
River Thames.**

Thames Tideway Tunnel - a cleaner, healthier River Thames.

The Thames Tideway Tunnel is the second of two major new tunnels designed to collectively capture sewage from the 35 most polluting combined sewer overflows along the River Thames built by the Victorians. London's Victorian sewerage network has done a superb job for the last 150 years, but it was built to serve the needs of a much smaller city and it simply can't keep up with the demands of the capital in the 21st century.

Why it's needed.

The sewers built by Sir Joseph Bazalgette in the 1860s still form the backbone of London's sewerage system today. Bazalgette knew that even the largest sewers he could build would not cope after very heavy rain, so he designed the system with overflow points, known as combined sewer overflows (CSOs), to allow any extra flows to go into the Thames, instead of backing up into streets and homes.

London's Victorian sewerage system is in excellent working condition, but it has run out of capacity. Built when London's population was two million, and designed for four million, they're now struggling to serve a capital city with more than eight million people - a figure that continues to rise. When they were built, the sewers overflowed into the Thames from CSOs only once or twice a year, but it's now happening almost weekly.

The Thames Tideway Tunnel will collect the flows from the CSOs identified by the Environment Agency as the most polluting, and connect up with the Lee Tunnel. This has already been constructed by Thames Water to take wastewater, otherwise destined for the river, to Beckton sewage works in East London.



The Lee Tunnel.

A cleaner healthier river.

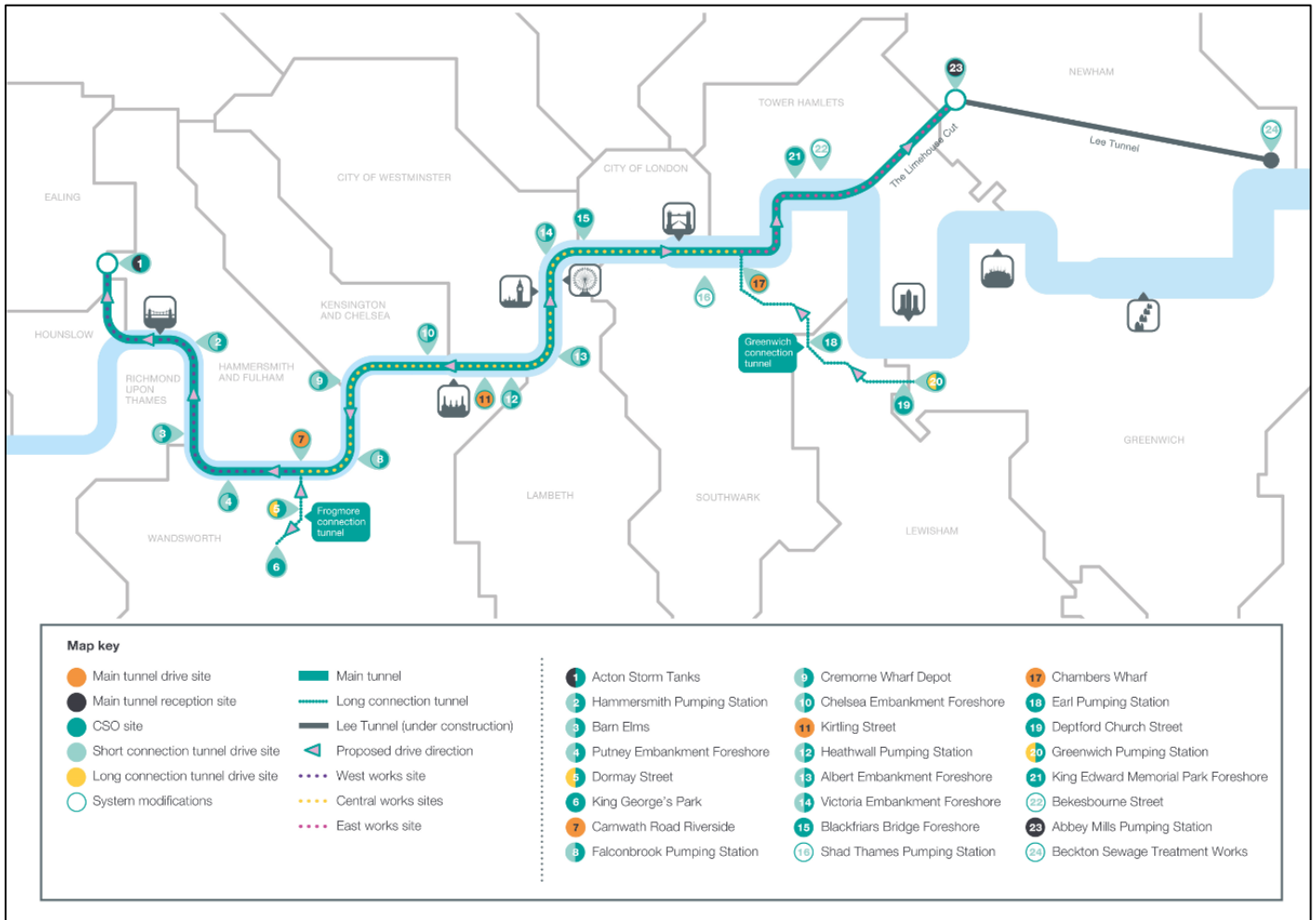
In August 2015, the water regulator Ofwat issued a licence to Bazalgette Tunnel Limited, which trades as 'Tideway', to design, build, commission and maintain the tunnel. When the tunnel is finished, the UK will be complying with international law – and the Thames will be safe for Londoners and wildlife again in the 21st century.

The tunnel will intercept at least 94% of the millions of tonnes of sewage currently discharged into the Thames in a typical year, making the river much cleaner, with huge health and aesthetic benefits for everyone who uses the river – now and for generations to come.

The tidal Thames can already support a range of fish species through different stages of their life cycle. When the tunnel starts operating in 2024, the Thames will be able to take its rightful place as one of the most important nursery areas for North Sea species. Many kinds of water birds will benefit from better populations of fish, and we can even look forward to seeing more porpoises, dolphins and seals in the middle of our capital city.

Protecting the River Thames ecosystem will help to sustain commercial fishing industries, and a cleaner River Thames will enhance London's reputation as a business centre and tourist destination.





Thames Tideway Tunnel design.

The Thames Tideway Tunnel will be the biggest infrastructure project ever undertaken by the UK water industry. Tideway has signed up a team of world-class contractors to offer sustainable and cost-effective methods of construction. Construction began in 2016 and is scheduled for completion by early 2024.

The main tunnel will be 25km and the two connection tunnels will be 4.6km and 1.1km long. There will be 24 construction sites to build the tunnel. In order to be self-cleaning under gravity, the tunnel needs to fall one metre every 790m. Starting from 35m deep at Acton Storm Tanks, it will finish at 65m deep at Abbey Mills Pumping Station. The internal diameter of the main tunnel will be 6.5m between Acton Storm Tanks and Carnwath Road Riverside, and then 7.2m to Abbey Mills Pumping Station. It has a capacity of 1.24million cubic metres and a design life of 120 years.

The tunnel will generally follow the route of the River Thames so that it can intercept the CSOs along the riverbanks. It will pass underneath all the rest of London's infrastructure, and through a variety of different ground conditions on its way from Acton to Limehouse. From here, it will run north-east to Abbey Mills pumping station, and connect to the Lee Tunnel.

Delivering a lasting legacy.

Tideway is committed to delivering the best value for money for Thames Water's customers, while maximising the long-term benefits for Londoners. Tideway's vision is to reconnect London – and Londoners - with the river. This is because delivering a cleaner, healthier River Thames will have many benefits for the people who live and work in London, and those who use the river for public amenity and leisure. It will also rejuvenate the river economy, and provide new areas of public realm on its banks.

The scale of the project means that it presents a historic legacy opportunity. Tideway has set out its legacy objectives in its Legacy Statement, and has made a total of 54 specific commitments to demonstrate that they're being delivered. For example, the project has pledged to create more than 4,000 direct, sustainable jobs. One in 50 of these will be an apprenticeship, and 25 per cent of the workforce will come from the 14 London Boroughs along the tunnel route. The project will create nine new areas of public foreshore, and open up new parts of the Thames Path. As a founding supporter of the Thames Skills Academy, Tideway will also deliver a new, skilled generation of river workers for the future. Find out more about Tideway's lasting legacy at

<https://www.tideway.london/>





**Tidefest –
celebrating the
River Thames.**

Tidefest – celebrating the River Thames.

Tidefest, a popular family-friendly festival, highlights the recreational, environmental and historical importance of the Tidal River Thames to the capital and sees a host of activities taking place along the river's banks. Thames Water is one of Tidefest's main sponsors, helping support the day of events along the River Thames.

Background.

TideFest is a fast growing River Thames event which took place for the first time in 2014 on World Rivers Day to highlight and celebrate the recreational importance of the Thames Tideway to Londoners. The event is part of the month long Totally Thames Festival and is organised by the Angling Trust, River Thames Society and London Wildlife Trust, and is sponsored by Thames Water. The festival has built on its success in 2014 and has established itself as a key date in the London diary. Tidefest includes a wide variety of river based events in Chiswick, Kew, Brentford, Barnes, and elsewhere along the tidal Thames. Tidefest 2017 was held on Sunday 10 September with around 2000 people taking part in activities and events.

Activities and events.

At Tidefest 2017 there were many activities at Strand on the Green by Kew Bridge, and on the Kew Bridge Piazza for the first time. Activities here included arts and crafts, live music, refreshments, charity stalls and children's games. There were also boatyard tours, paddleboarding, kayaking, river dipping, guided walks, an angling competition, live fish tanks and much more. Events were also held at Richmond, Chiswick Pier, Brentford, Barnes, Deptford, Hackney, Beckton nature reserve and other locations along the Thames Tideway.



Discovering what lives in the River Thames

Tidefest angling competition.

50 anglers took part in the Tidefest Angling Championship. Many Bream were caught from Strand on the Green, with the winner Mike Smith catching a Bream weighing over 28lbs from his peg beside Kew Railway bridge. A small Barbel was seen at Chiswick and most competitors caught several eels, a positive sign of them returning to the river.

There were children's activities run by Thames21 including river dipping, water testing and games designed to explain and increase understanding of what's going on in the river. There was also seine netting supervised by ZSL and the Institute of Fisheries Management to highlight what lives in the river. A number of baby bass were collected when seine netting, demonstrating the importance of the River Thames as a nursery area for the species. The Environment Agency had a fish tank displaying the live fish from the river.



- Tidefest is a popular family-friendly festival
- Celebrating the recreational, environmental and historical importance of the Tidal River Thames
- Around 2000 people took part in activities and events at last year's Tidefest





Monsters and plastics.

Active 360 ran supervised paddleboarding sessions for those new to paddleboarding and a 'Paddle and Pick' clean-up of Kew Bridge Drawdock. This was in support of the environmental charity Watertrek UK who work to protect waterways around London, and elsewhere, from plastic pollution.

There was also a popular and special film screening of "A Plastic Ocean", a new adventure documentary that brings to light the consequences of our global disposable lifestyle and uncovers the shocking truth about what is lurking beneath the surface of our seemingly pristine seas.

Wallace the Wet Wipe Monster was set up on the foreshore to highlight the campaign against plastic pollution being run by the Marine Conservation Society. The wet wipe monster helped promote our 'Bin it – don't block it' campaign in the fight against fatbergs, which are a congealed mass of fats, oils and greases and other non-flushable items such as wet wipes, which block the city's sewers and can cause serious issues such as sewer flooding and pollutions.



'Paddle and Pick' clean-up and Wallace the Wet Wipe Monster



Bird ringing at Beckton.



Birds at Beckton.

We hosted an open day at Beckton's Creekside Nature Reserve. The reserve sits on the banks of the River Thames and the River Roding, in East London, and boasts a huge mixture of vegetation and wildlife.

The site is open all year round, however, for one day members of the public joined Thames Water conservation experts to take part in activities such as bird ringing, bird watching walks, bird box assembling and painting, and mini-beast hunting. The site was created next to Beckton sewage treatment works, one of the largest in Europe, and is a prime example of how these spaces can be of huge value to both wildlife and the local community.



Cruising on boats.

The River Thames Society organised four hour-long boat trips around the Thames Tideway islands, leaving from Kew Pier on the historic Thames launch the "Windrush". Thames 21 also hosted a relaxed trip on the river with commentary from their project officers about Thames 21's Love the Lea Programme. They have been working to improve the River Lea for the last five years, to provide habitats for wildlife and improve the water quality of the river they have been putting in new reedbeds into the Lea Navigation.



Guided walks and adventures.

There was an archaeologist-led tour of Oliver's island at Strand on the Green with kind permission of the PLA, who own the island. The island is usually 'out of bounds' but visitors accessed the island via kayaks and were able to hear about the long history and its current environmental importance. Attendees were also able to explore the Thames foreshore at Strand-on-the-Green, which is uncovered twice a day, discovering 'treasure' of the ancient past and the present with an archaeologist.

Oliver's Island and kayaking



Victorian Fire Engine from London Museum of Water and Steam.



History and discovery.

There was a demonstration of a Victorian Steam Fire Engine showing how they put out fires in London 150 years ago. Actors in period costume from the London Museum of Water and Steam demonstrated the original coal fired appliances. There were also Tidefest discounts to the London Museum of Water and Steam which is home to magnificent collection of steam pumping engines and tells the history of London's water supply.

The Museum of London Archaeology Time Truck hosted a rolling drop in demonstration of the Thames Water sponsored Cleaning up History education programme. This innovative activity included hands on education around London's sewers combined with the thrill of archaeological discovery.





**Developing a
drainage and
wastewater
management plan
– London2100.**

Developing a drainage and wastewater management plan – London2100.

Londoners have benefited from the foresight of the Victorian architects of the capital's sewer system. Built to serve a population of four million, at a time when the capital was home to two and a half million people, it still forms the backbone of the system today. But London's wastewater services now face 21st century challenges.

London2100 – a long term plan for London's wastewater service.

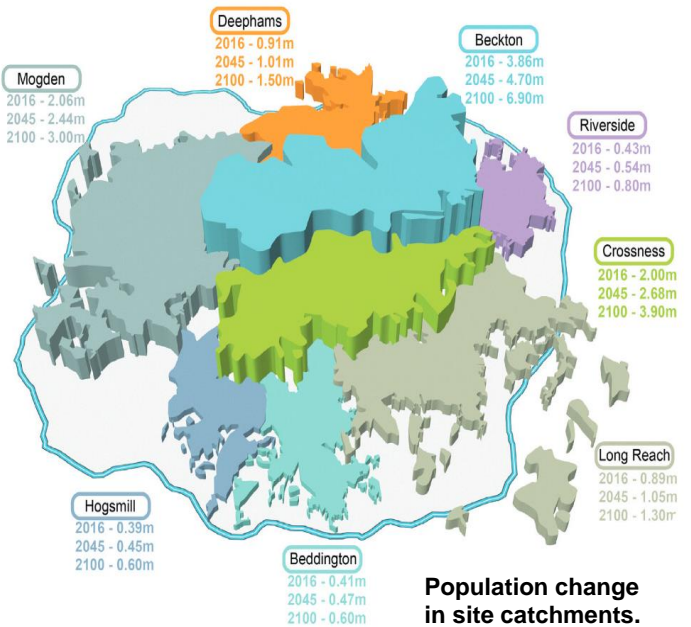
Thames Water has been developing an approach for strategic long-term drainage and wastewater management planning (DWMP) in London. This strategy will tackle a range of challenges including population growth, climate change, land locking of our sites, ageing assets and striving to meet tighter environmental standards.

The scale of these challenges means we need to think differently about the future, and look far beyond the conventional five-year price review cycles of the water sector. London's wastewater system is immense and complex, and significant changes will take time to achieve.

A much longer-term approach is needed to manage risks and embrace opportunities for innovation, which is why we're now considering time horizons of 25 and 80 years in a way that reflects water resource planning. We call this new approach London 2100.

Change can happen for many reasons, and we've been assessing these to help us develop possible future scenarios. This has enabled us to establish and evidence a 'case for change' for how we plan to futureproof London's wastewater assets against the uncertainties of the future.

- London 2100 is our approach for the strategic long-term drainage and wastewater management planning in London.
- www.thameswater.co.uk/London2100



What are our objectives?

The primary objectives for London2100 are:

- To communicate and gain acceptance of the idea that continuing the existing approach of investment does not provide best value for customers, hence the 'case for change'.
- To engage with stakeholders and bring them on board with being part of the team to develop solutions.
- To develop a framework to allow 'blue-sky' ideas to be generated, which will contribute to the overall solution in London.
- To ensure that the process developed for creating a plan can be applied to the whole Thames region.

Working with others.

We've engaged with a wide range of stakeholders to explain the need for longer-term planning of wastewater services and the importance of partnership working. We know the decisions we make today need to ensure best value for our customers in the longer term, but we can't do this alone. So we'll work in partnership with our customers, stakeholders, alliances, suppliers and our regulator to deliver better outcomes for all.

Stakeholder engagement is an ongoing activity. Key stakeholders which have been engaged so far include government, academia, businesses and organisations, financial groups, NGOs, regulators, charities and pressure groups.

Why do we need to do things differently?

London is seeing a rising demand for wastewater services in response to rapid population growth, climate change and urban creep. We expect these challenges to continue into the future. Most of London's wastewater treatment works were constructed in the early 1900s, although additional capacity has since been retrofitted to extend their life span. Some critical processes are fast reaching their capacity - by 2040, London's wastewater treatment works won't have enough capacity to handle the sewage from all the people who rely on them.

A number of strategic wastewater treatment sites were originally built away from communities, but they're now 'land-locked' – surrounded by housing and businesses as the city has grown, with little land left to expand. The pace of change, and potentially long lead times for constructing new assets to solve London's challenges, mean that the 'business as usual' approach to dealing with growth and quality drivers is no longer suitable.

In addition, there's the regulatory expectation that wastewater planning should be undertaken at a strategic level, similar to that for water resource planning. These issues have prompted us to take a focused, strategic approach to addressing both short and long term planning needs for providing drainage and wastewater services in London.

How will London2100 address these challenges?

An internal case was made to review the strategic planning approaches to wastewater services, looking beyond current investment horizons of five to 10 years to out to 25 years and 80 years. The London2100 team was established in April 2017 to work with existing infrastructure and non-infrastructure teams to develop a long term plan.

The team used the existing Water Resource Management Plan (WRMP) model as a framework to develop a focused strategic plan for London's wastewater services. A risk-based approach was used to help us adopt a proportional approach to planning operational and investment activities, depending on the probability and consequence of inadequate network and treatment provision over time.

The future of wastewater services could develop in many directions. While we can't predict exactly how the future will develop, we've used scenario planning to provide a disciplined method for forecasting how social, economic, political, technological and environmental drivers could interact. Using different scenarios, we can uncover evidence enabling us to develop wastewater services that integrate new technologies and create resilience, whatever challenges may face us in future.

Alignment to industry thinking.

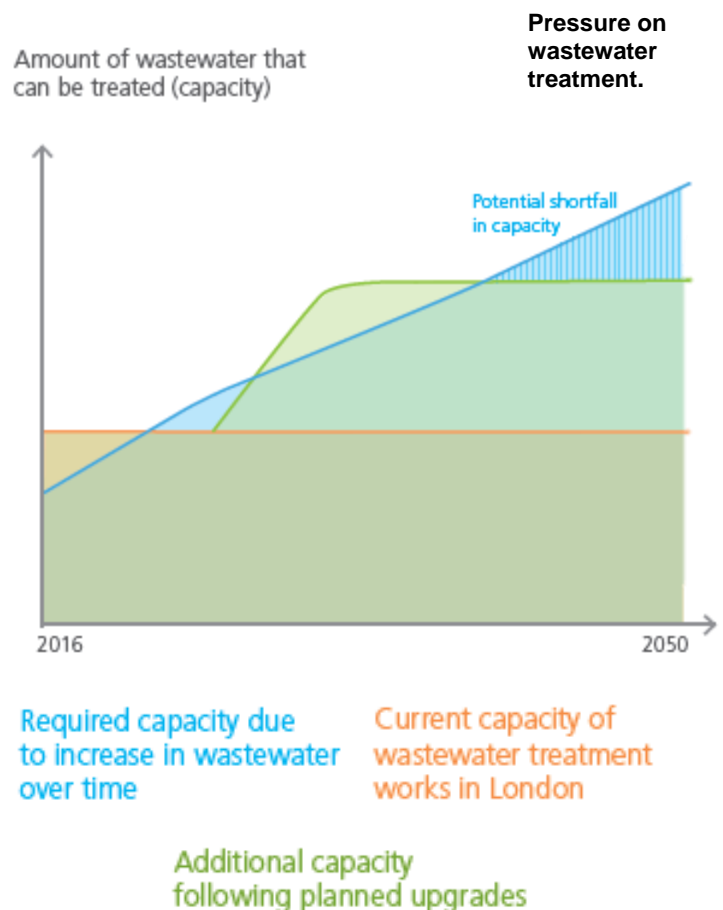
London2100 will deliver a safe, reliable, affordable wastewater service that meets our customers' requirements, as well as appropriate environmental standards, now and in the future, maintaining London's reputation as a resilient city.

The London2100 plan for drainage and wastewater management has been developed using many of the same concepts and approaches as the DWMP framework, which is currently being developed by WaterUK. Both planning processes aim to:

- Develop a structured approach to produce options for future investment.
- Continue to use the guiding principles of the Drainage Strategy Framework and the 21st Century Drainage metrics (we're also intending to add London specific metrics of our own).

Benefits of a long term wastewater plan.

- Futureproof London's wastewater assets against the uncertainties of the future.
- Continue to stimulate stakeholder buy-in, which is vital for delivering a successful long-term strategy.
- Be defensible, justifiable and able to stand up to challenge.
- Deliver better outcomes for customers for less money than the traditional planning processes.





**Virtual peek into
the future of
mental health
support.**

Virtual peek into the future of mental health support.

We're at the forefront of the drive to help people who are experiencing mental health issues, so we're constantly seeking new ways of offering crucial support. Now, using state-of-the-art virtual reality (VR) technology, we're training our managers how to spot signs of depression and anxiety, and how best to approach people to offer support.

Background.

VR training has been introduced as part of our mental health awareness programme and has been developed by the company's technology experts.

Our course is designed to equip specialists in teams with the skills to spot when people are having episodes of depression or stress at work, have supportive conversations with them, and point them in the right direction for help and support.

Research has shown that 16 million people – a quarter of the population – experience a mental health problem each year, according to the Mental Health Foundation. Poor mental health costs employers between £33 billion and £42 billion a year, with an annual cost to the UK economy of between £74 billion and £99 billion.

Our VR course.

As part of the course, the trainee wears virtual reality goggles and becomes a fictional character called 'Dennis' - a father of two with a stressful and demanding job, who's also experiencing a difficult time at home. The character finds it difficult to function at work, get out of the car and go into the building, but none of this is obvious to his manager or team-mates.

Trainees are shown clips through the eyes of Dennis, of him being offered support in the workplace, and how best to sensitively talk to people who may be experiencing difficulties.

Virtual reality is a very useful tool as sometimes issues aren't fully understood when explained. Our VR training enables people to experience and understand what others may be going through first-hand and become more empathetic, whilst also making learning more fun.



Mental health awareness.

Providing a mental health awareness campaign for our people doesn't just help to support mental health at work but can also benefit family and friends at home. Identifying and tackling mental health problems early can stop issues escalating and improve the chances of recovery. Workplaces should have a part to play in supporting this movement.

We've showcased our mental health virtual reality educational programme to many of the country's major safety-critical employers, including the British Army, other water companies and at the National Health and Safety Executives conference. We've offered our footage, in which the viewer becomes the person suffering the ill-effects of negative mental health, to all companies for free.

- **Our virtual reality training course has helped us reduce work-related illness absence by more than 75 per cent in the last five years.**
- **We have more than 200 mental health first aiders across the business, and we offer free annual personal and confidential medical assessments for all our people.**



**Innovative
maintenance using
unmanned aerial
vehicles.**

Innovative maintenance using unmanned aerial vehicles.

We're reducing health and safety risks, saving time and maintenance costs, and reducing operational downtime by using unmanned aerial vehicles (UAVs), commonly known as drones, to inspect equipment and infrastructure such as cranes, digesters and slow sand filters.

Background.

Unmanned aerial vehicles (UAVs) come in a variety of shapes and sizes, ranging from small handheld types up to large aircraft. Their usage is rapidly increasing thanks to a variety of applications, including taking still images or video footage using conventional, zoom and even thermal imaging cameras.

Benefits of UAVs.

UAVs offer solutions to many of the daily challenges and risks in our business including:

- Health and safety.
- Reducing costs.
- Saving time and improving productivity.
- Providing data and information with imagery.
- Reducing operational downtime.

Health and safety is an important reason for using UAVs, giving us safer access to confined or hard to reach places like roofs, towers and watercourses. Using them for inspections can significantly reduce the cost of traditional forms of access such as scaffolding, cherry pickers and scissor lifts, and the time taken to set them up. UAVs can also be used to gather information about the condition of our sites and assets, which helps us with maintenance and investment decisions. A wide range of information can be safely and accurately recorded.

We've carried out a successful trial to test whether the images from UAVs were sufficient and of an acceptable quality to satisfy insurance inspectors and the Health and Safety Executive. Although human inspections are needed and can't be ruled out completely, UAVs can be used for most inspections, for example in three out of every four years.

- **We saved around £1.3 million last year by using UAVs.**
- **UAVs help to reduce health and safety risks, costs and time taken by our daily activities.**



Examples of our UAV fleet.

How we use them.

Last year, we carried out a statutory inspection of a gantry crane track at Mogden sewage works. If we'd taken the conventional approach of putting up scaffolding and taking the asset out of service for inspection, it would have taken over a week to complete and cost us more than £100,000.

Now, with the latest UAV technology, we were able to carry out the inspection in three hours by photographing the gantry crane track using a high definition camera with a powerful optical zoom. The UAV eliminated the need for anyone to work at height, and the all the health and safety risks usually associated with this task.

Last year, we saved over £1 million thanks to using UAVs, and we expect to save even more by adding an anti-collision UAV to our fleet, which is specially designed for confined spaces like shafts and sewers.

We're now in the process of trialling this technology which will mean that our people won't have to work in confined spaces, and could save us around £250,000 per inspection.

Other UAV uses.

We use our UAVs with a variety of capabilities including taking high resolution images and thermal imaging. This technology can help us in all sorts of scenarios, improving the speed, accuracy and safety of many of our activities.

Enhanced access.

Across our business, we have hundreds of structures like cranes, digesters, shafts and tunnels that need regular internal and external inspections. This usually requires scaffolding, and most accidents are caused by falls, misuse or by objects falling from the scaffolding.

Our fleet of UAVs now enables us to inspect these and other equipment without putting our people into potentially hazardous situations.



Inspection of a gantry crane.

Asset inspections.

UAVs help us to quickly capture vast amounts of information over large areas, and let us identify and resolve issues fast before any risks emerge. By viewing our sites and processes from above, we're able to assess the health of these assets. For example, we can look for discoloration in our slow sand filter beds. To inspect our aerators, we can use a powerful optical camera lens to zoom in and look for bubbles.

Thermal imaging.

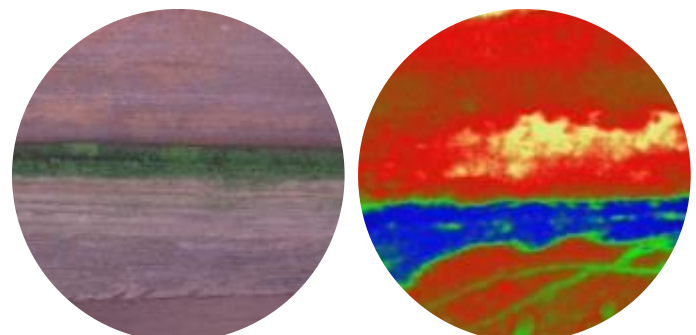
We also use thermal imaging cameras on our UAVs to detect leakage. Alongside accurate, real time aerial views of the ground, we can see the scale of leaks and pinpoint the source. We can also monitor temperatures in our network, carry out asset health inspections, and identify intruders on our sites.



Structural inspection of digesters.



Using optical camera to zoom in on our aerators.



Using thermal imagery to identify a leak in a field.

"It's fascinating what has been achieved. UAVs can drastically reduce safety risks by enabling us to inspect cranes and other equipment at height without putting people into potentially hazardous situations, as well as save on maintenance costs and time."

- Karl Simons, Head of Health, Safety, Security and Wellbeing.

