2. Water Underground

28 January 2026, 11:59am

58m 34s

David Harding 0:38
Yeah.
Oh.

Brown, Ella 1:48
Okay, good afternoon, everyone, and welcome to the Water Underground webinar. I'm Ella Brown and I'm an environmental resilience officer here at the City of London. And I'll be hosting today's event alongside my colleague Maddie, who is an emergency planning and resilience officer. So this is a four part series and we're being joined by industry experts to present on various themes around flood resilience. And we're also going to be sharing some simple action
to increase your personal and communal resilience to flooding. Please do note, so today is being recorded, so if you don't want to be shown in that recording, just turn your cameras off now. We have muted your mics, but if you do experience any technical issues, just let us know in the chat and we can sort it out.
And so we've got two speakers today and we're going to have time for questions at the end of both presentations. So please feel free to use the Q&A function throughout the sessions and then we'll come back and look at those questions. Yeah, so time to introduce our speakers. We're going to be looking at the topic of London's hidden rivers and how
underground transport infrastructure deals with flood risk. So first up, we've got David Harding, who's from Thames Water. David is a customer and stakeholder manager, and he's worked in the water industry investigating complex urban flood risk for 23 years. And in this time, David has delivered many projects around Lost Rivers, which is the focus of his presentation today.
So, I'll pass on to you now, David, to show your slides.

David Harding 3:17
Thank you. Yes, good afternoon. David Harling from Thames Water. And I'm going to talk briefly when my slides become visible. I'm going to talk a little bit about London or the city's lost rivers. I say a little bit because it's a very detailed subject.

and many others have done an incredible amount of research into the subject. So I'm going to talk fairly, fairly briefly about the rivers, but also about how they're integrated into the city's water infrastructure and how they still have an impact on flood risk.
So the contents, I can talk about London and its foundation around the rivers, then talk a bit more detail about three of the city's rivers, the Warbrook, Fleet and the Tythan, what happened to them, how they became lost rivers,
how they, what they are today and how they still impact upon flood risk.
So going back to the beginning, obviously London was founded by the Romans after the Claudian invasion. Don't test my history as to exact year. But basically they had to ford the river or bridge the river.
so to carry on their advance. So they chose a point where, the nearest point where it was narrow enough. There on the north banks, they built a military garrison and they chose it because of the crossing point, but also the proximity of the river's fleet.
of Wallbrook. So the two rivers and the abundant springs provided a water supply to the garrison, but also the surrounding marshy ground and the rivers themselves provided defensive barriers.
There are also the two low hills of Cornhill and Ludgate Hill, which still are discernible today, just about, provided lookout points. So the original sighting of the City of London was based upon its rivers.
So starting with the Walbrook, two sources are given for the River Walbrook. Springs to the north of the Angel in Islington, which remained a source of fresh water via the White conduit until relatively far into the 19th century.
Also, the Holy Well in Shore Ditch, and the name of Shore Ditch might derive from an old word for sewer ditch. The Walbrook joins the Thames at Walbrook Wharf near Karame Street Railway Station. Its name
is believed to derive from the brook by the wall after the Roman City wall, which it crossed underneath in a conduit. Administratively, up until including the Middle Ages, the City was divided by the River Walden Brook.
There were 24 wards, but they were referred to as E wards east of the Walbrook and west of the Walbrook. So it's an example of how the Walbrook continued to have a major impact on the lives of people living in London until, you know, throughout a lot of its history.
In 1954, a Roman era temple to the god Mithras was discovered, which was believed to have been originally built on the banks of the Walbrook. It's thought that because

the sort of the cult of Mithras was quite sort of
shadowy and mysterious with all sorts of strange goings on. It thought that the sort of secluded river valley of the Walbrook might have provided the ideal location for a temple and for the mysterious rights to take place in. But nowadays the entire length of the Walbrook
is part of the London Combined Sewer Network.
So moving on to the fleet, the fleet rises in springs in Hampstead Heath, in an outcrop of sandy heathland soil, which rises out of bushes overlain above the impermeable London clay.
It also feeds the famous swimming ponds in the Vale of Health on Hampstead Heath. The upper reaches of the river were originally known as the Holborn, or sometimes the Oldborn.
which gives its name to the modern Holborn area.
and it joins the Thames near Blackfriars Bridge. Much of the river was navigable until the early 19th century, after the Great Fire of London. The lower reaches of the fleet were turned into a canal by Sir Christopher Wren. And there is a favourite
Um...
Caravaggio painting of ships sailing down the River Fleet into the River Thames. It is still directly connected to its sources up on Hanstead Heath and the headwaters are still extant. You can still see small streams and rivulets.
on the heath, which feed into the ponds and into the river itself. The Fleet Valley was formerly known as the Valley of Wells because of the large number of springs along its length, feeding the river and also providing
water, fire wells, and modern day place names such as Clark and Well and Sadler's Wells reflect that history.
The fleet, it still has the capacity to sort of bite as a river. During Joseph Besalget's sort of re-sewering of London, the fleet sewer was rebuilt. And at the same time, the Metropolitan line was being built nearby.
using the same cut and cover technique whereby you basically just build a big trench, dig a big trench, lay whatever it is you want in the bottom of it and cover it back over. And then in June 1862 there was a very large storm across London and the fleet
burst its banks, such as they were, or burst its pipe into the excavations. And the floodwaters were so great that they inundated the nearby Metropolitan Line trench and much of the Clerkenwell area.

And thirdly, the River Tyburn, which also rises from sources around Hampstead Heath in that same sandy outcropping, and a place called Shepherd's Well, and also a source in Delsize Park.
It's often confused with the Tyburn Brook, which rises or rose near Marble Arch, which was named after the infamous Tyburn Hanging Tree, a place of execution, which stood near modern Marble Arch.
The time is a good example of just how much the rivers and the water of London have been modified because you have a water course which flows in a pipe in an aqueduct which crosses above the region's canal, a man-made watercourse.
Um...
There aren't, there are no, to my knowledge, there are no longer any roads named after the course of the Tyburn. But Oxford Street was formerly known as Tyburn Road and Tyburn Lane. It also, the river flows through the grounds of Westminster School. where it's long been associated with King's Scholars Pond, which was a pond which the boys of the school used for fishing and swimming.
On its original course, it split before reaching the Thames, but the main course joined it near Vauxhall Bridge.
but almost its entire length is now part of the combined sewer network. I say almost because there are traces of springs and wet ground near those sources and the upper reaches of the river, albeit they're part of the sewer net.
work have been prone to cause flooding in certain districts, to the point where there were even questions asked about the possibility of re-daylighting the river and bringing it to the surface. But being part of the combined sewer network, there are obviously certain issues with that.
So how did the City come to lose its rivers? In an earlier webinar in this series, I believe the subject of the great stink of 1858 and Sir Joseph Bazalgette's resurring of London has already been covered.
But basically, yes, as the city grew.
Development and buildings competed for space with the rivers. A lot of the city's roads ran along beside rivers and the widening of roads was hampered by the rivers themselves. Since Roman times, the rivers have always been used as a means of disposing of waste.
both liquid and solid. But ironically, with the arrival of sanitary improvements like piped water supplies into properties and flushing toilets, it made the situation much

worse. The rivers were far more healthy when people got their water supplies from the rivers and from wells.
and their solid wastes went into cesspools or middens and their wastewater, such as it was, was thrown into the street where it drained into the rivers. But their wastewater at that time, of course, there was a lot less of it. It didn't contain modern detergents.
It had just been used for sort of cooking, cleaning and laundry and the occasional washing of people. So it wasn't the same, it wasn't in the same volume or the same pollution as we know now. So gradually, in order to make space and get the rivers out of the way,
and to mask the pollution and the smells coming from them, many of them were buried and lost. So by the end of the 19th century, both the Walbrook and the Tyburn were completely buried. The Walbrook entirely from source to outfall and the Tyburn.
effectively from source to outfall. The fleet is now fully buried apart from its headwaters and sources on Hampstead Heath.
So what are, where are the lost rivers today? So all of the ones I've been speaking about are combined into the combined sewer network. Some of them even bear the names of the rivers, such as the Fleet Trunk Sewer, Fleet Mainline, King's Scholars, pond after the Westminster Boys swimming pond. And the rivers do flow, but they now only flow into the Thames intermittently following heavy rainfall.
So when Joseph Bazalgette built his system of interceptor sewers from west to east to intercept all the sewers and polluted watercourses that formerly just flowed straight into the Thames,
He knew that, you know, in times of heavy rainfall, they couldn't cope. And to avoid flooding, he built a system of overflows which could discharge into the River Thames. This is why, you know, we don't get widespread flooding from these sewers because of this extensive network.
work of storm reliefs and overflows. However, Joseph Bazalgette designed the system for a population of around two and a half million. I believe London is in excess of 9 million now. So as the population grew, as permeable surfaces became more and more paved over,
more and more surface water was captured and drained to the combined sewers. So those storm discharges became larger and more frequent. I believe the figure of 33 million tonnes of water per year was quoted. So to restrict those discharges to the

most extreme
storm events when the dilution is greatest. First the Lee and then the Tideway tunnels were built to convey the storm flows to Becton Sewage Treatment Works for treatment. They're both 7 metres in diameter. The Lee is 6.4 kilometres long and the Tideway tunnel is 25 kilometres long. And the design is that they will only discharge to the tidal Thames between three and four times per annum.
So there you can see a map of the main Tideway tunnel going from Acton in the west to Abbey Mills in the east, where the
the Joseph Bazalgette's northern interceptor sewers all combine and join the what's known as the northern outfall sewer, which then goes on to Becton Sewage Treat Works, which is Europe's largest. There was formerly a large storm overflow at Abbey Mills, which was one of the most polluting.
But now all those flows and all those flows along the length of the tide way, including those from south of the river, are intercepted by the tunnel. As I say, all storm overflows are fully treated for discharge now, with the exception of between 3:00 and 4:00 per annum.
during very heavy rainfall.
The top left hand corner, you could see an example there of one of the interceptor shafts, which intercepts the old CSO outfalls. That particular one is the fleet storm overflow. And it takes the fleet mainline sewer and the low level number one
It falls into a drop shaft, which then joins the main tunnel and carries on to Abbey Mills. And because the shafts often require the construction of embankments jutting out into the Thames, they've been all designed as public open spaces.
sort of pocket parks and viewing platforms, etc., so that they provide some additional benefit.
So we talked about the lost rivers and what they are now. So I'm going to finish by talking a little bit about the sort of the flood risk and the role that they play. So the surface geology of most of London basin,
is impermeable clay with small outcrops of permeable strata, such as those sandy ones I mentioned on Hampstead Heath. But this mainly impermeable layer overlays water bearing chalk, as it shows in the top right hand.
Illustration.
So this geology naturally leads to, you know, the formation of streams and rivers with multiple springs along their length, but also marshes and wetlands, which would be the natural geography of much of London.

And the lost rivers we've talked about were part of that natural drainage system for the surface water and the groundwater across most of the large parts of the London basin.
So by incorporating them into the combined sewer network, which was a process that took place incrementally over a very long period of time, the downside of it is that all that surface water and a lot of the grout is effectively turned into sewage, which there's only one thing you can
really do with sewage, which is treat it. So everything that goes into those sewers needs to be treated. And in large parts of London, including the City, the combined sewer network is the only drainage network for those areas.
So although the rivers, the rivers we discussed, they've all been buried and the land above them has been heavily modified, a lot of levels have been risen by the sort of demolition of buildings and, you know, the levelling of valleys. There are still traces all the lost rivers within the landscape. So former river valleys such as the Fleet, you know, they are still visible. Things like the Holborn Viaduct were built in order to convey transport across the river valley. And so
they can still to act as floodplains and collecting and channelling surface water.
Obviously, given that the rivers have been incorporated into the sewerage system, the only destination for that surface water is the sewerage system. But when man-made drainage systems become overwhelmed,
pipes become full. There's so much water falling, it simply cannot get into gullies and drains. Flooding occurs. Another consequence of a lot of those sewers having once been rivers, they're quite near the surface. So anything that's built underground, such as basements and the underground are therefore quite vulnerable to flooding from them. And back in July 2021, on a single day, more than 1000 properties, which many of which were basement properties flooded, and also London underground stations and tunnels.
And just sort of finish by sort of posing the question, is that how much more resilient might London be had it not lost so many of its tributary rivers? I suppose another, from a sustainability point of view, another question is how much more use could be put to all that surface water?
groundwater if it wasn't all channelled into the combined sewer network and turned into sewage. And then sort of just to sort of conclude, I mentioned that there are a great many people who have done a lot of very detailed research into the subject of lost rivers.

So there's just a few of those there that I've drawn from extensively in producing these slides. I recommend anyone who's interested take a look at those. There are also some very good walking tours where you can walk above.
the course of the former water courses. And that concludes what I have to say. Thank you very much.

Brown, Ella 24:12
Thank you, David. I'm definitely learning through this course a lot about the influence of kind of water features on place names and I'll definitely add a few of those to my reading list. So yeah, please, for all attendees, if you have any questions for David, just use the Q&A function and we'll come back at the end of the next presentation to look at questions. So
Our second speaker I'm about to introduce is Nicholas Druce, who is the head of drainage engineering for Transport for London. So Nick and his team provide a whole range of technical advice for anything drainage or flood related within TFL, and they play a very crucial role in implementing mitigation to ensure that the whole network is resilient and adapted to climate change. So please go ahead and show your slides, Nick.
You already are. Take it away.

Nicolas Gruselle 24:59
Perfect. Thanks for the intro and good afternoon everyone. Yes, so I'm Nick Gazell. I've been at TFL for about nearly five to six years now, part of the engineering department and specifically on drainage. And today I'm going to give you just a relatively brief overview of
the issue of flooding, generally speaking, in TFL, and in particular, the impact it has on our underground infrastructure, so mainly our tunnels.
S.
Just to set the scene, just to remind everyone of who we are, TFL. So obviously we are well known for the London Underground, but it's actually not only that. So we also manage a number of other assets.
in particular, the DLR, the overground, the trams, and something that is maybe less known sometime. We actually manage a number of assets on surface. So all the main roads in London are TFL assets and all the, you know, supporting
infrastructure that the roads needs, we manage that as well. So you have a number of

kind of figures, statistics on this slide. I'm not going to name all of them, but just to give you a feel, focusing on the ground again, we
We are managing 1000 kilometres of track in London and 350 kilometres of this track in LU are internal. So obviously a lot of our infrastructure are actually underground, as you know. And it's probably important to
remind ourselves as well that a lot of them are quite old. They've been built, you know, some of them 100 years ago, and we are still using them. And part of the challenge is managing the flood risk on this infrastructure.
Again, just to put some context, I've just put some scary pictures of flooding and impact on metro in the world. You know, you could find many more than that. But I think that it is tight quite well, what we have to manage and what we have to control. So some pictures of what can happen, what happened in 22 and 16 in the US, and in 22 in Madrid, and more in particular in 21, 22, which David has added to the flooding.
in particular and in 2021, where we've been quite severely impacted in surface, obviously, as you can see in the pictures, but also on track in our tunnel, our station. And I think that was kind of another wake up call for us just to accelerate our resilience and adaptation.
to climate change and generally speaking.
In terms of the overview of flood risk management in TFL, important to understand that we have some duty from a kind of legislative and regulatory point of view to make sure we manage the flood risk, in particular
because obviously there is a safety component to it. So there are some national legislation that we have to obey to as a transport organisation, such as the Flood and Water Management Act. But we also have policy guidance we follow at national but also regional level.
So we have the Mayor Transport Strategy that's kind of defined the overall strategy in London. And part of that is what's our strategy to manage surface water and flood risk. And we at TFL, we also have our own climate change adaptation plan, which we published in 2023.
And this one has definitely a strong focus on flooding in particular. The other risk is the heat. And there are kind of the three, the two pillars that we have to work with. On the bottom right,
of the corner of the slide of the slide, I've put a picture of our flood risk GIS. So we have our own kind of tool, GIS system, to assess flood risk, generally speaking. And

basically what we've done is we've gathered all the data.
that various stakeholders have on flood risk. So that will be the Environmental Agency, Thames Water, the GLA, the Borough, and that just allows us to very efficiently risk assess our flood risk. And we do that, obviously,
on new projects. So any new project will be subject to a flood risk assessment to make sure we build mitigation into the design solution. But also on our existing assets, we have run, you know, regular at regular frequency flood risk assessment just to make sure we can inform the organisation
on the level of the risk it's subject to and make sure we can adapt to it and be resilient to it. We do that on, so across TFL, so that will be assessing the risk on, you know, LU station, the tunnels. Also, we have a number of line side buildings.
as we call them, which are all the buildings that are outside the station. But you have some very critical buildings, such as, you know, transformer room, substation, signalling room, these sort of things. And we do that and we assess the risk coming from all sources. So it's not only surface water.
It's also tidal, so coming from the Thames, or fluvial for all the rivers we still have in London that haven't been buried. And another one is actually the water member, so it's less.
You know, the link to climate change is less obvious, but there are some links. And it's actually one of the main risks we have at TFL, with surface water, is a risk coming from water main burst.
So focusing on our tunnel and underground infrastructure, which was the topic of today, just to explain that we have two types of tunnel at EFL. We have the subsurface tunnel. So those will be for basically the Circle Line, District Line, Hammersmith and City, Metropolitan Line.
They are just, I think Dave mentioned that as well. They are just below the surface, they've been built as cut and cover, just open trench, put your tunnel and cover. And then we have the deep tube tunnel, which are the vast majority of the tunnel are deep tube tunnel, I think under 350 kilometers.
probably a good 300 R deep tube tunnel. Those will be typically between 15 and 35 metres deep. I think the deepest is at about 50, 60 metres from ground level. And they've been built using tunnelling metals.
As you can see, that's the picture you can see at the bottom. And they are basically lined using cast iron or precast concrete rings. And they are about 3.6 metres diameter. And obviously, these two will be

acting slightly differently on and subject to different type of risk coming from groundwater and surface water, which I would explain on the next slide. So this is a typical and simplified
cross section of the geology in London, which David has also explained. So basically you have the superficial deposit where the, what we call the shallow aquifer sits. So this shallow aquifer is basically directly linked with surface water. So if it rains,
this will, you know, you'll have a higher shadow aquifer, which is what we call the groundwater. Then you have this thick layer of London clay, which is in theory supposed to be impermeable. And usually our deep top tunnel will be built at the bottom of this clay.
or below it.
So, and then you have the chalk. So, the deep aquifer will be sitting in the chalk, usually much slower than the tunnel. So, if the tunnel, the deep tunnel are subject to water ingress, it's actually not coming from the deep aquifer, it's coming from the shallow aquifer, because obviously hydrogeology is quite a complicated science and you do have some link.
So the water do manage, usually we don't really understand fully where, you know, exactly where the passage is, but the shadow aquifer finds its way to the lambest group and therefore impact our tunnel.
The water ingress issue. So first thing to say is water ingress on such old infrastructure.
It's expected and it's not necessarily actually an issue. So if the quantity is manageable, we do have a number of drainage assets in our tunnel to control this water coming in. And quite often, in the majority of the case, that's fine.
we manage that. So we have problems when it's either the water comes in at the wrong place and either we haven't got the drainage assets to deal with it or it's straight on a critical infrastructure which we have to protect.
So that can be an issue. All the quantities, just too much water coming in. That happened usually is quite sudden. And then we have to react very quickly. And actually quite often that's the case. That's more the composition of the water coming in. That is an issue.
Because of where the tunnel are located, as I've explained on the previous slide, quite often we have not only water coming in, but quite a large quantity of sand, which are just sitting, you know, in the tunnel and could impact our infrastructure. So sometime you know, controlling and managing the water is actually okay. The problem is just

sitting up all our, you know, channels and pumping station that we have. And that could be an issue. Another issue could be the corrosion. So some time for complicated chemical and geology element. The water is actually quite acidic and is creating some corrosion issue on infrastructure. As you can see on this picture, it's quite obvious.
So these are the sort of issues we have to deal with pretty much every day.
So, on on just to provide a bit more detail, so this is a typical cross section of what a tunnel, a deep tube tunnel looks like, so you can see you have the obviously the the tunnel itself, in most cases, cast iron lines, and then you can see on the on the side here, you'll have a...
a small hard front channel, which, you know, when you have just small amount of water and rest, just, you know, it's not flowing through, it's just dripping through. It will just end up in this channel, and then you have cross connexion to bigger channel.
which you can see here in the middle of the channel, and all end up in a pumping station. So we have, obviously at some point, we'll have to leave the water back in the surface. So we have a large number of pumping station, 1500 roughly approximately, which are discharging every day.
10s of thousands of cubic meta of water every day, which is fine. I mean, that's the way it has been designed. And yes, we do have to renew and we do have to upgrade sometime, but that's fine. But sometime when, as I've explained before,
is just not manageable because the drainage system is overloaded or it's too, you know, too many problems in terms of corrosion of sand coming in, then we do have to have more radical intervention, which is basically grouting. So we just
route using usually actually grout underneath the tunnel lining just to basically plug the leak. The problem with that is quite often if you stop the water coming somewhere, the water would find its way somewhere else. So it's not our preference. We will always try to let the water come in and manage the water, but sometimes we do have to intervene and then we just need to make sure it's done a very comfortable way.
This one, this slide is just to explain that. So the water ingress is an issue. It's, you know, every day. But in terms of flood risk, the main risk actually on our underground infrastructure is the risk coming from surface water and water and burst, as I've mentioned earlier.
coming from surface. Obviously the water, if London is flooded at surface, will find,

could find its way to our tunnels through station entrances or we have the number of shafts as well. Tunnel portals, you can see this picture here, for example, this just goes through the tunnel. And that's really the main risk we have.
And we have a number of way of mitigating that. In most cases, we actually have more operational mitigation measure. So we have a number of protocol, such as we have an emergency response unit team that are put on call.
if we have warning from the EA or the Met Office, just to make sure they are on call, they have temporary pumps to deal with that, just to make sure we can react very quickly and recover as well, very quickly in case of flooding. And we also have some more kind of engineered solution.
So I've put a picture here of what we call passive resistance. So passive resistance will always be our preferred solution. So it's basically building something high enough so it's not impacted by flooding when you design it. But obviously on existing infrastructure, you know, you're not going to start lifting all our station.
entrance scenes, it's just not possible. So we might have some time to put more kind of floodgate type, which I have put a picture here. It's not ideal because it's, although it's a relatively simple infrastructure, you have to make sure you have the right.
procedure in place. You have the people on site, the right training, you know, the right competency for the people to intervene at the right time, the sufficient warning system as well, evacuation protocol. So if you take all in all, it's actually not
a simple solution of all, but sometimes we have to put one in place.
But more generally, I think the proper way, I would say, and the main way to manage flood risk in London, is to start working in partnership, all of us, to make sure, you know, all the major stakeholders, which most of them have mentioned already,
the Environmental Agency, Thames Water, TFL, Network Rail, the Borough, the GLA, all working together to make sure we have a kind of a pan London surface water strategy. So in 2021, following the flooding, the City Hall, so the Mayor of London, ask us to do just that, all this organization, because it was quite clear we were all working too much in silo and we all had to work together if we wanted to come up with a strategy that was going to work long term.
We often say water doesn't understand organisational boundary, which is correct. It's either we all work together and come up with a common strategy or it's not going to work. And we are starting to see some very good work coming up from this strategy.
And a lot of it is actually about sustainable drainage system. It's kind of, I think there is a consensus within the industry that it's either we manage to build sustainable

drainage system at scale in London, and then we can, we have a chance to make our city resilient, or I think it would be tricky.
and we'll have to manage the risk in another way, but that's kind of the only way, to be perfectly honest. I put a picture here of one of the rain gardens we've built two years ago at Todd West Roundabout, just as an example. They are just such a lovely, you know, infrastructure and way of dealing.
with flooding issue. And not only they provide flood risk resilience, but they're obviously adding benefit in terms of biodiversity, water quality as well, which is more and more high up on the agenda. And amenities, just, you know, the feel.
and the difference you can make by just building Rain Garden in London. They are just win-win-win solutions.
I would just leave it like that. As conclusion, just a quick reminder of what I've been through. So yeah, we are managing a wide range of assets above and below ground in TFL. We understand our flood risk. We have projects ongoing business as usual to make sure we understand the risk.
and then we can make informed decisions when it comes to mitigation measures. Most of them will be procedural, but we also have hard engineered solutions sometimes. Our tunnels are supported by drainage assets to manage water ingress.
but sometimes it's just too much or the wrong composition of the water coming in and then we have to intervene by usually grouting. And then I think the key takeaway probably is understanding that the main is actually coming from surface and that we need to treat.
that as a common problem, all of us. I think this workshop is probably part of that as well, just to raise awareness and make sure we all work together. And I think SUD's sustainable drainage system will be a big part of the solution.
I will leave it like that. Thank you very much and happy to take any questions.

Brown, Ella 45:32
Thank you, Nick. And yeah, I completely agree with the need for a collective approach for managing surface water risk. So yeah, time for questions. We've already had a few in the Q&A. So I will start off with, there's been a question around in the city about wasting or
not recognising the resource that rainwater can be in terms of capturing it within grey water recycling services within buildings. And so this particular questions asked about Thames Water having a policy to create incentives for buildings to disconnect

their surface water discharge. If I may, I might just quickly just speak on the side of the city just to say that within our planning policy, we do have, yeah, policy and supplementary sustainable guidance just to encourage developers to consider integrated water management within any new developments. But David, I don't know if you have any more to say just on what Thames Water are doing to incentivize kind of integrated water management.

David Harding 46:35
Yes, I mean, there's always been the option to disconnect your surface water from the public sewer network. It's
It's not a huge financial incentive. I think for a sort of typical domestic dwelling, it's around the sort of 30 or 40 pounds a year reduction in the bill, but over a long period of time, you know, that would accumulate. I think, yeah, there are obviously challenges within the city in the, you know, as I talked about, you know, with the geology, infiltration can be difficult, but it's not impossible because, you know, if you disconnect the surface water, what do you do with it? You know, infiltration can be a challenge on the clay, but it's possible.

Brown, Ella 47:17
Good.

David Harding 47:29
You know, obviously there aren't any water courses because they're now combined sewers in the City. But as you alluded to, rainwater harvesting and grey water to reuse are, you know, excellent ways of dealing with it. Obviously, they're much easier to build into new properties.
or during sort of major renovation works than they are retrofitting to existing. But yeah, that really is something that, you know, I suppose we incentivize by the, you know, the disconnection rebate.
Obviously, if you can reuse rainwater or grey water, that will reduce your potable water usage. So there's another financial incentive there. We also, if you can't harvest or we do, well, we do sort of offer schemes whereby people can obtain things like

Brown, Ella 48:15
Mm.

David Harding 48:27
water butts or planters, you know, something that sort of combines some rainwater storage from gutter downpipes with, say, a planter on top and maybe a, you know, space for storage or something like a wheelie bin. You know, there are schemes where we offer products for that, often for free, including the installation.
Although, you know, they are subject to change those schemes. And sort of moving away from the property, you know, we do encourage things like suds, things like rain gardens, et cetera, pocket parks. And, you know, we have contributed to a number of such schemes.
through the London boroughs and through GLA initiatives. I mean, probably as big, if not big, a driver above flooding could be the reduction of storm overflows.
Obviously, I mentioned that
You know, the London sewers do discharge into the Tideway Tunnel now.
but obviously reducing the use of the tunnel and the amount of effectively rainwater that needs to be treated at Beckton is desirable. But moving further out in London, you know, there are areas where there are still storm discharges or overflows from sewage treatment works and intercept.
protecting surface water before it goes into the sewer system will help reduce that.
So we have got a, I think it's about across the Thames region, there's about an 18 million pound river health fund, which is aiming to sort of reduce storm discharge and improve river health, and large parts of that
would be delivered via slowing down the flow or diverting the flow of surface water away from public sewer networks. So there are details of those schemes on our website. By all means, inquire.
So, yeah, we did as.

Brown, Ella 50:32
Definitely cheque those out, yeah.

David Harding 50:34
Yeah, yeah.

Brown, Ella 50:36
Thank you. And then we've got.

David Harding 50:36
And as Nick said, you know, we aim to work in partnership with the other flood risk management authorities to encourage sustainable water use.

Brown, Ella 50:46
Exactly, it's that joint up approach between everyone involved in the sector. There's one around, a question for you, Nicholas, actually. Using, so you spoke about the kind of groundwater and the sheer amount of groundwater that just come into the tube tunnels. And I was, they were wondering,
if there's an opportunity to how you could utilise this water to kind of solve the cooling of the tube, which I know everyone experiences as a very hot environment.

Nicolas Gruselle 51:13
But.
Yeah.
Yeah, I mean, there is obviously a huge opportunity given the volume we extract every day. The fact that this water is relatively clean as well, you know, it's groundwater, so it's not highly contaminated, although it can be cohesive and full of sealed.
So, yes, the opportunity, and we do have actually projects for using, and this water is relatively cool as well. So, there are some projects to clean the tube. So far, it has been, you know, it's a large scale, but it's not to say that.
It's not being explored. We've also been working with other organisations actually that could make use of this water. So it's just to say we are fully aware of the opportunity, always very keen to explore that.

Brown, Ella 51:59
Mm.

Nicolas Gruselle 52:15
Obviously.
You know, having a good idea is something and make it real can be a bit more complicated, so you know.

But we are always partnering with people just to explore these sort of opportunities. Absolutely.

Brown, Ella 52:32
Thank you.
David, we have another question for you around, I think you almost posed the question to us on one of your slides about how resilient London would be if it hadn't lost its rivers, but the question asks whether there has been any kind of simulations within Thames Water to see how the level of protection that would exist if those kind of
True catchments did still exist.

David Harding 52:57
I mean, there's certainly been a lot of simulation about, you know, what the existing risks are. But also, you know, the Environment Agency has produced maps of surface water flow and inundation areas, fluvial flood risks.

Brown, Ella 53:11
Mm.

David Harding 53:17
Yeah, we also do modelling of our sewer network and, you know, simulate the performance in various sort of rainfall return periods. I suppose the answer to...
the impact, because I suppose the issue is that the opportunity for daylighting the lost rivers that are part of the sewer combined sewer network are sort of minimal to nil. So I suppose there's not been a lot of sort of investigation as to, you know, what the benefit would be.
I mean, one of the authors that I credited at the end of my slides did put in his book, did sort of put together a proposal because a previous mayor of London talked a lot and got very excited about daylighting the River Fleet.
notwithstanding the fact that it's a combined sewer. But one of the authors did suggest that there's no reason why you couldn't create in parts a new river fleet, a man-made but naturalised channel, a divert flows from headwaters.
through it. Yes, and I suppose were that possible, you could also divert some of the surface water from the capital into this new river. I suppose the short answer is we do

simulate the flood risk in London A lot.
And, you know, how the combined sewer network performs. But no, we don't really look at what the benefits would be of daylighting rivers like the fleet, because realistically speaking, it's not going to happen soon, is it?

Brown, Ella 55:12
Thank you.
Got a question for you again, Nick. It's talking about how risks are relating to the, I guess, overtopping of Thames flood defences or Thames, the risk associated with the River Thames flood defences and how that's kind of considered in the risk to, I guess, underground stations as well.

Nicolas Gruselle 55:39
Yes, so that's what we call the tidal flood risk. So we do assess that. So what we do is we do assess the risk with protection working.

Brown, Ella 55:54
Mm.

Nicolas Gruselle 55:55
because there is still a risk. And we do also model the discrete bridge of the defenses. So obviously, they are all managed by the EA. This front defense, we all rely a lot on the EA to manage that and they have the adaptation pathway where they already know what they have to do in the next 100 years to make sure we are still protected. And obviously the flood barrier is only one element of it. You also have all the, you know, all this wall along the Sam are basically flood defense.
So what we do as well is we do simulate more major, but on the ground with, you know, it's a cross-party simulation. What would happen if it was to overt up? So basically all, you know, organisation just meet and discuss.
what would be the response to it, you know, understanding where the water would be going. It's because a lot of it is about making space for the water. The water can't disappear. It has to go somewhere. But you probably prefer to flood a car park than properties, for example. So it's just being able to manage the water when
when it's flooding. So yeah, it is definitely considered the risk coming from tidal.
Yeah.

Brown, Ella 57:18
Thank you. And wow, the time has flown and it's nearly time to wrap up the webinar. But before everyone goes, I just want to say a massive thank you to David and Nick for your amazing presentations. And then I just ask everyone to open the chat and look at our flood resilience toolkit takeaways for this week, which we've encouraged people to read and save the GLA's guidance on preparing for flash flooding, which particularly focuses
on the risk to basement properties, and then also to save some flood contacts into your phone in case of flooding or emergencies. So we've suggested a few for you there. They're really simple takeaways, but it's so important to build this resilience to flooding with these steps. And also just to give a shout out to our next event, which is happening in two weeks time on the 11th of February,
And this is all this event is going to be looking about future proofing, the future proofing to flooding. And we're going to look at local and global examples with a particular focus on business continuity and sustainable drainage systems, which have come up today. So yeah, thank you all again for attending and thank you for our presenters. Yeah, see you all soon.

David Harding 58:24
Bye.

Nicolas Gruselle 58:25
Bye.

stopped transcription