

Written evidence from Chartered Institution of Water and Environmental Management

1. CIWEM is the leading independent Chartered professional body for water and environmental professionals, promoting excellence within the sector. We provide independent commentary on a wide range of issues related to water and environmental management, environmental resilience and sustainable development.
2. We welcome the opportunity to respond to the Committee on its inquiry on Water Quality in Rivers. This response has been compiled with the assistance of our members, who are expert practitioners in this field.

Summary

3. The challenge of water quality in rivers in the UK is a complex, wicked one which needs a wide range of solutions to be implemented across society to resolve. This will require:
 - Increased awareness of the nature of the origins and pathways of the pollution.
 - Increased appreciation of the range of tools and solutions available to mitigate the problem, the various parties responsible for implementing them and their capacity to do so.
 - Increased understanding of the quantum of investment needed to resolve pollution of rivers, how that can be achieved most efficiently where the costs should be borne.
4. Current discussions around river water quality are focused quite intently on sewage pollution associated with stormwater overflows. Campaigns such as End Sewage Pollution have raised this up the agenda with the public. Responses by Government have focused primarily on the water industry as the necessary instigators of improvement as they are responsible for managing the sewage and surface water drainage network that is the source of much of the pollution. These should help drive action but at the moment only touch on part of the problem and solutions.
5. Stormwater overflow discharges are a particular problem in the form of combined sewer overflows (CSOs) but can also occur from wastewater treatment works. Nowadays, surface and foul water are handled in separate systems but in much historic development a combined sewer system still exists. Urban infill development of impermeable surfaces, extensions to upper components of the sewer 'catchments' and groundwater ingress into ageing sewers can result in high flows which could risk sewer flooding to connected properties.
6. CSOs are the safety relief valves in the network, designed to operate during heavy rainfall when the rivers into which overflows will discharge are at high flow. However some are discharging far more frequently than initially intended. This problem is exacerbated by water and sewerage companies (WaSCs) having an incomplete understanding of the exact detail of their drainage and sewerage assets (because these have developed incrementally over time, including with misconnections having been made). Increasing levels of monitoring put in place over recent investment rounds will improve this picture but there is considerable progress still to be made.

7. Additionally, whilst WaSCs have responsibility for the network and what is discharged from it, they have limited control over what is put into it so cannot fully own the solutions. Many other parties need to act too. These vary from consumers and what they put down their toilets, to manufacturers of sanitary products, to highways agencies whose actions have a considerable impact on the volume of water in sewers, to housing developers and local and national government who set and enforce the rules against which developers must build. Sewage pollution cannot be considered solely through the lens of the water industry.
8. Because there is a range of parties each with a major role in both the problem and the solution it is arguably easier to focus in on the actions of just one. However this complex problem will only be solved with focused actions from all concerned. It will not be cheap to fix and is likely to require a degree of additional regulation to encourage parties who are not fully engaged to embrace their responsibilities and drive the right interventions.
9. Fortunately there is a timely opportunity to respond to other challenges including decarbonisation of transport and climate resilience to deliver changes in our urban fabric that can make a positive impact on issues such as water quality too. As streets are re-engineered for electric vehicle charging and active travel, opportunities can be taken to also work green-blue infrastructure into streetscapes and undertake sewer re-engineering works at the same time. This needs a collaborative, multi-agency approach as we detail in our evidence. It will be challenging, but failure to address it this way is likely to lead to poorer outcomes and higher costs.

Response to inquiry questions

How could drainage and sewerage management plans, introduced by the Environment Bill, play a role in reduced sewer discharges?

- 10. Drainage and sewerage management plans (DSMPs) offer the opportunity for a longer-term, strategically planned approach to managing drainage and sewerage assets. The reasons for frequent stormwater discharges are many and complex and need a strategic approach to resolve. In maximising the effectiveness of DSMPs, water and sewerage companies (WaSCs) will need cooperation from a range of other bodies, particularly local flood authorities (LLFAs) and highways agencies (HAs) because WaSCs are only directly responsible for a small proportion of the water in their drainage and sewerage networks.**
11. Strategic planning elsewhere in the industry, e.g. with water resources management plans, has been effective in building resilience and this is being taken further through the nascent regional planning approach.
12. DSMPs will undoubtedly help drive a better understanding of the nature and condition of sewers and therefore stormwater overflows. It is important that the plans consider stormwater storage and treatment capacity in the round; not just sewerage but also wastewater treatment works, which can also discharge to the environment once a certain capacity of stormwater in the works is exceeded.
13. The twin problems of stormwater overflows and urban flooding are so intertwined that they are effectively one problem and need to be addressed in a properly integrated way. One example of where this is being done well is through the [Living with Water](#) initiative in Hull.
14. In view of the range of contributory factors and parties involved with stormwater overflow discharges, DSMPs must not be prepared in isolation by WaSCs but as integrated, collaborative plans. DSMPs could have been fully-integrated WaSC-LLFA plans that looked at water quality and

surface water flooding together. However, it was decided not to progress in this way, not least because the parties have completely different investment approaches and horizons. Consequently there remains a risk the approach will remain siloed, with too few people with requisite knowledge spanning the different technical disciplines involved. A coordinating oversight role – along the lines of the [Catchment System Operator](#) proposed in 2015 – could potentially assist in helping to integrate the activities of the various parties involved.

15. There is a duty established under the Flood and Water Management Act 2010 for LLFAs to cooperate with other Risk Management Authorities (in this case WaSCs), however, this duty may need to be reinforced by any regulations made pursuant to the creation of DSMPs, and a new duty on local authorities including HAs to prevent water pollution would help to drive this cooperation.
16. Detailed, collaborative planning is essential in developing solutions to these problems, but equally will need to be supported by provision for companies to make proportionate and timely investment (appropriately sequenced to effectively inform WaSC business planning so that planned solutions can be invested in promptly).
17. DSMPs should ensure greater WaSC-to-WaSC consistency in how drainage and sewerage challenges are assessed and presented, establishing a coherent, single version of the truth on the current performance of the system, what it could be in the future and the range of solutions needed to achieve that.
18. This will need to be underpinned by a target on future performance, which is well-understood by the public as water bill and tax payers in terms of the range and scale of investment needed to significantly reduce or even eliminate these discharges. This picture is far from being clear and understood. Strategic direction on speed of delivery will be essential, and is something that the work of the Stormwater Taskforce should provide greater clarity on.

How adequate are the monitoring and reporting requirements around water company discharges? How can technology improve and assist with transparency and enforcement?

19. **Recent announcements from Defra requiring greater monitoring transparency and reporting by WaSCs are welcome and should bring improved water company investment and performance on stormwater overflows. There are many considerations and areas for improvement regarding monitoring and reporting technologies, their reliability, costs, and the general level of understanding of overflow assets within water company systems. Technology can help considerably, but this will not be without potentially significant additional cost.**
20. Recent experience from our members indicates that WaSC understanding of their CSO assets is far from comprehensive. Even companies with stronger track records as far as technology deployment and environmental performance are concerned may not know how many live CSOs they have on their networks.
21. Further investigation can raise as many questions as it answers. For example, 'dual manholes'¹ (where both surface water and wastewater pass through the same chamber) can act as 'hidden'

¹ <http://ftp2.ciwem.org/1997/1997-05-22/SP1997.PAPER08.pdf> This paper dates back to 1997 but illustrates the nature of the problem of dual manholes.

unconsented and unreported CSOs and investigations can show that there are often many of these present. Much more effort is needed to produce a definitive list of overflow assets for each water company – both in terms of 'official' CSOs and other points in the drainage network where surface and foul water might mix. In line with this, it is also recommended that OFWAT expands its reporting definition of a CSO to include all potential wastewater discharges to the environment.

22. Across the last water industry asset management period (AMP 6), thousands of event duration monitors (EDMs) were installed on CSOs to identify where they were discharging. This utilised a simple sensor to provide an event duration rather than a quantitative assessment of how much sewage was discharging to the environment. This was a wholly appropriate approach considering the technological options currently available to the industry and the cost of more detailed monitoring. However, the data availability isn't as good as it should be due to various communication problems that the water companies have with their assets resulting in an incomplete picture.
23. The EDM approach does not cover all CSOs, although a number of WaSCs have chosen to go beyond this and reach 100% coverage. Monitoring is also occurring at wastewater treatment works. Increasing monitoring of this nature helps the system to be run in the most efficient and resilient way within the constraints of its physical capacity. It will also identify where pollution is occurring because of heavy rain causing overflows, or failure/ mismanagement of assets.
24. Real-time reporting of water quality requires real-time monitoring and in this context is not without practical challenges. Typically for example, E.coli and intestinal enterococci analysis takes around 24 hours (minimum) to provide results from a lab. There are technologies on the market that enable quicker analysis, but these require frequent attention and can't be left in the field for long periods of time (e.g. they need frequent calibrating, or refill of test chemicals, a power supply, and a way of communicating back to a central hub – factors which mean real-time monitoring/ reporting may only be feasible for more urban sites).
25. A project in [Chicago](#) is using [Proteus](#) and [Tecta](#) to provide real-time water quality monitoring and reporting. Tecta is reporting microbial quality in terms of cfu/100ml (the units used by the bathing water directive for E.coli and Intestinal enterococci standards). Other technologies tend to report in units that are used as a proxy for biological activity and it would be a challenge to link these confidently to faecal contamination. The cost of the solutions varies, but it would be reasonable to say that cost per sample using online monitoring might be between £0.1 - £5. Assuming the units take several samples a day, the costs can build up.
26. The traditional methods of sampling and analysis for bathing water quality would likely still need to be followed as the regulation sets out requirements for both, which is not compatible with the use of online monitors. So the cost of online monitoring is additional to the current field and lab costs. Thus, online monitoring is currently used as an early warning, but for compliance (and hence enforcement) purposes it is necessary to use laboratory methods.
27. So, there are solutions which can provide real time monitoring for bacterial quality, but they are not without their limitations. Comprehensive trials would help determine their technical feasibility, accuracy, and operating cost. In the meantime, real-time monitoring and information provision is most likely to be deployed to warn recreational water users that water downstream of CSOs may not be safe.
28. More extensive monitoring has and likely will further increase public demand to reduce and/or to disinfect CSO discharges. The costs of disinfection are currently being investigated by UKWIR but are likely to be significant both financially and in terms of carbon emissions if deployed widely.

29. In light of the current demands, monitoring will need to cover amenity areas where there is high recreational use but full bathing water status is either not desirable or feasible. It also still requires a certain amount of manual interpretation and analysis by the regulator. Development of technologies that not only report the data but can analyse it as well would be a welcome next step (e.g. alert if there is a suspected permit breach, link to rainfall events to understand if a spill occurred in extreme weather, report on spills that cross trigger levels for frequent spillers, etc).

What is the impact of plastic pollution and other materials on drainage and water quality in rivers and what should be done to mitigate it?

30. Plastic pollution and other materials – colloquially known as ‘unflushables’ are a significant exacerbator of the risk of sewage pollution through CSOs because they reduce the capacity of the sewer network, which may already be near or at its full capacity because of other factors such as historic additional connections. The vast majority of the problem is caused by wet wipes and more needs to be done to prevent them being put into sewers.

31. These waste streams act as binding agents for fats, oils and greases causing ‘fatbergs’, can block screens and attach to other in-pipe roughness such as joints and junctions, backing up and raising the level of water so that it is more likely to overflow.

32. The nature and scale of the problem is well-summarised by organisations such as [City to Sea](#) and water companies themselves. The issue of sewer misuse is a major problem for WaSCs because it can lead directly to sewer flooding which is one of the most critical performance failures for companies. Clearing this debris from sewers costs WaSCs in the region of £90m/ year. Where plastics end up being discharged as pollution themselves they are a source of the huge plastic and microplastic pollution problem impacting seas and freshwater. The [Marine Conservation Society](#) showed that almost 6% of beach litter is derived from sewers.

33. Ultimately the solution comes in the form of source control and this should be regarded as one core component of the complex issue of sewage pollution. [Water industry campaigns](#) have helped to reduce the problem to a point, but there have been recent [spikes](#) in blockages. The concept of ‘flushable’ products, underpinned by certification schemes such as [Fine to Flush](#), may go some way to improving things but their efficacy in practice [can vary](#).

34. Considerable further progress needs to be made in building public understanding of what is and is not appropriate to flush down the toilet, and why. In line with polluter pays principles this needs to involve the manufacturers of problem products through producer responsibility schemes, as well as the WaSCs who have to clean up the problem and who will ultimately pass the costs on to all customers, not just those who misuse the sewer.

How can consumers be persuaded to change their behaviour to minimise pollution?

35. This needs a multi-faceted approach as detailed above. The impact on customer bills needs to be made clear, but this needs a source-control approach involving WaSCs, problem product manufacturers, campaigning organisations and government to regulate where – and if – progress is insufficiently swift.

36. WaSCs are increasingly practiced at engaging their customer base using approaches which tap into their value systems and using behavioural economics to build engagement and understanding of problems. However for this to be effective, messaging and regulation needs to be effective at all touch points and ensure that action on the part of one party to improve things isn’t undermined by others.

What is the required investment level needed to minimise storm overflows vs the scope for sustainable drainage and nature-based solutions?

- 37. We interpret this question as presenting a binary, either/or choice. The reality is it is not, and it needs a multi-faceted, well-integrated suite of measures which require the education, engagement, cooperation and commitment of a wide range of parties. This range includes, but is not limited to: Defra and its agencies; MHCLG; Department for Transport; local government including lead local flood authorities, local planning authorities and highways authorities; the water industry; developers; drainage engineers; landscape architects; product manufacturers, and the public. Neither option alone will solve the problem. Focusing too heavily on one over another will most likely result in poor delivery and higher than necessary cost.**
38. The required investment level to minimise storm overflows is unknown because (a) the term "minimise", like campaign groups' "end sewage pollution" is loose and (b) because understanding of the sewerage and drainage network is far from complete as evidenced by our comments on dual manhole frequency. There is a need to define what society agrees is an acceptable level of sewage discharge into rivers, and under what conditions (how extreme), then what it agrees it is willing to pay to achieve this, and over what timescale. Drainage experts have indicated that costs to remediate all CSOs to a level where discharges are truly minimised would likely cost many tens of £billions.
39. SuDS and nature-based solutions are effective ways of reducing flow into sewers which is a critical factor in reducing stormwater discharge because one cause of stormwater overflow is progressive addition of new development to existing sewers. Managing surface water at the surface via SuDS and other blue-green infrastructure is internationally regarded as a more sustainable option than below-ground drainage, and done in the right way can deliver benefits for flood risk management, water quality, biodiversity, human health and wellbeing, placemaking and wider climate change adaptation e.g. mitigating urban heat island effect.
40. There is a fundamental need to look at this complex problem in the round. Stormwater overflows resulting in sewage pollution of watercourses is a symptom of a far wider mismanagement of water within our urban landscape.
41. There are multiple opportunities and touch-points through which individually small, or otherwise existing interventions can collectively have a significant impact on this problem. This needs to be the overarching philosophy for how we upgrade infrastructure and our built environments to meet the challenges of climate breakdown and nature recovery over the next decade and beyond. For example, as highways are upgraded to support electric vehicle charging and increased walking and cycling, opportunities should be taken within this highway reprofiling to incorporate SuDS into streets and highways to reduce the amount of runoff entering the system. Experience in Wales is showing that the positive impact of raingardens on filtering out pollutants from highway runoff discharge is significant. This is an ancillary benefit to their reducing the volume of water.
42. Such an integrated approach would be complex and need high levels of organisational synchronicity and cooperation. It may need a modified governance and regulatory framework or range of responsibilities to those which currently exist and will require a considerably improved level of awareness and engagement by wider government departments, such as MHCLG and DfT. Such an approach might change the balance of investment origins, perhaps with less focus on water and sewerage customers and a greater proportion falling on citizens / tax payers, although the reality is this is just a different way of slicing the same cake.

How effective are the planning policy and standards around sustainable drainage systems to reduce urban diffuse pollution in England?

- 43. The current 'planning-led' approach to delivering SuDS as a default mode of surface water management / drainage is far from effective in achieving well-designed and implemented multifunctional SuDS that will be adopted and maintained for the long-term, delivering the widest range of benefits to communities.**
44. Sensible and comprehensive proposals were put in place under [schedule 3](#) of the Flood and Water Management Act 2010, following the [Pitt Review](#) of the summer 2007 floods. These set out an approach which would establish clear technical standards for (multifunctional) SuDS delivery within developments, scrutinised by SuDS Approving Bodies (SABs) within Lead Local Flood Authorities, enabling that local authority to then adopt and maintain those SuDS. This was supported by an end to the automatic right of developments to connect to the sewer, ensuring that there was a strong driver for developers to comply with the standards set out. This represented an integrated approach to managing surface water within local government; arguably the most joined-up solution to dealing with surface water associated with new (and existing) developments, as well as from highways.
45. Government decided after 2010 not to commence Schedule 3 and to encourage SuDS delivery via a less regulatory, planning-led route. The technical standards initially drafted for use by SABs were slashed to consider only runoff rate (as opposed to the wider 'pillars' of quality, amenity and biodiversity). We expressed strong concerns at that time and subsequently [conducted research](#) and put forward [recommendations](#) for consideration in the [MHCLG review](#) of the application and effectiveness of planning policy for SuDS, which highlighted the shortcomings of current planning policy, the non-statutory technical standards as well as [planning practice guidance](#). We recommended strengthening of all of these – including in relation to how adoption should be enabled – should commencement of Schedule 3 not be something Government was willing to consider at that point.
46. Since then, the headline planning policies in the National Planning Policy Framework have been improved to more clearly mandate multifunctional SuDS. Some local planning authorities have strong supplementary planning documents (SPDs) relating to SuDS but the picture varies authority to authority, with quality often reliant on whether there is a well-informed SuDS 'champion' within the organisation.
47. Planning practice guidance has not been updated since 2015 despite MHCLG engaging on this in 2017 (we can provide the committee with our recommended updates to the planning practice guidance on request), and still contains frequent loopholes around cost and practicality which undermine the direction of the NPPF by enabling developers to claim SuDS are too expensive (more expensive than a conventional drainage system) without being required to evidence this.
48. The result of this is that too many SuDS schemes are poorly designed, shoehorned into development sites as an afterthought, not built out as required by planning conditions, poorly performing, not adopted or properly maintained and thus do not mitigate the problem of sewer overload as much as they could. However experience of our members is very clear that well-conceived SuDS schemes, designed early on in scheme development, are cheaper to construct and maintain and deliver far wider benefits than conventional drainage systems. So whilst technically – and in line with the findings of the MHCLG review – SuDS are now commonly being delivered on major developments, they are very commonly not being delivered *well*.

49. The more readily good SuDS practice can be reflected in local plans, masterplanning and outline applications, the better land values can capture necessary investment, the faster and cheaper scheme delivery can be, and the more readily requirements for adoption and long-term maintenance can be achieved.
50. The broad picture as far as SuDS delivery is concerned is that progress under the current system is slowly being made. However, it is being made *despite* the system not because of it. The [design construction guidance](#) updates for water company adoption sewers, including SuDS, is a partial step in the right direction as it enables water companies to adopt some, but not all SuDS features through interpreting the definition of a sewer set out in the Water Industry Act 1991 as broadly as possible. The Non-Statutory Technical Standards (NSTS) are being reviewed by Defra and the Environment Agency and revisions covering multi-functionality are being proposed. We would strongly recommend Government to put in place an updated and comprehensive NSTS.
51. Further guidance on SuDS is proposed in the consultation on the National Model Design Code, including a sustainable drainage toolkit. Despite this partial progress, the underlying tone of this piecemeal approach remains that SuDS are a 'nice-to-have' option for local authorities and developers rather than a fundamental change to how water should be managed in our urban environment. The tone that they may be a burden to developers as opposed to a more affordable, resilient, multi-beneficial enhancement to the built environment which can deliver against a wide range of current government objectives is still too prevalent beneath the surface, and enforcement of good design and delivery inadequate.
52. We strongly urge a more coherent policy from government to SuDS delivery to achieve their extensive potential. It is not too late to commence Schedule 3 of the Flood and Water Management Act given the amount of (flood) water (and sewage) that has passed under the bridge since it was last formally recommended by the Pitt Review well over a decade ago. Failing this, the latest round of planning reform are an opportunity to get things right but strong, clear direction and removal of loopholes will be vital.

Should local authorities and highways agencies be given a duty to prevent pollution to watercourses without prior treatment?

- 53. We consider that local authorities and other highways agencies should have a duty to seek opportunities in maintaining, upgrading or building new infrastructure, to prevent untreated runoff from roads and other urban surfaces being discharged into watercourses. The USA uses this principle under the Clean Water Act, to drive more sustainable management of surface water and offers a model for how it can be effective in achieving results. A duty would help to drive the incorporation of blue-green infrastructure (SuDS, treatment wetlands etc) into the renovation of highways and the public realm.**
54. Roughly 50% of water in a typical combined drainage network originates from highways and footpaths, which account for a large amount of the hard surface in our urban environments. Water companies are responsible for dealing with this water and charge all water customers through the highway drainage charge, on the basis that everyone benefits from the utility delivered by highways.
55. We understand that relationships between WaSCs and highways authorities can vary considerably authority to authority, with some highly cooperative and others practically non-existent. As with many issues concerning water management this is often dependent on the skills and motivations of individuals working within the organisations. A legal duty would help to underpin the importance of cooperation, not just strategically through DSMPs, but also operationally.

56. Where engagement is active between highways agencies and WaSCs presently this typically relates to consideration of increased loading on the network from new or major improvements to infrastructure, rather than their water quality impacts. We are pleased to note that Highways England acknowledges the importance of water quality within its [designated funds plan](#) but we would recommend that this recognition and prioritisation should be embedded within all highways agencies, possibly through an amendment to s.108(1) of the [Transport Act 2000](#) to embed water quantity and quality considerations within the requirement to develop Local Transport Plans. These should require that authorities requiring new gully connections to a drainage network should incorporate multifunctional SuDS to deliver flow, volume and water quality benefits.

How effective is Ofwat's remit and regulation of water companies? Does it facilitate sufficient investment in improvements to water quality, including sustainable drainage systems and nature-based solutions such as constructed wetlands?

57. Ofwat takes its direction from Government in terms of the priorities that it requires WaSCs to reflect in their business plans. In recent planning rounds, these have focused on issues including reducing leakage, reducing customer bills, managing flow within treatment works and tackling nutrient and pesticide pollution e.g. phosphate and methaldehyde. The last two planning rounds have included direction around event duration monitoring and some CSO rehabilitation. We would like to see a regulatory approach which prioritises and enables water companies to deliver their regulatory obligations through integrated, catchment-scale, nature-based solutions as far as possible before investing in hard-engineered, carbon-intensive solutions.

58. We need to better understand society's collective ambition in relation to water quality and stormwater overflows. However, we know that customer challenge groups commonly value the environment strongly. This needs to be understood in terms of willingness to pay and an appropriate improvement trajectory, translated into agreed, appropriate targets against which to regulate and invest.

59. The [Storm Overflow Assessment Framework](#) sets out a prioritisation programme for those storm overflows which are discharging above a threshold frequency and appraises them against criteria including their environmental impact (aesthetic, biological and water quality) and the cost/benefit of their remediation. This approach defines the level of investment that is directed to storm overflow remediation. It is effectively an investment rationing approach and the understanding of societal ambition on the extent and pace of pollution reduction will be important in informing the gearing of such mechanisms.

60. CIWEM is a strong advocate of nature-based solutions as a means of addressing the climate and nature emergencies. Because nature-based solutions can deliver carbon sequestration, climate change adaptation, water quality *and* other direct nature and amenity / wellbeing benefits there is a strong case for their high prioritisation by Ofwat for future investment. These approaches are particularly well-suited to managing surface water effectively *at the surface* and driving forward this separation of surface water from the network should be a regulatory priority for government and Ofwat over coming investment rounds.

61. There can be a less certain and extensive evidence-base to support the performance of nature-based solutions, and they generally take a period of time to mature and perform at the level they are designed to. For this reason, Ofwat should ensure that its requirements do not discourage the deployment of such approaches, but support them even where performance may take multiple investment rounds to fully optimise.

62. We view Ofwat's innovation fund positively in this context, particularly its first two [strategic innovation themes](#) of climate change mitigation and adaptation, and restoring and improving ecological status of water environments and reducing pollution. This is indicative of a welcome mindset, and we hope to see these themes carried through strongly in its future regulatory approach.

Is adequate investment being made in adapting water treatment systems to future climate change?

63. The Environment Agency has noted that climate change may result in up to 50% more flow through sewers by 2050 due to extreme rainfall events. Given that many combined sewer catchments are close to capacity it stands to reason that climate change represents a significant risk factor to increased pollution associated with storm events. More needs to be done to address this, as detailed above.

64. As climate change also increases the temperature of receiving waters, particularly during times of low flow, the impact of short but intense storms causing CSO spills is likely to be greater due to higher biological demand.

65. These circumstances underline the need to increase the climate resilience not only of drainage systems but also of receiving waters by ensuring that they have sufficient flow in them. Once again, nature-based solutions offer benefits through their ability to slow the rate of runoff into drainage networks, but to improve its quality too.

How could the designation of inland bathing waters by water companies affect the costs of achieving the associated water quality standards?

66. Extensive designation of bathing waters would not in itself affect the costs of achieving the requisite water quality standards. It would however be likely to drive a level of compliance which would be both expensive and potentially carbon intensive to achieve, particularly if pursued mainly through shorter-term water industry investment rather than a longer-term, well-planned and integrated approach.

67. This can be illustrated very crudely by considering the use of UV disinfection of effluent discharged to coastal waters to ensure bathing water compliance. South West Water, with a large number of coastal bathing waters has the highest customer bills in the country.

68. In rivers where effluent makes up a significant proportion of the flow, UV disinfection would almost certainly be required as bacteria is still present in fully treated effluent. There is also a need to understand the impacts of activities in the whole catchment on bathing water compliance. Other factors than effluent discharges can commonly cause water quality failures following rainfall events, e.g. runoff from agricultural land. Urban runoff can also be contaminated, therefore once again, the resolution of the problem of water quality will require delivery of a range of measures by a range of different parties. Meeting appropriate water quality standards for recreational use (including bathing) should take a variety of approaches, including through the use of warnings to recreational users of when it would be unsafe to use the water.

69. A comparison is commonly made between the number of inland bathing waters in Europe and that in the UK. It is worth noting that many of the countries in Europe have significantly higher water bills than those here. Denmark for example has very high standards of treatment for its wastewater effluent, however Danish water bills are in the region of twice the cost of those in the UK. Given Ofwat's recent emphasis on reducing bills, this is a critical question. Technically speaking

it is perfectly possible to achieve very high standards of water quality through a range of interventions. The question for water bill and tax payers is how much do they want to invest in achieving this, and how quickly.

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