

Surface Water Flooding Study

Impact and costings note

Introduction

This note presents the impacts and costs of the Commission's recommendations made as part of the Surface Water Flooding study. It considers the recommendations that could have significant implications on spending and the environment.

It presents:

- the impact of the recommendations on the Commission's objectives to support sustainable economic growth across all regions of the UK, improve competitiveness, improve quality of life, and support climate resilience and the transition to Net Zero;
- the expected costs of the recommendations, and their impact on the Commission's fiscal and economic remits; and
- uncertainty, distributional effects and risks around these estimates and the balance of evidence behind recommendations, as far as it has been possible to make these assessments.

The impact and costing note records the Commission's assessment of these factors in a standard format.

The core of each impact and costing note is how the cost of the recommendations affect the Commission's fiscal and economic remits. These were set out by government in the 'Remit Letter to the National Infrastructure Commission'.¹

The note is broken down into seven sections:

Section 1: Summary of study recommendations and outcomes

Section 2: Contribution towards the Commission's objectives

Section 3: Impact on the Commission's fiscal remit

Section 4: Impact on the Commission's economic remit

Section 5: Environmental impacts

Section 6: Distributional impacts

Section 7: Uncertainty

Annex A: Commission recommendations

Annex B: Summary of method and assumptions

The numbers presented in tables may not sum to the totals shown, due to rounding in the presentation.

¹ HM Treasury (2021), Remit Letter to the National Infrastructure Commission:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028591/CX_LETTER_NIC_REMIT_271021.pdf

Section 1: Summary of study recommendations and outcomes

The Commission has made eight recommendations as part of its Surface Water Flooding study. These are set out in Annex A, and further detail can be found in the accompanying [report](#).

The outcomes of the Commission's recommendations are underpinned by an increased level of investment in drainage infrastructure.

Outcomes

Modelling carried out on behalf of the Commission indicates that investing about £12 billion over 30 years in cost effective drainage infrastructure measures could reduce the number of properties that would otherwise be at high risk of surface water flooding in 2055 by around 60 per cent.

The Commission recognises that investment in infrastructure is only part of the solution, and enforcement and amendment of planning rules will also be required, including the enactment of Schedule 3 of the Flood and Water Management Act. This is the Commission's first recommendation. More detail can be found in the recommendations set out in Annex A, and the Commission's [report](#).

Level of Investment

The additional investment supporting the Commission's recommendations is £3.6bn (2022 terms), over 30 years from 2025. This is in addition to an indicative £8.4bn of existing ongoing investment over the same period.

The total level of investment estimated to be required to achieve the above outcomes is between £10.5bn and £14bn, in 2022 price terms, over the 30-year period from 2025 to 2055. For this note, the central scenario in the model, £12bn, has been presented.

Funding and Financing

Financing of the investment is split between public and private finance. The former is taxpayer funded and will be within the Commission's fiscal remit and the latter is predominantly funded by households and businesses through Water and Sewerage Company billing.

The Commission's analysis of baseline spending suggests that currently 60 per cent of investment is privately financed and 40 per cent is publicly financed. While that split may change in future, the Commission has retained it for indicating the impacts of its recommendations as follows:

- 60% attributed to investments by Water and Sewerage Companies, which is an additional £2.2bn investment over 30 years from 2025. Private investment is financed by companies and funded by billpayers.
- 40% attributed to public investment, which is an additional £1.4bn over 30 years from 2025. Public investment is financed by government and funded by taxpayers.

Section 2: Contribution towards the Commission's objectives

The table below reviews how the Commission's recommendations contribute towards its objectives.

Support sustainable economic growth across all regions of the UK

While there is no material direct impact, reducing the risk of surface water flooding where the risk is highest means that geographic disparity in exposure to flood risk and avoided damages is lessened. Also, by protecting assets from flooding, households and businesses can put their money into growing the economy instead of repairing/rebuilding flood damaged property.

Improve competitiveness

While there is no material quantifiable impact on competitiveness or productivity, businesses will benefit from reduced flooding damage and disruption.

Improve quality of life

Reducing the risk of surface water flooding contributes positively to quality of life across the following domains: Health, Local and Natural Surroundings and Comfort and Convenience.

The drivers behind improvements are:

- Lower frequency of flooding for households leading to fewer events detrimental to physical and mental health.
- The introduction of green SuDS, improving the natural environment and providing improved physical and mental health outcomes for those with a view of, or improved access to green space.

Support climate resilience and the transition to net zero carbon emissions by 2050

The investment level supporting the Commission's recommendations is predicated on a level of climate change² leading to increase frequency and intensity of rainfall events leading to surface water flooding.

The Commission's recommendations improve the UK's resilience to climate change.

² Surface Water Future risk and Investment Needs, Sayers and Partners et al, 2022, 2-degree and 4-degree (by 2100) climate change scenarios: <https://nic.org.uk/app/uploads/NIC-Sayers-and-Partners-Surface-Water-Future-Risk-and-Investment.pdf>

Section 3: Impact on the Commission’s fiscal remit

Of the modelled new investment of £3.6bn, 40% is assumed to be publicly financed and taxpayer funded. This is a total of £1.4bn over 30 years from 2025 to 2055, which includes capital expenditure (c. £1.1bn) and operational expenditure (c. £0.3bn). This relates to above ground interventions to reduce flood risk such as Sustainable Drainage Systems (SuDS). The capital expenditure sits within the Commission’s fiscal remit and the operational expenditure within the Commission’s economic remit.

Public financing for flood prevention is mainly through the Environment Agency’s grant-in-aid funding within the Flooding and Coastal Erosion Risk Management (FCERM) Programme, and through investment by Local Authorities.

Grant-in-aid support for surface water flooding schemes specifically, depends on the successful bidding for funding of these schemes and has been judged to be around £50m p.a. (2021/22 figure) based on successful bids submitted, with around the same funding in addition from local authorities.

Table 1: Fiscal remit impact

This table shows an indicative forward projection of today’s government capital financing for surface water flooding risk reduction, and additional government capital financing supporting the Commission’s recommendations.

Average annual expenditure (£m p.a., 2022 prices)	Total 2025-2054 (£m, 2022 prices)	2025-29	2030-34	2035-39	2040-44	2045-49	2050-54
Today’s investment projected forward (indicative)	£3,352	£112	£112	£112	£112	£112	£112
Additional investment from study recommendations	£1,100	£37	£37	£37	£37	£37	£37
Total	£4,453	£148	£148	£148	£148	£148	£148

The publicly financed element of the Commission’s recommendation will eventually be determined by government and may vary from 40%.

Section 4: Impact on the Commission’s economic remit

Of the estimated investment of £3.6bn, 60% is assumed to be privately financed and billpayer funded. This is a total of £2.2bn over 30 years from 2025 to 2055 funded by billpayers. This includes capital investment and operational maintenance.

In addition to the £2.2bn which is billpayer funded, c. £0.3bn over the same period will sit within public sector resource spending for operational maintenance of public assets.

The impacts presented below show the effect of implementing the recommendation relative to current investment levels and costs.

Table 2: Water company investment

This table shows today’s indicative annual investment by water companies into surface water flooding projected forward, and additional investment recommended by the Commission. The costs of financing this investment are passed through to households, businesses and the public sector in Water and Sewerage Company bills.

Average estimated annual investment by companies in surface water flooding £m p.a., 2022 prices)	Total 2025-2054 (£m, 2022 prices)	2025-29	2030-34	2035-39	2040-44	2045-49	2050-54
Today’s investment projected forward (indicative)	£4,848	£162	£162	£162	£162	£162	£162
Additional investment from recommendations	£2,172	£72	£72	£72	£72	£72	£72
Total	£7,020	£234	£234	£234	£234	£234	£234

This investment is ultimately paid for by households, businesses and the public sector through water bills. Tables 3(a) and (b) and tables 4(a) and (b) below show how this investment is funded. Tables 3(a) and (b) show total bills impacts across all households and bills, in £ million per year. Tables 4(a) and (b) show the impact on an average household bill, in £ per year.

Tables 3(a) & (b) and tables 4(a) & (b) show impacts across two scenarios:

1. 3(a) & 4(a) show additional costs attributed to households/businesses/public sector in the same proportions as they currently meet costs of water company services, and secondly
2. 3(b) & 4(b) show additional costs attributed according to the 'beneficiary pays' principle, where costs are attributed according to each group's share of expected annual damage reduction.

The Commission notes that there are choices for policy makers in how to share costs between households and business, and has presented these scenarios to illustrate differing approaches to how investment might be funded by the private sector.

Table 3(a) & 3(b): Costs passed through to households, businesses, and the public sector

These tables show the effect of implementing Commission recommendations relative to the current indicative level of investment in surface water flooding. They split total funding costs by households, businesses, and the public sector.

They take account of the fact that investment by water companies is paid for over time by billpayers, rather than as the investment takes place. They also include: savings to households, businesses, and the public sector from reduced direct flood damages (reflected in reduced insurance premiums) because of increased level of flood protection; and the public sector cost of maintaining flood protection defences

Table 3(a): Total costs passed through to households, businesses, and the public sector, in the same proportions as they currently meet the costs of water company services

Average annual expenditure (£m p.a., 2022 prices)	Total 2025-54 (£m, 2022 prices)	2025-29	2030-34	2035-39	2040-44	2045-49	2050-54
Households: costs passed through	£1,357	£9	£23	£38	£53	£67	£82
Households: reduction in direct damages	-£521	-£3	-£9	-£15	-£20	-£26	-£31
Businesses: costs passed through	£350	£2	£6	£10	£14	£17	£21
Businesses: reduction in direct damages	-£1,155	-£7	-£20	-£32	-£45	-£57	-£70
Public sector: costs passed through	£39	£0	£1	£1	£2	£2	£2
Public sector: current spending on maintenance of public sector assets	£347	£12	£12	£12	£12	£12	£12
Public sector: reduction in direct damages	-£128	-£1	-£2	-£4	-£5	-£6	-£8
Total	£289	£11	£11	£10	£9	£9	£8

Table 3(b): Total costs passed through to households, businesses and the public sector according to the 'beneficiary pays' principle

Average annual expenditure (£m p.a., 2022 prices)	Total 2025-54 (£m, 2022 prices)	2025-29	2030-34	2035-39	2040-44	2045-49	2050-54
Households: costs passed through	£504	£3	£9	£14	£20	£25	£30
Households: reduction in direct damages	-£521	-£3	-£9	-£15	-£20	-£26	-£31
Businesses: costs passed through	£1,118	£7	£19	£31	£43	£55	£67
Businesses: reduction in direct damages	-£1,155	-£7	-£20	-£32	-£45	-£57	-£70
Public sector: costs passed through	£124	£1	£2	£3	£5	£6	£7
Public sector: current spending on maintenance of public sector assets	£347	£12	£12	£12	£12	£12	£12
Public sector: reduction in direct damages	-£128	-£1	-£2	-£4	-£5	-£6	-£8
Total	£289	£11	£11	£10	£9	£9	£8

Tables 4(a) & 4(b): Impact on household bills

These tables show the impact on average household bills³ in England. They assume the insurance market is competitive, so savings in expected annual direct damage to property are passed on in lower building and contents insurance premiums. For context, the average household water bill in England and Wales is predicted to be around £419 p.a. in 2022⁴.

The numbers have been shown to one decimal place in order that the cost impact and profile of costs can be seen. The level of accuracy shown is not reflective of certainty in the cost impact, and the message taken away should be that the marginal cost impact to households of the Commission's recommendations is small and increasing over time.

Table 4(a): Impact on an average household bill, according to current household/business/public sector split

£p.a. estimate, per household, 2022 prices	Average p.a. over period	2025-29	2030-34	2035-39	2040-44	2045-49	2050-54
Average impact on household water bill	£2	£0.4	£1.0	£1.7	£2.3	£3.0	£3.6
Average impact on household insurance premium	-£1	-£0.1	-£0.4	-£0.6	-£0.9	-£1.1	-£1.4
Average impact on household	£1	£0.2	£0.6	£1.0	£1.4	£1.8	£2.2

Table 4(b): Impact on an average household bill, according to the beneficiary pays principle

£p.a. estimate, per household, 2022 prices	Average p.a. over period	2025-29	2030-34	2035-39	2040-44	2045-49	2050-54
Average impact on household water bill	£1	£0.1	£0.4	£0.6	£0.9	£1.1	£1.3
Average impact on household insurance premium	-£1	-£0.1	-£0.4	-£0.6	-£0.9	-£1.1	-£1.4
Average impact per household^{5,6}	£0	£0.0	£0.0	£0.0	£0.0	£0.0	£0.0

³ Summary of Assumptions in Annex B, and supporting detail can be found in the Commission's Technical Annex: <https://nic.org.uk/app/uploads/NIC-Surface-Water-Flooding-Modelling-Technical-Annex.pdf>

⁴ Statista, average water bills in the UK, 2021/22: <https://www.statista.com/statistics/1180324/household-water-and-sewerage-bill-united-kingdom-uk/>

⁵ Numbers may not add to the totals due to rounding

⁶ There is a net benefit to households in the region of 4% of bills impact, this is not visible due to rounding of numbers.

Section 5: Environmental impacts

The Commission is measuring the environmental impact of its recommendations across three environmental domains: Air pollution, Biodiversity and Water Quality. These are three of the themes in the government’s 25-year environment plan⁷, relevant to the Commission’s recommendations.

In addition, the Commission also measures the carbon impact of its recommendations. This includes embodied carbon in the manufacturing/construction of infrastructure as well as operational carbon emissions.

Table 5: Overall assessment of recommendations

Environmental impact	Contribution to net gain
<p>Air pollution A reduction in harmful pollutants and greenhouse gases.</p>	<p>Low positive</p> <ul style="list-style-type: none"> + Trees and vegetative SuDS can play an important role in absorbing airborne pollution (e.g., NOx, SOx and particulates), reducing the risks of and impacts from air pollution, particularly in urban areas. - Short term increase in airborne pollution during construction works depending on methods used.
<p>Water quality Improving at least 75% of waters to close to their natural state.</p>	<p>Low positive</p> <ul style="list-style-type: none"> + The filtration of water through above ground drainage pathways (development of SuDS for example) is likely to have a positive contribution to water quality. + Work carried out which will reduce overflow from combined sewer overflows, and reduce the risk of surface water flooding, is expected to have measurable improvement on water quality but this will be recognised in the Storm Overflows Discharge Reduction Plan.
<p>Biodiversity To achieve a growing and resilient network of land, water and seas that is richer in plants and wildlife</p>	<p>Low positive</p> <ul style="list-style-type: none"> + Green infrastructure such as multi-function SuDS can provide habitats for flora and fauna. + Reduced run-off from surface water flooding can reduce contamination of natural environments, maintaining balance in existing eco-systems. - Disturbance of land during construction depending on methods used.

Overall, the environmental impact of the Commission’s recommendation to invest £12bn over the 30-year period starting in 2025, has been assessed in the modelling to have a present value in the range of +£450m to +£550m.

⁷ Government 25-year environment plan targets: <https://www.gov.uk/government/publications/25-year-environment-plan/25-year-environment-plan-our-targets-at-a-glance>

Carbon impacts

The modelling includes an estimate of the abatement cost of carbon, including construction and operational carbon emissions.

Carbon costs are modelled to have a present value in the range £800m to £850m, based on a £12bn investment over 30-years starting in 2025.

Section 6: Distributional impacts

This section assesses the distributional impacts of the Commission’s recommendations across a set of dimensions.

The main impacts on consumers will be:

- additional costs passed through to them in their water bills.
- increased levels of protection from surface water flooding for those at greatest risk
- reduced insurance premiums for households with a reduced risk of flooding.

The Commission has evaluated the impact of this cost, based on a set of assumptions, across different income and expenditure groups and across consumers in different regions. It considers the impact of all sources of flooding – coastal, river and surface water – as the effects are similar and not differentiated by source.

Table 6: Distributional impact summary

Dimension	Description
Income groups	<p>Flooding disproportionately affects lower income households⁸, so under the Commission’s recommendations, this group can be expected to receive greater protection relative to higher income groups.</p> <p>Lower income households hold a greater proportion of their assets within the home⁹ and having a lower disposable income and a lower propensity to insure negates their ability to ‘bounce back’ from the effects of flooding.</p> <p>Investment by water companies is passed through to households in their water bills. Water bills do not vary materially by income group so lower income households will be disproportionately affected by any increase. However, the increase in bills is estimated to be in the region of 1% based on average household bills across the UK, so the cost impact on households will be low.</p>
Vulnerable/protected groups	<p>Several groups protected under the Equalities Act are more affected by flooding¹⁰ as they are less able to prepare, respond and recover: children, older people, and disabled people. These groups will receive protection from the risk as a result of the Commission’s recommendations.</p>

⁸ Sayers, P.B., Horritt, M., Penning Rowsell, E., and Fieth, J. (2017), Present and future flood vulnerability, risk and disadvantage: A UK scale assessment: http://www.saversandpartners.co.uk/uploads/6/2/0/9/6209349/savers_2017_-_present_and_future_flood_vulnerability_risk_and_disadvantage_-_final_report_-_uploaded_05june2017_printed_-_high_quality.pdf

⁹ Wealth and Assets Survey QMI - Office for National Statistics (ons.gov.uk): <https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/bulletins/distributionofindividualtotalwealthbycharacteristicgreatbritain/april2018tomarch2020>

¹⁰ Sayers, P.B., Horritt, M., Penning Rowsell, E., and Fieth, J. (2017), Present and future flood vulnerability, risk and disadvantage A UK assessment. Neighbourhood Flood Vulnerability Index: Characteristics, indicators and support variables: <http://www.climatejust.org.uk/sites/default/files/Sayers%20at%20el%202017%20-%20NFVI%20and%20Vulnerability%20Indicators.pdf>

Dimension	Description
Geographical	<p>The greatest number of properties at high and medium risk of flooding are in areas defined as ‘urban cities and towns’ and ‘urban major conurbations’¹¹.</p> <p>Over 85 per cent of the number of properties in areas at high risk of surface water flooding are in towns and cities. While the proportion of properties in areas at high risk of surface water flooding per 100,000 properties is roughly the same in villages, towns and cities, more properties are in towns and cities overall, and properties in towns and cities are more likely to be in areas at medium risk of flooding than those in smaller villages or rural areas. Therefore, the biggest challenge is in towns and cities, and interventions there are likely to protect the most properties.</p> <p>Where large infrastructure interventions are not cost-beneficial – for example, in some rural settings – property level protection can be employed to reduce the risk of property flooding.</p>

¹¹ Office for National Statistics definitions:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009128/RUCOA_leaflet_Jan2017.pdf

Section 7: Uncertainty

This section presents how robust the Commission’s recommendations are to different possible future states of the world based on a set of drivers, and to changes in assumptions.¹²

It assesses the degree of confidence in the fiscal and economic remit estimates, and other impacts outlined above, and the reasons for this judgement.

Table 7: Uncertainty summary

Driver	Classification	Description
Economic growth	Robust	Recommendations are robust to economic growth being higher or lower than expected.
Climate change	Robust	Recommendations are robust to a 2-degree and 4-degree increase in global average surface temperatures; recommendations for investment are designed to be adaptable to difference climate futures.
Technology and behaviour change	Robust	Flood defence engineering is mature. Developments in flood defence technology, affecting recommendations, is judged by the Commission to be unlikely. Recommendations are robust to behaviour change.
Population and demography	Robust	Recommendations need to be adopted together to be robust to population changes. The Commission’s first recommendation proposes measures to protect new housing stock and is robust to changes in population growth influencing the number of properties being built. Recommendations for additional investment consider the change in risk to existing properties and are not affected by population growth influencing the number of properties being built. Recommendations are not sensitive to changes in demographics.

¹² Supporting detail can be found in the Commission’s Technical Annex: <https://nic.org.uk/app/uploads/NIC-Surface-Water-Flooding-Modelling-Technical-Annex.pdf>

Sensitivity	Description
Costs and benefits	Recommendations are robust to changes in factors affecting the costs and benefits. The range of costs provided reflect testing of sensitivity ¹³ to both. The benefit-cost-ratio of the recommended investments is 2.1 (benefits = 2.1 x costs), which sits within a range of 1.6 to 2.8.

¹³ Supporting detail can be found in the Commission's Technical Annex: <https://nic.org.uk/app/uploads/NIC-Surface-Water-Flooding-Modelling-Technical-Annex.pdf>

Annex A: Commission recommendations

Recommendation 1: By the end of 2023, government should implement Schedule 3 of the 2010 Flood and Water Management Act and update its technical standards for sustainable drainage systems.

Recommendation 2: Government should do a comprehensive review of the effectiveness of available options for managing unplanned increases in impermeable surfaces and their costs and benefits. By the end of 2023 government should decide whether policy changes are required to reduce the impacts on surface water flooding or adjust investment levels for flood risk reduction accordingly.

Drainage systems must be improved to protect properties in the coming decades.

Recommendation 3: Government should require the Environment Agency to:

- use the results of the second National Flood Risk Assessment in 2024 to identify new priority flood risk areas
- require top tier local authorities and other relevant authorities in the newly identified flood risk areas to develop detailed local risk maps that can be integrated into the Environment Agency's national map, and models that can be used to plan future management of surface water flooding, from 2025 onwards.

Government should set national risk reduction targets to drive and monitor progress.

Recommendation 4: By early 2025, government should set a long-term target for a percentage reduction in the number of households at high and medium risk of surface water flooding.

Recommendation 5: The government should require the Environment Agency to work with risk management authorities in the new flood risk areas to agree appropriate local objectives by mid-2025.

Funding should be allocated to the places that need it most.

Recommendation 6: By the end of 2025, government should require:

- the Environment Agency to allocate public funding to flood risk areas based on their levels of risk
- Ofwat to enable water companies to deliver investment to achieve local objectives, and to build and maintain sustainable drainage.

The investment needed from both sources should be reviewed every five years, in line with Ofwat's Price Reviews and single joint plan cycles.

Local authorities and water companies should develop and deliver costed, joint plans.

Recommendation 7: Government should require:

- top tier local authorities, water and sewerage companies, and, where relevant, internal drainage boards in the new flood risk areas to produce and deliver costed, joint

investment plans for managing surface water that achieve the agreed local objectives and follow the 'solutions hierarchy'

- the Environment Agency to assess and agree the final plans with input from Ofwat
- joint plans to be completed by 2026 and revised every five years following the review of flood risk areas the year before, and to inform the following Ofwat Price Review.

There should be support for the properties remaining at risk.

Recommendation 8: By end 2024, government should explore options for funding property level measures for those properties that remain at high risk of surface water flooding because improving drainage infrastructure is not cost effective, prioritising those in rural areas.

Annex B: Summary of method and assumptions

Modelling methodology and assumptions can be found in the Technical Annex¹⁴.

For assessing the incremental impact on household costs and business costs of Water company investment, investment has been assumed to occur uniformly over the 30-year period starting in 2025/26. Businesses and public sector have been assumed to form around 20% of the Water & Sewerage Company revenues, based on data on wholesale revenues available in company accounts.

The weighted average cost of capital for water companies has been assumed to be 4.5% p.a. in real terms, based on historic margins above the risk-free rate published by the OBR. Run-off of investments has been assumed at 60 years. The impact on bills is not sensitive to these assumptions.

¹⁴ Supporting detail can be found in the Commission's Technical Annex: <https://nic.org.uk/app/uploads/NIC-Surface-Water-Flooding-Modelling-Technical-Annex.pdf>